either a repulsive state or an attractive state with sufficient vibrational energy (due to the operation of the Franck–Condon principle).

In some cases activation of a chemical reaction by an isomeric transition may follow from the formation of an undissociated molecular residue which, either before or after it regains an electron, is itself in a sufficiently reactive state. The irradiation of solutions by X-rays, wherein the same type of molecular excitation is produced, has also led to the observation of chemical decomposition and activation processes.[9]

(9) See H. Fricke, E. J. Hart and H. P. Smith, *J. Chem. Phys.*, **6**, 229 (1938), for bibliography.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA RECEIVED MARCH 20, 1940

Reaction of Sulfur with Mercuric Acetate in Glacial Acetic Acid

BY RICHARD E. VOLLRATH

When sulfur is heated with mercuric acetate in glacial acetic acid, no mercuric sulfide is formed but instead mercurous acetate. Quantitative experiments in which the reduction product was estimated as mercurous chloride and the oxidation product as barium sulfate indicate that the chief process taking place corresponds to

$$6Hg(C_2H_3O_2)_2 + S \longrightarrow 6HgC_2H_3O_2 + 6HC_2H_3O_2 + H_2SO_4$$

By carrying on the reaction in a sealed tube at 135°, over 90% of the mercury can be recovered as mercurous acetate. No more than a trace of mercuric sulfide was obtained after prolonged heating.

Prolonged heating of the mixture gives some mercurated acetic acid or related compound, as indicated by the fact that addition of sodium iodide no longer gives a precipitate of red mercuric iodide but instead a pale yellow iodide having the characteristics of an organic mercury compound. Further work is being done on this phase of the problem.

DEPARTMENT OF PHYSICS
UNIVERSITY OF SOUTHERN CALIFORNIA
LOS ANGELES, CALIFORNIA RECEIVED JANUARY 27, 1940

NEW BOOKS

Statistical Method from the Viewpoint of Quality Control. By WALTER A. SHEWHART, Ph.D., Member of the Technical Staff, Bell Telephone Laboratories, New York, with the editorial assistance of W. EDWARDS DEMING, Ph.D., Senior Mathematician, The Department of Agriculture, Washington. The Graduate School, The Department of Agriculture, Washington, 1939. ix + 155 pp. Illustrated. 16.5 × 24.5 cm.

Based on four lectures delivered in March, 1938, this book is a critique of statistical quality control, for readers who already have some acquaintance with the elements of statistical theory, and are more interested in applying than in developing it. Chemists and physicists will be interested in the analysis of the data on basic physical and chemical constants, in the light of which the incompatibilities pointed out by R. T. Birge may be evidence that statistical sins, even in high places, do not go forever unpunished. "When a scientist makes a mistake in the use of statistical theory, it becomes a part of 'scientific law'; but when an industrial statistician makes such a mistake, woe unto him for he is sure to be found out and get into trouble." The discussion of the specification of accuracy and precision will be a disappointment to readers who are looking for easy answers, "...neither the physical nor the numerical aspect of an operation by itself can be taken as a complete description of the operation." The table of contents by sections goes far toward atoning for the lack of an index, and the typography reflects credit on the Lancaster Press.

ELLIOT Q. ADAMS

Theoretical Qualitative Analysis. By J. H. REEDY, Associate Professor of Analytical Chemistry, University of Illinois. McGraw-Hill Book Co., Inc., 330 West 42d St., New York, N. Y., 1938. ix + 451 pp. 34 figs. 14.5 × 21 cm. Price, $3.00.

Most present-day Qualitative Analysis texts consist of companion sections on the theory of the processes of precipitation and separation, and on the characteristic reactions of the various ions, with the detailed analytical procedures. The author has followed this plan, presenting first some 150 pages of theory dealing with solutions, colloids, mechanics of precipitation, analytical operations, equilibrium, mass law, ionization and its applications, sulfide behavior, amphoterism, complex ions, hydrolysis, cell potentials, and the handling and balancing of equations. This list is a comprehensive and ambitious one for the space allotted; the treatment of each item is matter-

of-fact and necessarily brief, too much so at times, since many concepts and mathematical statements have to be introduced, considered and dismissed with little or no introductory background or explanation.

The qualitative analytical part of the book occupies the remaining 270-odd pages, consisting of the usual descriptive paragraphs on cations and anions (much more extensive than in most texts), the systematic procedures for the various groups, and short sections on dry (blowpipe) analysis and the dissolving of solid substances. The systematic cation procedure handles the silver group in the customary way, and the copper and tin group sulfides are divided with ammonium polysulfide. In the large iron–nickel family the whole group is precipitated as hydroxides and sulfides, and these are divided either with sodium hydroxide–peroxide, or by solution of all except cobalt and nickel in hydrochloric acid, followed by separation of the soluble members with sodium hydroxide (the phosphate–oxalate interference procedure also is given in some detail). The alkali earth cations are precipitated as usual with hot ammonium carbonate and then analyzed by a choice of methods: chromate–sulfate–oxalate, chromate–ferrocyanide–sulfate, chromate–chromate–oxalate, or the alcohol separation of the nitrates and chlorides. The Mg–Na–K group ions are identified by several methods, the phosphate–perchlorate–zinc uranyl acetate, and phosphate–perchlorate–fluosilicate (incorrect flow-sheet) methods being suggested. The anion analysis treatment is quite detailed, the radicals being classified on behavior into six groups: (I) insoluble silver salts (8), (II) slightly soluble silver salts (4), (III) silver and barium salts insoluble in dilute acid (11), (IV) soluble silver and barium salts (7), (V) barium salts insoluble in acids (3), (VI) silicates.

Every book contains factual and typographical faults or arguing points; in this text there might be mentioned: the use of certain unattractive (to the reviewer) plural and compound words, such as, mediums, equilibriums, deionization, saltlike, noncorrodible, nonoxidizing, timesaving, glycerin (glycerol preferred), nonionizing, nonaqueous, subreaction, semichemical, etc.; the unorthodox definition of molal solutions (p. 11); the unusual concept of "solid concentrations" (p. 50); the slightly severe treatment of the Arrhenius theory (pp. 72 ff.) (John Dalton has fared much better; did Arrhenius ever propose that ions actually existed as free simple atoms or groups?); the typographical oversight which has allowed the signs on anions to join end-to-end (preferably spaced or set up as $^{-}{}_{-}$ or $^{--}$).

ALLEN D. BLISS

General Chemistry. Theoretical and Descriptive. By THOMAS P. MCCUTCHEON, Ph.D., Professor of Inorganic Chemistry, University of Pennsylvania, HARRY SELTZ, Ph.D., Professor of Physical Chemistry, Carnegie Institute of Technology, and J. C. WARNER, Ph.D., Professor of Chemistry, Carnegie Institute of Technology. Third edition. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1939. xiii + 685 pp. Illustrated. 14 × 22 cm. Price, $3.75.

This is a book which will appeal to the instructors who wish to give a full course in General Chemistry for the able student who has already had work in physics and chemistry. Hearing so much about the necessity of making chemistry simple arouses one's fears that teachers may choose texts which leave out the meat and that the chemical soup will be too dilute to satisfy the strong student. It is therefore encouraging to find another text, thorough in its presentation and accurate in detail, meet with sufficient support to warrant a third edition.

The subject matter is divided into two parts, following the plan of former editions. Part I, entitled "Chemical Principles and Theories," is complete in itself and would be received with favor for some uses if it were bound separately. This part is written with the viewpoint of the physical chemist and includes a good deal of the material ordinarily found in elementary physical chemistry texts. Nevertheless, the presentation is not too mathematical and a student who has had or is taking his first college mathematics, should comprehend fully any of the material presented.

Part II, entitled "Descriptive Chemistry," contains the usual factual information about the elements and their compounds. Following an introductory chapter on "Acids, Bases and Salts. Metals and Non-Metals," there are several chapters in which the non-metals and their compounds are presented in the conventional order. The metals are discussed in families following the order of the Periodic Table, two chapters on Organic Chemistry being included after group IVb.

The book has eight full-page portraits, about seventy-five excellent drawings, some seventy references (most of which are to more advanced texts) in Part I, no references in Part II, and a twenty-two-page two-column index.

It is the opinion of the reviewer that the text should have several fields of usefulness, such as: (1) a textbook for sincere and able students who have had some previous training in science; (2) a review for the upperclassman who wishes a logical presentation of chemical theory, which is not cluttered up with factual data about individual substances; (3) reading for teachers in related fields of Biology, Physics, Geology, and Mathematics, as well as Elementary Chemistry teachers, who for any of various reasons wish to be brought up to date in chemical thought and terminology.

C. R. CONARD

The Nature of the Atom. 115 pp. Illustrated. By G. K. T. CONN, M.A. (Aberdeen), B.A., Ph.D. (Cambridge). **The Wave Nature of the Electron.** 78 pp. Illustrated. By G. K. T. CONN. **The Nature of Crystals.** 114 pp. Illustrated. By A. G. WARD, B.A., Scholar of Trinity College, Cambridge. All three volumes published by Chemical Publishing Company, 148 Lafayette Street, New York, N. Y., 1939. 12.5 × 19 cm. Price, each, $1.50.

This series of little books is intended for the intelligent lay reader who desires a somewhat more thorough exposition of modern conceptions of the structure of matter than is to be found in the ordinary popular book on general physical science. Though the volumes belong naturally together, each is complete in itself, containing a carefully developed presentation of its subject. The ap-

proach is historical, in order to show why it has so frequently been necessary to abandon naive conceptions in favor of difficult and at first sight apparently fantastic abstractions. Assuming no special knowledge of mathematics on the part of the reader, the authors have been at pains to present their material in a way which should enable him to obtain, at the cost of a few hours of careful reading, some real comprehension and appreciation of the trends of recent Physics. The volume on crystals contains excellent illustrations and diagrams of the simpler lattice types, with directions for the construction of models which will undoubtedly, if followed, aid the reader to grasp the elementary theory of the crystal lattice. There is considerable discussion of modern views of different kinds of binding forces between molecules, atoms and ions. The volumes on the atom and the electron present what are now the standard results of wave mechanics.

A. S. COOLIDGE

A Short History of Chemistry. By J. R. PARTINGTON, M.B.E., D.Sc., Professor of Chemistry in the University of London, Queen Mary College. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1937. xiv + 386 pp. 124 figs. 13.5 × 20.5 cm. Price, $2.50.

This Short History of Chemistry by Partington comes as a welcome addition to our somewhat meager list of really readable histories of chemistry. In the first portion the author has traced the beginnings of chemistry through the alchemical, iatrochemical and phlogiston periods in a most delightful manner, and has brought a fresh viewpoint on pre-Lavoisierian chemistry. His own investigations into original sources add a personal touch and the profuse illustrations are indeed refreshing. It is pleasing to note the emphasis and recognition given to that pioneer, van Helmont. The work on the discovery of gases by the group of British chemists is well described.

The main portion of the book, exactly one-half of the entire contents, is devoted to the period from Lavoisier down through the establishment of the valence theory. In giving account of the advances made and theories proposed during this badly confused period in the development of our science, the author has been only moderately successful. In the opinion of the reviewer, more definition might have been given to the interpretation of prevailing theories, in order to clarify the concepts, notations and viewpoints as they gradually evolved. In using this text with a class in the history of chemistry, the reviewer's students encountered this difficulty of interpretation. Yet, it might be said in justice to the author, that other histories of chemistry covering this epoch are likewise difficult to read and harder to understand; the authors are not entirely to blame, the period itself was chaotic.

The period of expansion following 1860, in which Inorganic Chemistry became definitely etsablished, Organic Chemistry greatly expanded and Physical Chemistry became differentiated as a separate branch of the science, is covered rather briefly by the author. For this brevity the author states in the preface "...this part of the subject is dealt with in the ordinary lecture courses on Chemistry, and need not be repeated in a book of this kind." For one seeking a concise (57 page) account of the development of chemistry from 1860 to relatively recent times, he will find it here.

On the whole, this book is one of the finest short histories of chemistry ever written. The reviewer commends it and congratulates the author in his accomplishment.

C. J. ENGELDER

Introduction to Practical Organic Chemistry. By FREDERICK GEORGE MANN, Sc.D. (Cantab.), D.Sc. (Lond.), F.I.C., Fellow and Lecturer, Trinity College, Cambridge, University Lecturer in Chemistry, and BERNARD CHARLES SAUNDERS, M.A., Ph.D. (Cantab.), B.Sc. (Lond.), Fellow and Charles Kingsley Lecturer, Magdalene College, Cambridge, University Demonstrator in Chemistry, Sometime Assistant Master, Eton College. Longmans, Green and Co., 114 Fifth Avenue, New York, N. Y., 1939. ix + 191 pp. Illustrated. 14.5 × 22.5 cm. Price, $1.50.

This book is "essentially a severely abridged version" of "Practical Organic Chemistry" by the same authors (*cf.* THIS JOURNAL, 61, 1297 (1939)), and has been designed "to cover the essential requirements for the organic chemistry of the 1st M. B. examination at Cambridge and most other British universities, the various Higher School Certificate Examinations, the Chemist and Druggist Qualifying Examination of the Pharmaceutical Society, and examinations of a similar type. It is, therefore, directed at a specific group in Britain.

Inasmuch as the larger book has been competently reviewed, it seems that it remains only to point out the extent of abridgment. The section on methods and manipulation has been cut from 37 to 27 pages; preparations occupy 64 pages compared to 164 in the larger book; the section dealing with reactions and identification of organic compounds has been shortened from 79 to 57 pages; 24 pages instead of 77 are devoted to quantitative analysis, and the section on simple enzyme reactions has been deleted.

The use of a great deal of fine print does not increase the readability of the book, but if one desires a laboratory text in which preparations, reactions and identification of organic compounds and quantitative organic analysis are treated in the brief space of 172 pages, the text can be recommended. The exposition is clear and concise, and the choice of material good.

NATHAN L. DRAKE

Gmelins Handbuch der anorganischen Chemie. (Gmelin's Handbook of Inorganic Chemistry.) **Aluminium-legierungen.** (Aluminum Alloys.) Collection of Patents. Edited by G. APEL, Regierungsrat in the Patent Office. First Supplement, Parts I–III. Verlag Chemie, G. m. b. H., Corneliusstrasse 3, Berlin W 35, Germany, 1939. VI + 1877 pp. Price, RM. 72 + 49.50 + 31.50.

This is a First Supplement to the Collection of Patents on Aluminum Alloys published in 1936 as an Addendum to the volume on Aluminum in Gmelin's Handbook. It covers all the patents on aluminum alloys which have appeared in England, France, Germany, Switzerland and the

United States during the succeeding three-year period, that is, from the beginning of 1935 to February, 1938. The same convenient system is followed as before, namely, listing the foreign constituents of each alloy alphabetically and putting all the alloys with the same final constituent in a single group arranged in the order of increasing complexity.

A list of the trade names of recognized aluminum alloys with their percentage composition and the name of the inventor or manufacturer is also provided.

The present collection, in spite of the short interval of time covered must include more than twice as many alloys as the original volumes. This is an indication of the extraordinary activity in this field.

ARTHUR B. LAMB

Rheological Memoirs. Volume I, Number 1, January, 1940. EUGENE C. BINGHAM, Editor. Experimental Investigations upon the Flow of Liquids in Tubes of Very Small Diameter. By Dr. JEAN LEONARD MARIE POISEUILLE, translated by WINSLOW H. HERSCHEL. Published by Rheological Memoirs, Easton, Pennsylvania. 101 pp. 10 figs. 15.5 × 23 cm. Price, $2.00; bound in cloth, $2.50.

The preface says in part: "There is no gainsaying that an adequate library is one of the most important of tools, even granting that research is highly dependent upon the laboratory. Even with the deployment of our scientific journals to cover every field, there still are memoirs which are not readily available. There are works which need to be made more accessible, not because of an existent demand and a probable financial return or for reasons of patriotism or other allegiance. There are some classical researches which are needed as tools of research and in education....

"It is now proposed, under the title of Rheological Memoirs, to publish in inexpensive form certain classical memoirs in rheology in the English language which are not only important but inaccessible to the majority of readers. For the rheologist, such a paper would be that of Poiseuille published in the *Mémoirs présentés par divers savants à l'Institut de France* in 1846. This paper was the one which brought to the world the knowledge of viscous flow and the data there given are still regarded as among the best available for the absolute determination of the viscosity of water....

"The attempt will be made to publish rheological memoirs from time to time in unbound numbers, exactly as are the journals. When a suitable number of these are published, it is proposed to bind them in book form. Subscriptions may be placed with the Rheological Memoirs, Lafayette College, Easton, Pa., or with the Secretary of the Society of Rheology in care of the American Institute of Physics, 175 Fifth Avenue, New York, N. Y. The publication is edited by Dr. Eugene C. Bingham, and each paper is passed upon by the Publications Committee of the Society of Rheology.

"A fund has been collected to initiate this project. The response of the public will determine whether this type of publication will support itself and be continued."

This monograph by Poiseuille, which was originally published in 1846, should be read by every chemist or physicist interested in the flow of liquids. Poiseuille, a man trained as a physician and physiologist who was primarily interested in the circulation of the blood in the human body, boldly challenged the accepted formulas of the hydraulic engineers and demonstrated that flow of liquids in narrow tubes obeys different laws than the flow in wide pipes. In addition to the great historical interest of this paper in opening a new branch of science, it is remarkable that nearly one hundred years ago Poiseuille evidently attained a precision in his experimental results which would be difficult to surpass at the present time even with the aid of modern equipment.

The translation has been done splendidly. A brief biography of Poiseuille and many critical notes add to the interest and value of the pamphlet. Our thanks are due to Eugene C. Bingham and to Winslow H. Herschel for making this masterpiece available.

Other memoirs on plasticity and lubrication are foreshadowed.

GRINNELL JONES

Molecular Spectra and Molecular Structure. I. Diatomic Molecules. By GERHARD HERZBERG, Research Professor of Physics, University of Saskatchewan. Translated with the Co-operation of the Author by J. W. T. SPINKS, Professor of Physical Chemistry, University of Saskatchewan. Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y., 1939. xxviii + 592 pp. 181 figs. 16 × 23.5 cm. Price, $6.50.

The German edition of this book has been reviewed in the February, 1940, number of THIS JOURNAL. The English edition does not differ in any essential respect from the German, though some improvements have been made. The translation is adequate. The book provides an accurate and up-to-date account of the theory of diatomic molecules, especially those portions of immediate applicability to spectral analysis; some of the more difficult details and certain more complex portions of the theory are omitted. The theory is illustrated by many examples, a large number of which are discussed in detail. Table 36 summarizes the data on the ground states of the known diatomic molecules, including isotopic molecules, and has been revised as of July, 1939. The new values of the physical constants are used, instead of Birge's table of 1929. As most calculations in the literature are based on the older values, the reader using the data in the present volume will need to exercise some care in order not to introduce inconsistencies. The book is furnished with an excellent subject index. Altogether, it is a work which is indispensable to anyone who has a serious interest in the field covered.

O. K. RICE

Quantitative Biological Spectroscopy. By ELMER S. MILLER, Assistant Professor, Department of Botany, University of Minnesota. Burgess Publishing Company, Minneapolis, Minn., 1939. 213 pp. Illustrated. 21 × 27 cm. Price, $3.50.

This manual contains eighteen chapters. A brief history of optics and a summary of the theory of molecular spectra is given in chapters one and two. Chapter three

deals with thermopiles, photoelectric cells and amplifiers and chapter four with spectrophotometric instruments. In chapter five spectrophotometric methods for the determination of the absorption in the ultraviolet, visible and infrared regions of the spectrum are described and chapter six is devoted especially to photoelectric spectrophotometry. After having presented in chapter seven the basis of absorption spectroscopy including calibration and standards, the author has discussed in chapter eight the sources of error which may influence the accuracy of measurements. These chapters, which give a survey of the various types of spectroscopic apparatus and discuss the performance of absorption measurements represent a valuable collection of information otherwise obtainable only by wearisome search through scattered literature. They are enriched by fine illustrations.

The following chapters may be considered as a second part of the manual dealing with the applications of absorption spectroscopy: to chemistry (chapter nine); to the determination of molecular structure (chapter ten), and chapter eleven emphasizes the importance of infrared absorption spectroscopy for chemistry. Furthermore, chapters twelve to seventeen include the application of absorption spectroscopy to important biological material, such as absorption spectra of vitamins, cytochrome and other pigments; spectrophotometric studies of hemoglobin derivatives; absorption spectra applied to lipids and lipid metabolism; analysis of binary, ternary and quaternary mixtures (with special reference to chlorophylls and carotenoids); application of quantitative spectral analysis to plant pigment inheritance studies. The last chapter presents selected annotated references of spectrophotometric studies.

The compilation of these various applications of absorption spectroscopy will be of great value not only for those who intend to become acquainted with this field but also to those already familiar with the subject, especially with respect to the critically and clearly stated precautions which must be observed in investigations of this kind. It is unfortunate that the selected references given in the last chapter are not accompanied by a compilation of the references on these subjects for the past five years, particularly since many of them are given in the chapter bibliographies. Considering the significance of the application of absorption spectroscopy to biological problems this manual, written by a competent author, is welcome.

ADOLPH STERN

Thermodynamics for Chemical Engineers. By HAROLD C. WEBER, Associate Professor of Chemical Engineering, Massachusetts Institute of Technology. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1939. vii + 264 pp. Illustrated. 15 × 23.5 cm. Price, $3.25.

The author states in the preface that it is his purpose to present the more important thermodynamic relations in a manner particularly useful to the chemical engineer. The preliminary preparation expected of the students is indicated by the statement "Familiarity with the fundamentals of physics will be useful, and the simultaneous study of physical chemistry, as practiced in many schools, will be helpful." In the reviewer's opinion practically all of the book can be readily understood by most students without any previous or simultaneous study of physical chemistry. One exception is the chapter IV on phase relations which would be quite difficult for any student who had not made some study of the temperature–pressure–composition diagrams for binary systems. Many other sections of the book would involve unnecessary repetition for students who have taken a course in physical chemistry which even approximately covers the material in any standard text. As examples of this type of material may be cited portions of Chapters V, VI, VIII, and XVI.

In the preface it is suggested that the first fourteen or fifteen chapters include as much material as can be covered satisfactorily in a two semester course. Such a selection omits consideration of equilibrium constants, electrochemical effects, third law, and free energy as a function of temperature. The reviewer believes that these topics are of more importance in a course on thermodynamics than some other topics, such as fluid flow which is treated in considerable detail in chapter XI. Such topics are more suitable for a course in plant design than one in thermodynamics.

Objections to the material contained in the book are relatively few. Chapter XIX on electrochemical effects is probably the poorest in the book. In the first place the diagram on p. 241 does not even remotely resemble a workable cell. Then on p. 242 the author speaks of the cell reaction for a cell consisting of two hydrogen electrodes one in 0.1 molal hydrochloric acid and the other in 0.1 molal sodium hydroxide as being the transfer of hydrogen ion from a solution where its activity is a_1 to one where its activity is a_2. Actually the cell reaction is the formation of water from its ions. Later in the chapter the reader is left without any clear idea how to determine whether a given cell is functioning reversibly.

The numerous diagrams will be found an aid to the student. However, it is unfortunate that the author did not select a reaction for the figure on p. 27 which could be balanced at some pressure which can be contained by apparatus which is obtainable. Figure 9, p. 79 and Fig. 10, p. 81, both have entropy of vaporization as ordinates, it would be better to call it by this name rather than speak of an enthalpy function, especially since the term entropy is used elsewhere in the same chapter.

Those teachers who agree with Professor Weber as to the content of a course in thermodynamics for chemical engineers will probably be well satisfied with the book as it is. Those who believe more stress should be laid on the material covered in the last five chapters will have to amplify the book considerably.

G. K. ROLLEFSON

Colloid Chemistry. By ROBERT J. HARTMAN, Indiana University. Houghton Mifflin Company, 2 Park Street, Boston, Massachusetts, 1939. xxviii + 556 pp. 184 figs. 16 × 24 cm. Price, $4.75.

This textbook of colloid chemistry treats the subject under four general headings: surface chemistry (130 pages), lyophobic colloidal systems (225 pages), lyophilic colloidal systems (80 pages), and the biocolloids (100 pages). In the first section are treated the general char-

acteristics, theories, and applications of adsorption, including a chapter on contact catalysis. The second section is concerned primarily with the preparation, properties, and stability of sols, aerosols, emulsions, and foams. [Since a *sol* is by definition a colloidal system, the tautological expression *colloidal sol*, which the author uses frequently in this section, is not recommended.] The third section deals with lyophilic sols and with gels. The final section is devoted specifically to biocolloids and some colloidal aspects of organisms.

In the preparation of this book, the author has attempted "to present the important phases of colloid chemistry without overemphasizing one narrow phase of the subject at the expense of others which are to the average student and reader just as important." A specialist who writes a textbook is very likely to devote proportionately more space to the authoritative and critical analysis of that portion of the field in which he is directly interested; the remainder of the specialist's books will be less authoritative and is likely to be less critical. In this book the author has accomplished his worthy aim of avoiding overemphasis on some phase of colloid chemistry at the expense of others equally important; but unlike the specialist's book, this volume suffers throughout from the lack of a critical analysis on the part of the author of the large amount of material that he has compiled.

The book gets off to a good start with the section on adsorption phenomena. The survey of Langmuir's valuable contribution is especially good. Because of the space devoted to Langmuir, much less prominence could be given to the important work of Harkins, Bartell, and Adam.

For the purpose of "avoiding much possible confusion" the lyophobic and lyophilic colloidal systems are considered separately, although the author recognizes clearly that no exact line of demarcation can be drawn between them. On page 140, the author puts the oxide sols on the border line: "For example, the hydrosols of the oxides of such metals as iron, vanadium and chromium will tolerate the presence of more electrolytes than lyophobic colloids, such as suspended metals, before a state of instability is reached; and yet they are far more sensitive to electrolytes than lyophilic colloids such as protein suspensions." In the light of this statement the student unfamiliar with the various factors which influence the stability of sols, may be confused on finding on pages 260–261 that the precipitation value of sodium chloride, for example, is 28 for a certain gold sol and 9.25 for a certain ferric oxide sol. As a matter of fact, most of the oxide sols are not near the border line but are distinctly more lyophobic than lyophilic in their colloidal behavior. The gels are classified under lyophilic systems although dilute jellies of such lyophobic materials as platinum and cadmium have been prepared. In inorganic gels the capacity of the solid phase to form an interlacing structure may be much more important for gel formation than the lyophilic character of the solid phase.

The chapters dealing with the preparation and the physical, optical, and electrical properties of sols, are among the best in the book. The chapter on the stability of sols appears less satisfactory. Little attention is given to the constitution of colloidal particles and the discussion of the mechanism of the electrolyte coagulation process on which so many people have worked, is inadequate. No mention is made of the outstanding work of Verwey on this subject. The space devoted to biocolloids in this book is considerably greater than in most introductory treatises on colloid chemistry. For this reason it may be found of special use to students of biology and biochemistry.

The book is very attractively printed. The cuts include 40 excellent reproductions of photographs. The subject matter is well outlined by the generous use of section and paragraph headings. Throughout the book, distinctive terms appear in black face type. The interested instructor will be impressed by the good physical make-up of the book, but he will want to read it carefully to determine whether the choice and treatment of the subject matter are sufficiently critical to serve his purposes as a textbook for advanced undergraduate and graduate students.

HARRY B. WEISER

Die Ultrazentrifuge. Theorie, Konstruktion und Ergebnisse. (The Ultracentrifuge. Theory, Construction and Results.) By Prof. Dr. THE SVEDBERG and Dr. KAI O. PEDERSEN, Physical-Chemical Institute of the University of Upsala. Verlag von Theodor Steinkopff, Residenzstrasse 32, Dresden-Blasewitz, Germany, 1940. xii + 433 pp. 154 figs. 15.5 × 23.5 cm. Price, RM. 35; bound, RM. 37.

This comprehensive monograph is a thorough description of ultracentrifuges as developed in Professor Svedberg's laboratory at Upsala and of the results obtained with these machines by Svedberg and his pupils. Svedberg's development of ultracentrifugation is from every standpoint —technical, theoretical and in fruitfulness—one of the great triumphs of physical chemistry. For that reason his description within the confines of one book is of the widest importance.

The monograph is a coöperative effort of Svedberg and his pupils. General and introductory sections have been written by Svedberg himself; most of the sections on theory and method have been prepared by Pedersen. Special topics in theory and results have been written by several of Svedberg's pupils, and Bauer and Pickels have contributed a detailed description of their type of the air-driven ultracentrifuge.

The four principal parts of the book are devoted (1) to the theory of sedimentation, (2) to the construction of ultracentrifuges, (3) to the various methods of measurement with ultracentrifuges and (4) to the summary of results obtained with Svedberg's ultracentrifuges. The last of these parts without a doubt holds most interest for the general reader. Svedberg has a number of times summarized the data from his laboratory but this review, being more detailed and comprehensive, is of correspondingly wider usefulness. It should be read by all biochemists and physical chemists. Active workers with ultracentrifuges will probably find especially valuable the two chapters dealing with methods of measurement and with general theory. There is much useful technical information on design and construction, particularly of rotors, in the chapter describing the oil-turbine ultra-

centrifuge. This description makes apparent the enormous amount of work that has gone into developing the instrument; after studying it one can readily understand why more have not been built.

The few workers with ultracentrifuges who are not directly a part of the Svedberg school will find the book largely a record of the point of view, as well as the accomplishments, of one group. There is, of course, the greatest justification for this in the overwhelming role that Svedberg has played in demonstrating the usefulness of centrifugation in the study of macromolecules. At the same time this physical technique will reach its full usefulness only when it can be widely and freely employed and its methods modified by many people of varied interests. There is thus a real need to have ultracentrifugation, and its still unrealized opportunities as a research tool, presented in such a way as to encourage others to try to use it. Very high centrifugal fields are useful, not only as a step in molecular weight estimation, but also as a tool for the isolation and purification of macromolecular substances. The centrifuges necessary for such preparative work as well as for accurate measurements of sedimentation rates on the heavier proteins can be much less costly and complicated than those described in this monograph. Many persons feel that the air-turbine ultracentrifuge is important for the very reason that it makes possible instruments the average laboratory is equipped to build and operate. From this standpoint it may be regretted that the treatment of air-ultracentrifugation is restricted to a detailed description of one excellent but still very complicated, and costly, instrument.

RALPH W. G. WYCKOFF

BOOKS RECEIVED

March 10, 1940, to April 10, 1940

J. E. BELCHER AND J. C. COLBERT. "Properties and Numerical Relationships of the Common Elements and Compounds." Third edition. D. Appleton-Century Co., Inc., 35 West 32d St., New York, N. Y. 350 pp. $2.00.

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MEYER BODANSKY AND OSCAR BODANSKY. "Biochemistry of Disease." The Macmillan Co., 60 Fifth Avenue, New York, N. Y. 684 pp. $8.00.

E. M. CHAMOT AND C. W. MASON. "Handbook of Chemical Microscopy." Volume II. Second edition. "Chemical Methods and Inorganic Qualitative Analysis." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 438 pp. $5.00.

ERNEST CHILD. "The Tools of the Chemist." Reinhold Publishing Co., 330 West 42d St., New York, N. Y. 220 pp. $3.50.

THOMAS B. CRUMPLER AND JOHN H. YOE. "Chemical Calculations and Errors." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 247 pp. $3.00.

WILLIAM LLOYD EVANS, ALFRED BENJAMIN GARRETT AND LAWRENCE LARKIN QUILL. "Semimicro Qualitative Analysis." Ginn and Company, 15 Ashburton Place, Boston, Mass. 246 pp. $2.00.

JOHN THEODORE FOTOS AND R. NORRIS SHREVE. "Advanced Readings in Chemical and Technical German." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 304 pp. $2.50.

W. F. GERICKE. "The Complete Guide to Soilless Gardening." Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y. 285 pp. $2.75.

E. HOPE, Editor AND F. W. ATACK, Founder. "The Chemists' Year Book 1939." Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y. 1257 pp. $6.00.

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KURT H. MEYER AND H. MARK. "Hochpolymere Chemie." Band 1. "Allgemeine Grundlagen der hochpolymeren Chemie." Akademische Verlagsgesellschaft m. b. H., Sternwartenstrasse 8, Leipzig C 1, Germany. 345 pp. RM. 22.20; bound, RM. 24.20.

MAXIMILIAN PFLÜCKE. "Periodica Chimica." Verlag Chemie, G. m. b. H., Sigismundstrasse 4, Berlin W 35, Germany. 208 pp. RM. 11.25.

LEON B. RICHARDSON AND ANDREW J. SCARLETT. "General College Chemistry." Henry Holt and Company, 257 Fourth Avenue, New York, N. Y. 683 pp. $3.75.

"Gmelins Handbuch der anorganischen Chemie." System-Nummer 68: "Platin." Teil C, Lieferung 2. "Verbindungen bis Platin und Caesium." Verlag Chemie G. m. b. H., Berlin W 35, Germany. 119 pp. RM. 14.25.