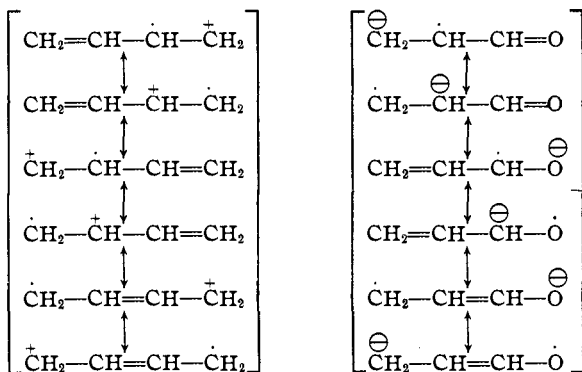
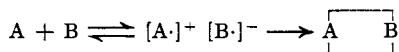


lar compound formation by Weiss.¹ Both components, after the electron exchange, will be hybridized, *viz.*, in the simplest case, the reaction between butadiene and acrolein,



We thus arrive at a mechanistic picture in which collision results in electron transfer followed by formation of a dipolar aggregate, held together



by ionic forces (and possibly further by interparticular overlapping of the orbitals of the non-bonded electrons in each half; in this event, the link could be described as an *intermolecular semipolar bond*,² *cf.* $[A^+]:[B^-]$). Stereochemically, the

(1) Weiss, *J. Chem. Soc.*, 245 (1942).

(2) (Note added in proof, November 25, 1942.) This concept is a logical extension (or modification) of the theory of molecular complex formation which is not implied in Weiss' paper.¹ I intend to develop these ideas further; meanwhile, I note that Dr. L. C. Bateman (*Chemistry and Industry*, 61, 453 (1942), received November 23) has independently proposed a similar picture during a discussion at the Chemical Society (London) on October 15, 1942. On this side these ideas were first embodied in Dr. J. J. Leavitt's Dissertation, "Some Properties and Reactions of Unsaturated γ -Lactones," Harvard University, September 1, 1942.

aggregate would consist of two parallel charged (usually flat) surfaces, oriented in such wise as to take maximum advantage of electrostatic attractive forces. The first step is probably in most cases rapid and reversible, the rate-controlling process being the usually (but not always) substantially irreversible rearrangement of the ion-pair complex to the product $\boxed{A \quad B \text{ above}}$.

This picture is in complete conformity with the large body of observed phenomena attendant upon the reaction. There may be cited: (i) transient color formation, (ii) steric course of the reaction, (iii) effect of substituents of divers electrical character on the ease of reaction both of the diene and the dienophile, (iv) observed molecular compound formation preceding reaction in certain cases, (v) the occasional abnormal course of the reaction (notably in the case of heterocyclic nitrogen bases, and ketenes), (vi) solvent effects.

The procession of the reaction by the above course further indicates the possibility of catalysis by donor or acceptor molecules which cannot themselves participate in the diene-addition reaction. Preliminary experiments designed to test this possibility give some qualitative indication that dimethylaniline and 1,3,5-trinitrobenzene exert such an accelerating effect.

The situation will be considered in detail in a forthcoming publication.

CONVERSE MEMORIAL LABORATORY
HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS

R. B. WOODWARD

RECEIVED NOVEMBER 12, 1942

NEW BOOKS

Elementary Physical Chemistry. By MERLE RANDALL, Professor of Chemistry in the University of California, and LEONA ESTHER YOUNG, Professor of Chemistry in Mills College. Randall and Sons, 2512 Etna St., Berkeley, California, 1942. (Photolith reproduction.) xiv + 455 pp. Illustrated. 15.5 × 23.5 cm. Price, \$4.50.

Physical Chemistry. By FRANK THOMSON GUCKER, JR., Associate Professor of Chemistry, Northwestern University, and WILLIAM BUELL MELDRUM, Professor of Chemistry, Haverford College. American Book Company, 88 Lexington Avenue, New York, N. Y., 1942. xii + 683 pp. 262 figs. 14.5 × 22.5 cm. Price, \$4.00.

As physical chemistry has advanced beyond its historic preoccupation with aqueous solutions of electrolytes, an

adequate grasp of its subject matter has become increasingly difficult to obtain in a single year-course. An "introductory" course in the third, or even second, year of college is a frequent answer to this problem as well as to the needs of students majoring in other sciences or preparing for medicine. Such a course, covering one or two semesters, is the province of the two text-books with which we are concerned. They both deal mainly with "classical" principles; both stress experimental facts and the deductive approach, with a minimum of mathematics and thermodynamics. Parallel or previous study of the calculus would be desirable but not essential. In both cases the problems of beginning students have been kept clearly in mind; extensive use of illustrations, graphs, exercises and applications should go far to stimulate interest and

assure comprehension. Both books can be recommended as sound, carefully written and well made contributions to the teaching of *introductory* physical chemistry.

The Randall and Young book has several unique features. It introduces the physico-chemical method of treatment by analyzing a familiar process—vaporization of a liquid. Gradually, and quite naturally, *concepts* are developed, *e. g.*, boiling point, vapor pressure, equilibrium, heat content, temperature scale, escaping tendency, partial pressure, activity, activity quotient, cycles. Soon important relations begin to appear as experimental facts, such as the Clausius–Clapeyron equation, Trouton's rule, and Raoult's law. The first third of the book is devoted to this kind of analysis of phenomena encountered in analytical or organic laboratory. The remainder of the book develops the basic principles in a more quantitative and fairly systematic manner. The emphasis is strongly on equilibrium, and particularly heterogeneous equilibrium, including distillation, freezing point, solubility and distribution. There are brief sections on flow of fluids and reaction rates, but almost no mention of atomic, molecular or crystal structure, isotopes, colloids, surface phenomena or photochemistry. Though much briefer than most such texts, it is notable for the extensive use of figures (279). Many of these excellently illustrate principles by graphs of experimental data (with copious references); others show laboratory or industrial apparatus. All figures are supplied with explanatory paragraphs which of themselves give a good descriptive picture of physico-chemical behavior. Another important feature are the 690 exercises distributed in small groups at appropriate points throughout the text. They are original and stimulating, and often serve to extend the textual discussions or to apply them to other fields.

The Gucker and Meldrum book is more conventional in plan. After brief discussions of fundamental chemical theory, atomic structure and valence, it takes up in order the states of aggregation (123 pp.), thermochemistry (27 pp.), solutions (55 pp.), kinetics (19 pp.), equilibrium with particular reference to solutions of electrolytes (about 200 pp.), colloids and surface phenomena (78 pp.), phase equilibrium (31 pp.), and thermodynamics (34 pp.). Structure and its relation to properties, reaction mechanisms, and quantitative aspects of heterogeneous equilibrium receive only minor attention. The book owes much to "Introduction to Theoretical Chemistry" by the same authors, but covers much more of the "classical" ground and at a somewhat more advanced level. The development is largely empirical, with little aid from thermodynamics or calculus, although such aids are available in the final chapter if use can be made of them there. There is strong emphasis throughout on the application of chemical principles in biological phenomena. There is contained an unusual amount of well-selected experimental data (262 figures, 124 tables). The numerous figures showing how well, or sometimes how badly, theories accord with actual facts are particularly commendable. An adequate number (258) of problems and review questions is provided; several of a given type are usually included, but there is fair variety and range of difficulty. Each chapter closes with a carefully prepared reading list of books and review articles, frequently with specific

page references and helpful comments on scope and character.

ARTHUR F. BENTON

The Electron Microscope. By E. F. BURTON, Head of the Department of Physics, University of Toronto, and W. H. KOHL, Development Engineer, Rogers Radio Tubes Limited, Toronto. Reinhold Publishing Corporation, 330 West 42nd Street, New York, N. Y., 1942. 233 pp. Illustrated. 15.5×23.5 cm. Price, \$3.85.

Great things are expected of the electron microscope as a tool of the investigator in pure and applied research. Like all things not well understood, it has sometimes been the subject of over-enthusiastic expectations. On the other hand, a lack of comprehension of the instrument operates to delay the useful applications to which it may be put.

In this volume, the authors by simple steps lead the reader gradually to a comprehension of the nature of vision and the elements of optical science, through a brief course in electronics and its branch called electron optics, the basis of taking magnified pictures without light.

This is a book for the thoughtful reader, not a picture book. Copiously illustrated, however, with homely diagrams, adequate although executed with non-professional draftsmanship, and with half-tone reproductions of photo and electron micrographs, it presents a physicist's explanation of the theory and operation of this modern instrument in a manner easily comprehended by scientists in fields other than that of electronics. For the lay reader who enjoys a certain amount of homework the thoughtful study of this volume will present much that is authentically and interestingly informing in various fields of life of today and of tomorrow.

JOHN W. M. BUNKER

Introduction to Semimicro Qualitative Chemical Analysis.

By LOUIS J. CURTMAN, Professor of Chemistry, The City College, The College of the City of New York. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1942. x + 377 pp. 38 figs. 14.5×22 cm. Price, \$2.75.

This book is a follow-up of the author's earlier "Qualitative Chemical Analysis," based on experimental testing of modifications of macro methods to semi-micro scale, and containing some relatively new procedures, also. The first 130 pages (Part I) are a discussion of the usual background topics of modern qualitative analysis, ranging from coordination theory and acid-base theory, through solutions, equilibrium, ionization, solubility product, and oxidation-reduction, to buffer solutions, hydrolysis and colloids. Part II (75 pp.) takes up the reactions of the metal ions, followed by a much shorter section on the anions, with copious equations. Part III (16 pp.) deals with calculations, and includes many simple weight relation and normality problems. Part IV on laboratory work (87 pp.) devotes several pages to general advice, directions and warnings on semi-micro work, followed by orientation and practice tests on various metal ions. Then come the systematic procedures for the metal ions, followed by tests

on anions. Part V gives the systematic detection of the anions, preparation of the solution for metal analysis, the phosphate separation. The 30-page Appendix gives recording notes for data, desk equipment lists, reagent lists, and specifications for stock solutions, with a long table of solubilities.

The background section seems to be well written and adequate, while the sections on the characteristics of the various ions give a variety of tests on each ion. The cation analysis scheme has a few departures from the usual procedures: the separation of the copper and tin subgroups using potassium hydroxide; an extra step for complete separation of arsenate ion in strongly acid solution; ammonium sulfide precipitation of the iron-nickel family with immediate separation of manganese with nitric acid and potassium chlorate; partial precipitation of magnesium with the calcium group. The anion analysis is worked out in some detail. The typography, design and mechanical execution are good; a few small details which might have been improved are the lack of style consistency in the literature citation footnotes, the use of unattractive full capital abbreviations (such as E. M. F. instead of e. m. f.), a few old-fashioned spellings (sulphur, in particular), and the hyphenation of such words as silver-ion (as nouns).

ALLEN D. BLISS

Introduction to the Microtechnique of Inorganic Analysis.

By A. A. BENEDETTI-PICHLER, Dr. Techn. Sc., Assistant Professor of Chemistry, Queens College, Flushing, N. Y. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1942. vii + 302 pp. 84 figs. 15.5 × 23.5 cm. Price, \$3.50.

In the 1920's Dr. Benedetti-Pichler came to New York from Austria, where he had been a student of the chief founder of inorganic microchemistry, Friedrich Émich, and inaugurated one of the first, if not the first, systematic course in that subject at an American university. At that time microchemistry was very young indeed, and untried; now it has matured and its standing in the science is secure, and it has a place in most educational curricula that emphasize analysis and manipulative technique; moreover, there is nowadays scarcely an industrial laboratory of any pretensions that does not have some facilities for microchemical work. Dr. Benedetti-Pichler deserves much of the credit for these developments.

The book under review "is intended as an introduction to the microtechnique of chemical experimentation." Briefly summarized, it purports to do two things: describe, in the manner of a laboratory manual, certain of the basic manipulative and observational techniques that have been developed for or adapted to microchemistry, in order to facilitate operations on a reduced scale; and illustrate the application of these techniques to qualitative and quantitative inorganic analysis. Thus this volume, which is presented as a college textbook, is divided into three parts: I, Apparatus for General Use; II, Qualitative Analysis, A, Confirmatory Tests, B, Microtechnique of Qualitative Analysis; III, Quantitative Analysis, A, Gravimetric Determinations, B, Titrimetric Determinations; followed by a bibliography and the usual appendices.

The present book replaces an earlier work, "Introduction to the Microtechnique of Inorganic Qualitative Analysis," by Professor Benedetti-Pichler and Dr. W. F. Spikes. Readers familiar with the older book will be interested in a comparison of its subject matter with that of the new one. The three parts in the older were: I, The Microscope; II, Qualitative Analysis (Apparatus and Technique); III, Microqualitative Scheme. Thus the most important addition in the volume under review is the inclusion of microquantitative analysis; some may feel that the most important omission is the systematic scheme for microqualitative analysis. Many writers make a rather vague distinction between "micro-" and "semimicro-" procedures. The present volume carries this a step further and describes typical "centigram, milligram and microgram procedures." The reviewer believes that this is a useful pedagogical device.

The reviewer believes that the book will serve very satisfactorily for the purposes intended. But he cannot refrain from deploring the lack in this book, as in most other texts on microchemistry, of any material that will qualify the student to apply microtechniques in a practical way when he sets up as a microchemist in an industrial or a research laboratory. Deplorable especially is the lack of emphasis on the fact, so palpably real to supervisors of microlaboratories in industry, that more often than not the selection, isolation and preparation of the sample for microanalytical attack requires at least as much effort and skill as the actual microanalysis. The reviewer does not quarrel with what is in this book: clearly the student must learn all of this before he is even competent to microanalyze pure substances; but it is contended that the book would have had a great deal more value in orienting the student of microchemistry into the "world of things as they are," if another fifty pages, giving some applications of microtechniques to practical problems, had been added. There is no dearth of these, as the author is well aware. Doubtless the author would reply that his book is not a compendium but an introduction, and that he deliberately chose to cover only those aspects of the subject that he did cover, leaving to others the industrial applications. That is a valid reply, which the reviewer would have to accept; but he still deplores the fact that the "others" have not arisen, and he hopes for their early emergence.

Minor criticisms are the absence of an author index, and of a presentation of the increasingly versatile and important electrographic technique.

BEVERLY L. CLARKE

Physical Chemistry for Students of Biochemistry and Medicine.

By EDWARD STAUNTON WEST, Ph.D., Professor of Biochemistry in the University of Oregon Medical School. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1942. xiv + 368 pp. 24 figs. 16 × 24 cm. Price, \$5.75.

The jacket informs us: "The primary aim of this book is to present the selected phases of physical chemistry recognized as basic to an understanding of biological phenomena." In doing so, the author has treated the following topics: the structure of matter, including atomic structure; valence, including in his discussion electro-

valence, covalence, coördinate valence, and the hydrogen bond; the gas laws; theories of solutions, including solubility, osmotic pressure, electrolytic dissociation, diffusion, and the mass law; acids and bases, including buffer solutions; the determination of pH by various methods; the colloidal state and membrane phenomena including surface phenomena, size of colloidal particles, adsorption and the Donnan equilibrium; oxidation and reduction, including reference to the theory of oxidation-reduction potentials and the mechanisms of biological oxidations; and finally, the velocity of reactions.

These topics have, on the whole, been chosen with discrimination and have generally been treated in the light of contemporaneous theory. Omission of any reference to the theory of Debye and Hückel is surprising to this reviewer, as is the bare statement that: "Neutralization of toxins by antitoxins seems to proceed according to the laws of adsorption." Whereas the very elementary treatment presupposes only a low level of preparation in mathematics, physics, and chemistry, the insertion of numerous simple problems, and pertinent questions should help the reader to coördinate his knowledge on an elementary, quantitative plane. The more inquisitive reader is referred to more extended summaries, but rarely to original definitive literature. The relations of physical chemical principles to biology are well illustrated and stressed.

In these days when inadequate preparation is likely to become more general, this book can be used profitably by both premedical and medical students.

RONALD M. FERRY

Organic Reactions. Volume I. ROGER ADAMS, Editor-in-Chief, WERNER E. BACHMANN, LOUIS F. FIESER, JOHN R. JOHNSON and H. R. SNYDER. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1942. vii + 391 pp. 15.5 × 23.5 cm. Price, \$4.00.

Organic chemists will welcome this first volume of the series with more than ordinary enthusiasm, for it is a landmark in the literature of organic chemistry. The series is a new departure, and will make available extremely valuable information in a readily applicable form. Perhaps the nearest approaches to the present series are the still useful but quite out-of-date special parts of Houben-Weyl and Lassar-Cohn on general organic reactions such as condensation, nitration, etc.

Primarily, the work is concerned with the scope and limitations of important laboratory reactions. "The subjects are presented from the preparative viewpoint, and particular attention is given to limitations, interfering influences, effects of structure, and the selection of experimental techniques. Each chapter includes several detailed procedures illustrating the significant modifications of the method." The textual material, tables and extensive bibliographies provide a coverage that is as nearly complete as one might wish.

The twelve chapters have been written by authors who have had particular experience with the reactions or processes described: (1) "The Reformatsky Reaction" (Ralph L. Shriner); (2) "The Arndt-Eistert Synthesis" (W. E. Bachmann and W. S. Struve); (3) "Chloromethylation of Aromatic Compounds" (Reynold C. Fuson and C. H.

McKeever); (4) "The Amination of Heterocyclic Bases by Alkali Amides" (Marlin T. Leffler); (5) "The Bucherer Reaction" (Nathan L. Drake); (6) "The Elbs Reaction" (Louis F. Fieser); (7) "The Clemmensen Reduction" (Elmore L. Martin); (8) "The Perkin Reaction and Related Reactions" (John R. Johnson); (9) "The Acetoacetic Ester Condensation and Certain Related Reactions" (Charles R. Hauser and Boyd E. Hudson, Jr.); (10) "The Mannich Reaction" (F. F. Blicke); (11) "The Fries Reaction" (A. H. Blatt); and (12) "The Jacobsen Reaction" (Lee Irvin Smith).

Some of the chapters have many more formulas in the tables than others. A strictly uniform pattern of presentation may not be the best procedure for a work of this kind, but a more extensive use of formulas instead of names in some of the chapters would be preferred by students and others.

It is interesting to note the occasional cases where "name" reactions bear the name not of the original discoverer, but of one who subsequently explored the broad aspects of the reaction.

The series, separate volumes of which will appear periodically, will form something more than a mere adjunct to laboratory procedures. It is the sort of work that not only stands alone, but that will prove an invaluable supplement to every text or reference work in organic chemistry. With the appearance in recent years of a wide variety of excellent books on organic chemistry, the content of some seminar and special topics courses may be revised to place added emphasis on immediately current articles instead of extensive surveys which are increasingly available.

Although this work appears in war times, the general idea was conceived several years ago and in this respect is unlike "Organic Syntheses," the origin of which is directly traceable to meeting the needs for research chemicals in the last war. The editors and authors are to be complimented and thanked for a splendid work which must have made unusual demands on them in these strenuous times.

HENRY GILMAN

Chemical Refining of Petroleum, the Action of Various Refining Agents and Chemicals on Petroleum and its Products. By VLADIMIR A. KALICHEVSKY, Research and Development Laboratories, Socony-Vacuum Oil Co., Inc., and BERT ALLEN STAGNER, Ph.D., Consulting and Research Chemist. Revised edition. Reinhold Publishing Corporation, 330 West 42nd St., New York, N. Y., 1942. 550 pp. Illustrated. 23.5 × 15 cm. Price, \$7.50.

The rapid advances which have been made in the refining art during the past decade have made necessary revision of this well-known book which was first published in 1933. Much of the book was rewritten (apparently in 1940) and the material rearranged with improved results. The subjects covered include the composition of petroleum; treatment with sulfuric acid; sulfuric acid sludge and hydrogen sulfide; recovery and manufacture of sulfuric acid; treatment with alkaline reagents; sweetening operations; refining by adsorption; refining with solvents; deterioration and anti-detonants; inhibitors of atmospheric oxidation; gums and cracked petroleum products;

and deterioration of lubricating and similar oils. A very useful supplementary list of U. S. patents on petroleum refining is presented, patents issued up to January, 1940, being listed. The glossary of terms which occupied some 23 pages in the first edition is now omitted; definitions of such terms as aldol, alkyl, amine, anthracene, bauxite, benzoyl, etc., are certainly superfluous in an A. C. S. Monograph.

The authors have written a very readable treatise. The style and makeup are excellent; subheadings are used liberally. The chemical reactions which occur in the various refining processes are discussed briefly but perhaps adequately for the purpose of the book.

Although the book will appeal chiefly to the refiner and to the petroleum technologist, it can be read with profit by chemists who are interested in the application of chemical procedures to the refining of petroleum.

V. N. IPATIEFF

Organic Syntheses. An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. 22. LEE IRVIN SMITH, Editor-in-Chief, HOMER ADKINS, C. F. H. ALLEN, W. E. BACHMANN, NATHAN L. DRAKE, R. L. SHRINER, H. R. SNYDER, and A. H. BLATT, Secretary. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1942. 114 pp. 15.5 × 23.5 cm. Price, \$1.75.

The addition of this new book to the series of publications in the field of synthetic chemistry entitled "Organic Syntheses," must be considered as filling a useful service. We have now available for reference twenty-two volumes of this practical organic text. The organic preparations recorded have been selected, approved and checked by a competent editorial board experienced in the modern technique of synthetic organic chemistry, and the new volume should prove to be just as helpful as any of the editions already published.

In this volume are described satisfactory methods for the laboratory preparation of thirty-four different organic compounds representative of the aliphatic, aromatic and heterocyclic series. Several of these will prove of immediate service as key substances in new research programs.

The very complete literature references are extremely useful for workers interested in the different fields represented by the preparations recorded. The practical nature of the work should prove very helpful to those workers who do not have access to good library facilities and the literature of chemistry. A subject index for volumes 20-22 is printed in this volume.

TREAT B. JOHNSON

Technical Report Writing. By FRED H. RHODES, Professor of Chemical Engineering, Cornell University. McGraw-Hill Book Company, Inc., New York, N. Y., 1941. vii + 125 pp. 8 figs. including one of conventional symbols. 15.5 × 23.5 cm. Price, \$1.50.

The author, struck, as many others have been, "by the appalling lack of ability of students and graduates to write effective reports," and having concluded that they are unlikely to learn in courses in English how to construct and

write a good report, decided that it was up to him to train his students in technical writing by requiring that the reports in his courses be written in good English and subjected "to the same careful criticism that is exercised in the editing of articles for publication in the better technical journals." As there was no satisfactory textbook covering this precise field, he proceeded to write one, and has succeeded admirably in what he set out to do. In a series of brief chapters he outlines the importance of effective presentation, written or oral, of the results of an investigation, particularly where this presentation is to reach the less strictly technical members of an organization, and discusses the characteristics and proper organization of a good technical report, with pertinent remarks on many details of style and usage to which the writer of a report should, but usually does not, pay attention. In these pages I saw no statement with which I do not fully concur, nor any significant omission; and noted only a single error which might puzzle the reader, namely, that on page 99 in the columns headed "deviation" the numbers are the square of the deviation. The last few chapters, occupying more than half of the book, deal briefly with some of the simpler methods of analyzing, correlating, and depicting experimental data; references are given to other books which treat these matters more fully. If ways can be found to induce students—and not only students, but graduates—to absorb, and make use of, the teachings of this book, there should be fewer complaints of poor organization of reports and articles and of sloppy writing which makes it more difficult for the reader to grasp what the writer is trying to convey.

JOHN JOHNSTON

A Shorter Course in Organic Chemistry. By J. C. COLBERT, Associate Professor of Chemistry in the State University of Oklahoma. Second Edition. D. Appleton-Century Company, Inc., 35 West 32nd Street, New York, N. Y., 1942. xvii + 355 pp. 15 × 23 cm. Price, \$3.75.

Introductory Organic Chemistry. By E. WERTHEIM, Professor of Organic Chemistry in the University of Arkansas. The Blakiston Company, 1012 Walnut Street, Philadelphia, Penna., 1942. vii + 482 pp. 82 figs. 15.5 × 23.5 cm. Price, \$3.00.

These two books are intended for students who are in related sciences of biology, medicine, home economics, etc. Both aim to give a student a well grounded appreciation of the graphic formula and of the structural theory of organic chemistry. The means by which each attains this end are, however, widely different and represent two views on the method of instruction. The book by Colbert begins with a chapter on the theoretical basis of organic chemistry which includes such topics as the Bohr atom, the coordinate and covalent bond, the valence of carbon, resonance, isomerism (structural, dynamic, optical and geometrical), classification as aliphatic, aromatic, and heterocyclic, and the importance of analysis and physical constants of organic compounds. After this introduction there is (part one) a sequence of fourteen chapters (246 pages) on aliphatic compounds, in which hydrocarbons, halogen alkyls, alcohols, acids, the lipids (fats, phosphatides, waxes and

sterols), amino acids and proteins and other topics are described. In part two, there are five chapters (68 pages) which describe aromatic compounds, monosubstituted benzene derivatives and heterocyclic compounds. The aim of the author is to develop the fundamental theory slowly but thoroughly in about the first third of the book and then give the remainder as a rapid survey. The book contains many excellent charts, directions for study and numerous questions. A short appendix gives the methods of calculating yields and the formulas of compounds.

The opening chapter of the text by Wertheim emphasizes the special fields covered in organic chemistry, the elements present in organic compounds, the industrial value of organic products such as leather, oils, chemicals, resins, etc.; the sources of organic compounds, the general methods by which the chemist analyzes them, the skeleton structure, the carbon atom and structural isomerism. After this introduction there follows a series of twenty chapters on hydrocarbons, halogen derivatives, alcohols, etc., in which the chemistry of functional groups and aromatic compounds are discussed. This material is divided into about 227 pages on aliphatic and 92 pages on aromatic and heterocyclic compounds. The concluding four chapters are, respectively, on digestion and absorption of foods, metabolism, nutrition and foods. Throughout the work the author has chosen to omit technicalities while stressing points of fundamental importance. The commercial and social aspects of organic chemistry are emphasized. Numerous illustrations of such subjects as the processing of soap, uses of cellophane and synthetic resins, synthetic rubber, animals showing the effect of diet deficiency, and respiratory apparatus are included. The photographs of molecular models are especially good. A generous supply of study questions is included with each chapter. The forty pages of appendix contain a glossary of terms in chemistry, biology and medicine, a discussion on the removal of stains, a list of reference books and analytical data on foods.

This review does not argue the merits of the two methods of instruction. The opening chapter of each text probably presents a pretty good picture of the principle which each author proposes to use with students who desire only a short course in organic chemistry. A conscientious student who will study either text and solve the problems can undoubtedly acquire a good knowledge of the subject.

AVERY A. MORTON

Equilibrium and Kinetics of Gas Reactions. An Introduction to the Quantum-Statistical Treatment of Chemical Processes. By ROBERT N. PEASE. Princeton University Press, Princeton, New Jersey, 1942. ix + 236 pp. Illustrated. 15.5 × 23.5 cm. Price, \$3.75.

This is a textbook designed for first year graduate students. The first part, about one-third of the book, is a review of the fundamental thermodynamics of equilibrium in gaseous systems. Nearly half of this part is devoted to the formulation of thermodynamic quantities in terms of partition functions and illustrations of their use. Only sufficient theory is developed as is needed in the numerous practical applications.

The rest of the book treats the rate and mechanism of gas reactions. This part begins with a brief description of the theory of the absolute rate of reactions. Chapters on reactions of simple order, quasi-unimolecular, chain, and oxidation reactions follow. The book closes with a brief account of surface-catalyzed reactions.

It is unfortunate that there are few gas reactions even moderately free of complications, as much might be learned from them. The reluctance of chemical reactions to proceed in a straightforward way is in itself remarkable, and the result is that the theory of reaction rates is far ahead of experimental confirmation. Indeed, it is almost true that the reactions which are least understood are those which have been studied most. While the reviewer does not agree with all of the conclusions of the author, the evidence for and against particular mechanisms is presented fairly. Such help in interpreting the mechanism of complex reactions as can be given by the theory of absolute reaction rates is freely used. The complicated behavior of oxidation reactions is particularly well presented.

Typographical errors are few and unimportant. The book emphasizes a common viewpoint of equilibrium and the approach to equilibrium in gas reactions, and the author is to be congratulated on his clear and readable survey of a complicated and fascinating field of study.

DARRELL V. SICKMAN

Introductory College Chemistry. By HORACE C. DEMING, Professor of Chemistry, and B. CLIFFORD HENDRICKS, Professor of Chemistry, University of Nebraska. Second edition, completely revised. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1942. xii + 521 pp. 176 figs. 15.5 × 23.5 cm. Price, \$3.00.

This revision of Deming's popular and widely used "Introductory College Chemistry" should be of interest to anyone teaching a group who are either less advanced or do not need a detailed and comprehensive course in general chemistry. In the preparation of this revision the original text has been largely rewritten. A few changes in order of presentation have been made and new questions and exercises have been added. However, in this rewriting there has been no loss of clarity or logical presentation. The practical aspects of chemistry are stressed, but not to the exclusion of fundamental principles.

The order of treatment is the fairly standard: Introduction—Oxygen—Water—Atomic Structure—Hydrogen—Acids—Bases—Salts—Non-metals—Metals—Organic Chemistry. Although the order may not appeal to some teachers, the authors seem to have maintained excellent continuity.

All in all, the book would seem to be worthy of the careful consideration of anyone interested in a well-written, up-to-date, and readable, but less comprehensive textbook.

C. H. SORUM

Du Pont—One Hundred and Forty Years. By WILLIAM S. DUTTON. Charles Scribner's Sons, New York, N. Y., 1942. x + 396 pp. 16.5 × 23.5 cm. Price, \$3.00.

This book presents the story of a chemical enterprise through which from remote beginnings in colonial days runs

unbroken for seven score years the red thread of a family name and a spirit which as the years went by became a cherished tradition to be passed on from generation to generation. It is to a notable degree a biography of an institution. The outstanding figure of the earlier chapters is Eleuthère Irénée du Pont, one of two sons of Pierre Samuel du Pont de Nemours, who had been elevated to the nobility because of distinguished services to his country, and his work in connection with the Peace of Paris between the United States and England. At the country estate of his father he met many notable visitors, among them Benjamin Franklin, Lafayette, Talleyrand, and Lavoisier. The latter became interested in the boy of fourteen and two years later gave him a position in the gunpowder factory of which Lavoisier was chief. After four years there he became first assistant to Lavoisier in his laboratory. Then followed the French Revolution, the reign of terror, the migration of the du Pont family to America, and the erection of the little gunpowder factory on the Brandywine near Wilmington in 1802 based on the training given by Lavoisier and financed by French and American capital.

The close connection of ammunition and explosives with the pioneering development of the West, and the wars, of the last century gives historical interest to the large section of the book which covers that period in which nitroglycerine and dynamite and nitrocellulose and smokeless powder gave a new trend to the explosive industry. With the present century there began an era of expansion which in its broader outlines reflects the progress of the chemical industry in America over the past forty years. The reader finds here much which appeals to his imagination. In no field of human endeavor more than in chemistry is the spirit of the pioneers more clearly reflected, and adventure and discovery and individual initiative and resourcefulness become the keys to accomplishment. The concluding chapters dealing with the development of a broad program of research, dyestuffs, cellulose products, plastics, synthetic rubber, nylon, high pressure reactions, and the management and policies of the Company, although presented in popular vein, are informative and interesting. The book is written in excellent literary style, and bears evidence of a painstaking effort on the part of the author to write with authority and accuracy, without sending his bucket too often to the well of sentimentality.

ROBERT E. SWAIN

Practical Physical Chemistry. By ALEXANDER FINDLAY, Professor of Chemistry, University of Aberdeen. Seventh edition, revised and enlarged. Longmans, Green and Co., 55 Fifth Avenue, New York, N. Y., 1942. x + 335 pp. 124 figs. 14 × 22 cm. Price, \$3.00.

The most recent edition of this well-known book embodies few innovations. Six new experiments and a number of alternative applications of the previously used experimental methods have been added.

The book has sixteen sections; the first three of which are general in nature—Calculation of Results and Errors, Determination of Weight and Volume and Thermostats. The first two of these present very satisfactory discussions of the material covered. Chapter III on Thermostats is a

useful compendium of temperature control mechanisms. The discussion of circulation of the bath fluid—an extremely important factor in constant temperature control—is rather inadequately treated.

The thirteen chapters following cover convenient groupings of experiments. The chapter headings, showing the range of topics, are: Density of Gases and Vapours, Density and Vapour Pressure of Liquids, Viscosity and Surface Tension, Optical Measurements, Osmotic Properties of Solutions, Distribution of a Substance between Two Non-Miscible Solvents, Conductivity of Electrolytes, Transport Numbers, Measurements of Electromotive Force, Velocity of Chemical Reaction in Homogeneous Systems, Thermochemistry, Heterogeneous Equilibria, and Colloids. Each chapter includes a short discussion of the underlying principles, then a rather complete description of the apparatus used and the technique of measurement, and finally several alternative experiments illustrating each method. Under each heading the more important types of apparatus are described and experiments suitable to each are suggested.

A good feature of this manual is the unusually large number (approximately 90) of experiments included in this edition. This gives the user wide latitude in the selection of exercises adapted to his needs.

The use of the concept of activity and the application of the Debye-Hückel theory to conductance experiments are evidences of the author's modernity in viewpoint. This edition includes experiments on absorption spectra, the glass and antimony electrodes for pH measurements, and the tungsten electrode for redox reactions. The author explains that he has been "reluctantly compelled to omit" certain subjects such as unimolecular films, dielectric constants, colorimetry, and photochemical reactions.

The book is well written and should be found thoroughly satisfactory by most users. It is to be hoped that the publishers will make new cuts for the next edition, some of the cuts in this edition being so old that they detract considerably from the appearance of the book.

ELIJAH SWIFT, JR.

Experimental Physical Chemistry. By W. G. PALMER, M.A., Sc.D., D.Sc., Fellow of St. John's College, Cambridge, University Lecturer in Chemistry in the University of Cambridge. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1942 (Cambridge: at the University Press). xi + 321 pp. 89 figs. 13.5 × 21.5 cm. Price, \$2.75.

Some seventy-five experiments divided into eight sections comprise the contents of this new volume. Most of the experiments are the result of the author's experience over a number of years in the Physical Chemistry Laboratory at the University of Cambridge. As a result, the directions given are rather detailed and allow for the mistakes in technique and understanding which the average student might be expected to make. The author includes sufficient theoretical material in each section so that reference to other texts is usually not necessary, though references for further reading are suggested. Carefully worked out sample calculations are included with each experiment.

An unusual section in this book is the chapter on Crystallization and Properties of Crystals. Several experiments are given, illustrating supersaturation, influence of foreign substances on crystal habit, isomorphism and isodimorphism, alternative systems being suggested in each case.

The author has confined the experiments to those requiring apparatus "simple enough to be assembled or constructed by the students themselves from ordinary laboratory equipment." While many of the fundamental principles taken up in the elementary course in Physical Chemistry are illustrated by such equipment, the limitation imposed cuts out a large group of experiments which not only demonstrate alternate methods, but also offer invaluable experience to the student. Experiments using more costly equipment should not be scorned—thus, most students find the Abbé refractometer an easily handled piece of equipment giving them excellent results as an analytical tool when working with minimum boiling mixtures. The use of the polarimeter, refractometer, spectrometer, bomb calorimeter, oil film balance, tensiometer, etc., show the student more refined methods of measurement which do not offer too great difficulties in manipulation and which produce results satisfactory in every sense.

The author is apparently unaware of the work of Grinnell Jones and collaborators on conductance measurements and on the redetermination of the conductance standards (see p. 187). It is also surprising to find no mention of the parachor in this book.

In spite of the poor binding and paper, which are to be expected in these times, the type is clean and very legible and the cuts clear and well drawn. Laboratories without the more expensive facilities mentioned above will find that the directions for assembling equipment given in this text will enable them to carry out a very satisfactory program of experiments covering the fundamental principles of physical chemistry.

ELIJAH SWIFT, JR.

General Chemistry. By HARRY N. HOLMES, Professor of Chemistry in Oberlin College. Fourth edition. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1941. viii + 720 pp. 198 figs. 16 × 24 cm. Price, \$3.75.

The fourth edition of General Chemistry by Harry N. Holmes has not lost any of the values that made the text so teachable in the first edition.

The arrangement of the non-metals is just the same as in the previous editions but there is a decided improvement in the arrangement of the metals. These are studied according to the metallurgy of various groups. They are then taken up again according to their position in the Periodic system. This seems to be a decided improvement over the usual method of presenting the metals.

The historical method of presenting chemistry has been fairly well preserved although enough of the modern concept of the atom has been given in the first few chapters to permit the use of the modern theories if one desires.

The exercises at the end of each chapter as well as the references are very well done. The chapter outline and the review suggestions in the early part of the book should be quite a help to the conscientious student.

The application of chemistry to industry and to ordinary living has been brought up to date and should help to create an interest in the science of chemistry.

It is a text that should be examined in order to be appreciated.

JOHN B. ZINN

BOOKS RECEIVED

October 10, 1942–November 10, 1942

FREDERICK J. BATES AND ASSOCIATES. "Polarimetry, Saccharimetry and the Sugars." Circular of the National Bureau of Standards C440 (May 1, 1942). 810 pp. For sale by the Superintendent of Documents, Washington, D. C. \$2.00.

HARRY C. BIDDLE. "Chemistry in Health and Disease." Second edition. F. A. Davis Company, 1914 Cherry Street, Philadelphia, Pa. 718 pp. \$3.50.

J. AUSTIN BURROWS, PAUL ARTHUR, AND OTTO M. SMITH. "Semimicro Laboratory Exercises in General Chemistry." The Macmillan Company, 60 Fifth Avenue, New York, N. Y. 331 pp. \$2.50.

NICHOLAS D. CHERONIS. "Semimicro and Macro Organic Chemistry. A Laboratory Manual." Thomas Y. Crowell Company, 432 Fourth Avenue, New York, N. Y. 388 pp. \$2.75.

EDWARD F. DEGERING. "The Quadri-Service Manual of Organic Chemistry." Houghton Mifflin Company, 2 Park Street, Boston, Mass. 221 pp. \$2.50.

ED. F. DEGERING, CARL BORDENCA AND B. H. GWYNN, *et al.* "An Outline of Organic Nitrogen Compounds." Planographed by John S. Swift Co., Inc., Third and Vine Streets, Cincinnati, Ohio. 381 pp. \$6.00.

ED. F. DEGERING AND NINETY-SIX ASSISTANT EDITORS. "An Outline of Organic Chemistry." Fourth edition. Barnes and Noble, Inc., Fifth Avenue at 18th Street, New York, N. Y. 386 pp. \$1.25.

ED. F. DEGERING AND ONE HUNDRED ELEVEN COLLABORATORS. "The Work Book of Fundamental Organic Chemistry." Barnes and Noble, Inc., Fifth Avenue at 18th Street, New York, N. Y. 256 pp. \$1.25.

ALFRED BENJAMIN GARRETT, LAURENCE LARKIN QUILL AND FRANK HENRY VERHOEK. "Introductory Chemistry for the Laboratory." Ginn and Company, Statler Building, Boston, Mass. 239 pp. \$1.60.

AMÉ PICTET. "Souvenirs et Travaux d'un Chimiste." Éditions de la Baconnière, Boudry (Neuchâtel), Switzerland. 228 pp. 9.—fr. suisses (l'exemplaire); 20.—fr. suisses (lux).

ROGER J. WILLIAMS. "A Textbook of Biochemistry." Second edition. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y. 533 pp. \$4.00.

HERMAN FREDERICK WILLKIE AND PAUL JOHN KOLACHOV. "Food for Thought." Indiana Farm Bureau, Inc., Indianapolis, Indiana. 209 pp. \$2.00.