

z. There are two such sets with $x_1 = 0.313$, $z_1 = 0.125$; $x_2 = 0.138$, $z_2 = 0.008$. These parameters lead to satisfactory (*h0l*) intensities.

The sixteen platinum positions projected onto (010) form four, well-separated squares per unit with Pt-Pt = 2.84 kX. Each point must represent three platinum atoms. $P(xy)$ gives 2.82 kX. for one important Pt-Pt distance along b_0 . There are four molecules, or possibly four continuous chains, per unit cell. The square projection on $P(x,z)$ suggests that platinum is octahedral, as expected. The complete structure has not yet been determined.

"Hexamethyldiplatinum" is quite soluble in benzene, but negligibly soluble in non-aromatic hydrocarbons. The pronounced difference suggests that benzene may depolymerize the molecule. It is noteworthy that benzene leaves the tetramethylplatinum tetramer unaltered.³

Thanks are due Prof. Henry Gilman for advice and encouragement.

(3) R. E. Rundle and E. J. Holman, THIS JOURNAL, 71, 3264 (1949).

DEPARTMENT OF CHEMISTRY
IOWA STATE COLLEGE
AMES, IOWA

GABRIELLO ILLUMINATI
R. E. RUNDLE

RECEIVED AUGUST 15, 1949

NEW BOOKS

Aquametry. Application of the Karl Fischer Reagent to Quantitative Analyses Involving Water. By JOHN MITCHELL, JR., M.S., and DONALD MILTON SMITH, Ph.D., Ammonia Department, E. I. du Pont de Nemours and Co., Inc., Wilmington, Delaware. (Chemical Analysis, Vol. V. A Series of Monographs on Analytical Chemistry and Its Applications. Editors: Beverly L. Clarke and I. M. Kolthoff) Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1948. xi + 444 pp. 51 figures. 15.5 × 23.5 cm. Price, \$8.00.

The monograph "Aquametry" by John Mitchell, Jr., and Donald Milton Smith is the fifth of a series dealing with topics in Analytical Chemistry. The present work is primarily concerned with "the application of the Karl Fischer reagent to quantitative analyses involving water" but the authors have done much more than is indicated in this sub-title. The book is written in two parts; the first and longer section deals with considerations of a general nature as well as with specific quantitative determinations using the Karl Fischer reagent; the latter part deals with the determination of organic functional groups.

Contained in the first part is a brief survey of the classical methods used for the determination of water. It is shown later that in most cases the Karl Fischer Reagent yields better results and for this reason the older methods are not discussed in detail. There follows a chapter which presents almost in outline form a summary of the most important procedures which utilize the Karl Fischer Reagent. The presentation of this laboratory manual so early in the running text is a departure from the usual practise. It is placed in its particular position so that persons who have studied the pertinent portions of the book will be able to work in the laboratory more efficiently. The authors then present a discussion of possible alternative compositions of the reagent and give what they consider to be the best of those studied. After an investigation of the stoichiometry of the reactions involved, there is given a series of general discussions which deal with the determination of water on the macro and micro scales. This includes an excellent review of the important instrumental as well as the usual visual methods. Then actual working procedures are given for many common organic and inorganic materials. In each of these latter cases there are outlined alternative methods when such exist but these are necessarily brief. Extensive references are given in all cases. The first section is closed with examples of reactions with inorganic compounds which lead to apparent anomalies. These include redox couples which react with the iodine liberated

in the titration to give false end-points. The second part of the book will probably be of great use to organic chemists. In this section there are detailed instructions for the determination of various functional groups such as the alcoholic hydroxyl, the amino and the carbonyl radicals. These are not direct titration methods but include some intermediate water producing step. The frequent reference to interfering substances will be of great help to future workers. The book closes with a chapter on work which is as yet not done.

The volume as a whole is formulated in a concise, accurate and readable manner. The lack of serious errors is commendable and is probably due in large part to the care with which practically every entry was checked in the laboratory of the authors. If all future volumes in the Analytical Chemistry series are up to the standards set by Mitchell and Smith, one can easily visualize a set of these treatises in every complete chemical library.

EDWARD H. DE BUTTS

Natural Products Related to Phenanthrene. By LOUIS F. FIESER and MARY FIESER, Department of Chemistry, Harvard University. Third Edition of the Monograph Previously Entitled "Chemistry of Natural Products Related to Phenanthrene" by L. F. Fieser. A. C. S. Monograph No. 70. Reinhold Publishing Corporation, 330 West 42nd Street, New York 18, N. Y., 1949. xii + 704 pp. Price, \$10.00.

More than a decade has passed since the scientific world greeted with unanimous acclaim the first edition of Fieser's treatise which Butenandt has called a model *par excellence* for chemical monographs. The first edition arrived at a time when steroid chemistry had just firmly established itself as a special branch of organic chemistry, when most of the important hormones and related products had been discovered and the rough outlines of their structures had been drawn. Since then, in a bewildering multitude of papers, the more intimate structural details have been furnished with which to complete the picture. Once again Fieser, now in coöperation with Mrs. Fieser and Dr. Turner, has summarized the significant developments and has presented them in an eminently lucid and readable manner. The book is much more than a mere review of the subject. It abounds in original ideas concerning the revision of nomenclature, the relations between physical properties and structure of steroids, the course of certain

reactions and other points, ideas which might well have been the subject of separate publications. Like its predecessor the present edition is bound to become the most significant treatise, the standard reference book on the subject.

It appears futile to the reviewer to recommend this volume to the specialists in the field. They have been waiting impatiently for its appearance and they have probably enjoyed reading it by the time this review is published. The reviewer strongly recommends study of this book to organic chemists in general and to graduate students in particular. Not only does it present a very important subject in a most captivating manner, but it also acquaints the reader with a multitude of reactions and syntheses, and with the significance of physical properties in form of a story rather than as isolated facts. In short, the monograph is recommended as an outstanding, advanced textbook of organic chemistry.

WERNER BERGMANN

The Theory of Solutions of High Polymers. By A. R. MILLER, Imperial Chemical Industries, Research Fellow at the Royal Society Mond Laboratory in the University of Cambridge. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y., 1949. vi + 117 pp. Illustrated. 14.5 × 23 cm. Price, \$3.25.

The aim of this brief monograph is "to give an account of the [recent] mathematical advances in the treatment of solutions of high polymers," a subject to which its author has made significant contributions. The introductory chapter discusses models for solutions of simple molecules and the formulation of partition functions for them. The extension of the quasi-lattice model to polymer solutions is dealt with briefly in the second chapter. Chapter III begins with an account of Bethe's method and its grand partition function analog presents the fairly obvious extension to monomer-dimer mixtures and ultimately leads to the formulation of a partition function for monomer-polymer systems of zero mixing energy. The comparison of the theory with experiment in Chapter IV is partially satisfactory, but a rather large discrepancy occurs in dilute solutions. The refinement of the theory (Chapter V), after the manner of the late Dr. W. J. C. Orr, to allow for non-randomness brought about by non-zero energies of mixing fails to remove the discrepancy. The final chapter (VI) presents a non-mathematical discussion of limitations of the theory and concludes with a statement to which this reviewer subscribes completely: "Further advances . . . are probably to be sought in a physical model which represents an actual liquid more faithfully than does the quasi-crystalline model, rather than in refinements of the mathematical and statistical techniques."

The subject is approached primarily from the viewpoint of the contributions of its author supplemented in part by those of Guggenheim and of Orr. This preference is excusable and may in part be justified, but the casual disposal of the alternate method of direct evaluation of the combinatorial factor because it "introduces unwanted algebraic complications" is not realistic and may be quite misleading. The emphasis on mathematical rigor is commendable, but it is disappointing to see that it carries one substantially no further than the obviously simpler procedures. In the opinion of this reviewer, the book's most serious weakness occurs in the discussion of the failure of the theory as applied to dilute solutions. This failure has been shown to result from the certain inapplicability of the assumption of randomness in dilute solutions, and separate theories have been advanced which are successful at sufficient dilutions. These are either misrepresented or ignored altogether. The author prefers to attribute the state of affairs in dilute solutions to aggregation of molecules which in some unexplained fashion is favored by dilution!

The book contains a number of minor errors, few of which are troublesome. It is disconcerting to see Raoult's law misstated on p. 3 and again in the figures appearing on pp. 70, 71 and 72, where the activity is equated to volume frac-

tion in the name of Raoult. Research workers interested in polymers or in the statistical mechanics of solutions will welcome this monograph. It will not be digested easily, however, without a well developed feeling for the methods of statistical mechanics.

P. J. FLORY

The Basis of Chemotherapy. By THOMAS S. WORK B.Sc., Ph.D., Research Staff, National Institute for Medical Research, London, and ELIZABETH WORK, B.A., Ph.D., Research Staff, Department of Chemical Pathology, University College Hospital Medical School, London. Interscience Publishers, Inc., 215 Fourth Ave., New York, N. Y., 1948. xx + 435 pp. 14.5 × 22.5 cm. Price, \$6.50.

The authors present the subject of the drug therapy of infectious diseases from the point of view of the biochemist and microbiologist. Principal exposition is given to bacterial and protozoal diseases, less attention (due no doubt to our lesser knowledge) to virus infections, and scanty attention to parasitic and mycotic diseases. Throughout the book is emphasized the place of enzyme inhibition and metabolite antagonism in mechanisms of drug action. The first half of the book consists of an orientation in these subjects through excellent chapters on cell metabolism, essential metabolites, and enzyme inhibition, along with a historical introduction as fascinating as some popular expositions, but far more penetrating. The second half of the book consists of chapters on "Drug Antagonism," covering substances that diminish or modify the action of drugs, "Drug Resistance," or the tendencies toward adaptation or selection of resistant strains of organisms, and a brief chapter on "The Relation of Structure to Activity." This arrangement may inconvenience somewhat readers seeking information on particular groups of drugs or organisms, but serves well the authors' purpose of seeking logical bases for chemotherapeutic action. The book shows strongly the influence of Wood, Fildes, Woolley, Lwoff, and Sevag.

The book seems to be addressed mainly to advanced students of chemistry, microbiology and medicine; it should be extremely useful to these groups. More advanced research workers may also find in it convenient summaries of work in fields related to their specialties, and references that might otherwise be overlooked. The style is direct and readable, the explanations usually clear, printing legible, and formulas carefully drawn.

WALTON B. GEIGER

Fourier Technique in X-Ray Organic Structure Analysis. By A. D. BOOTH, Ph.D., Fellow and Lecturer at Birkbeck College, London. (The Cambridge Series of Physical Chemistry. General Editor, E. K. Rideal.) Cambridge University Press, The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y., 1948. vii + 106 pp. Illustrated. 14.5 × 22 cm. Price, \$2.75.

This little book comprises an extremely condensed, but rather complete, presentation of the methods currently being used to discover the atomic arrangements in complex crystals. As the author writes in his preface, this subject is developing so rapidly that one or two important methods inevitably were not included, because they had not been discovered when the book was written two years ago. This detracts in no way from the book's value.

There are seven concise chapters, entitled, respectively: I. The interaction of X-rays with matter; II. The representation of electron density by Fourier series; III. Methods of obtaining approximate structures; IV. The refinement of atomic coordinates; V. Methods of computation; VI. Mechanical computation; VII. The results of Fourier synthesis. These titles show the scope and character of the book: it is intended as a handbook for those actively engaged in the determination of crystal structures. Such workers will find here many valuable de-

tails not conveniently available elsewhere. In particular, the author has included many of his own important contributions to the art of crystal structure analysis by means of Fourier series. For beginning students of X-ray diffraction methods, however, this book may well prove too concise.

DAVID HARKER

Rhenium. DVI-Manganese. The Element of Atomic Number 75. By J. G. F. DRUCE, M.A., M.Sc. (Lond.) R.Nat.Dr.(Prague), F.R.I.C., Fellow of the Chemical Society, Member of the Masaryk Academy of Work, Corresponding Member of the Royal Bohemian Scientific Society, Member of the Netherlands Chemical Society, etc. Cambridge University Press, The Macmillan Company, 60 Fifth Avenue, New York 11, New York. 1948. viii + 89 pp. 14.5 × 22 cm. Price, \$2.50.

This book is the first published summary of the studies of rhenium since the appearance of "Das Rhenium" by I. and W. Noddack in 1933. In the fifteen-year interval between the writing of these two books knowledge concerning rhenium has increased materially through the efforts of numerous investigators in many countries. These advances are briefly and clearly reviewed in this newest publication, and the present status of the element is shown in concise manner.

The subject matter is divided into eight chapters. In the Introduction there is a brief and impartial summary of the search for both eka-manganese and dvi-manganese. This is followed by chapters devoted to (2) The Isolation and Properties of Rhenium, (3) The Oxides of Rhenium, (4) Perrhenic Acid and Its Salts, (5) The Halogen Compounds of Rhenium, (6) The Sulfides, Selenides and Thio-Salts of Rhenium, (7) Some Organic Rhenium Derivatives, and (8) Applications and Patents Related to Rhenium. Possibly the most valuable feature of the book is the complete and useful bibliography, of which there are over 300 references, arranged both topically and chronologically.

That the author is eminently qualified to give authoritative information about rhenium is indicated by the fact that at least 36 of these references are to his own articles, those of his late colleague, F. H. Loring, and their collaborators. Few first edition errors are apparent. There is an adequate index.

In this book Dr. Druce has made an outstanding contribution to the literature of the less familiar elements. It will be welcomed by all who are interested in rhenium.

B. S. HOPKINS

Radioactive Measurements with Nuclear Emulsions. By HERMAN YAGODA, Senior Physical Chemist, National Institute of Health. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y., 1949. ix + 356 pp. 75 figs. 22 × 14 cm. Price, \$5.00.

The first phenomenon utilized for the detection of radioactivity was the fogging of photographic emulsions. Methods based on the use of sensitized halide emulsions were quickly supplanted by procedures based on ionization measurements. In the last few years, however, emulsions have been staging a strong comeback, owing particularly to the development of thick, fine-grained emulsions astonishingly well suited to the study of densely ionizing particles. These emulsions may be designated as "nuclear" to distinguish them from ordinary photographic emulsions. Studies such as the now classic researches of Powell and his collaborators on the detection of meson components in cosmic radiation illustrate the refinements in techniques employing nuclear emulsions which have reached a point hardly conceivable ten years ago. No comprehensive treatment of radioactive measurements using nuclear emulsions appears to have been available until the publication of this book.

It has been the author's purpose to present a volume which provides sufficient coverage of the field so that "any

scientist who owns a microscope can make quantitative measurements." There seems to be little doubt that this objective has been achieved remarkably well and that the reader will find a well integrated description of theory and practice in the use of nuclear emulsions. The material is organized into 12 chapters, the first two of which afford a succinct account of basic principles. Probably one of the most useful sections is the third chapter on laboratory manipulations in which the reader will find a number of recipes for the preparation of various types of samples as well as useful material on exposure and processing of emulsions. In other chapters there are included numerous instances of applications to radiochemistry, biology, crystallography, metallurgy and nuclear physics. A bibliography containing some 700 references is included.

The text is enlivened by many historical references and quotations. Some readers will be interested in the author's use of the word "serendipical." This is an adjectival construction from the word "serendipity" coined by Walpole in the 18th century to indicate the gift of finding agreeable or valuable things not sought for. It is to be hoped that this word comes into more common use because it is a convenient descriptive term for one of the most characteristic aspects of scientific research.

The format employed is one with small margins on a convenient page size. However, the glossy finish renders the print somewhat less legible than would have been the case on a rougher stock.

MARTIN D. KAMEN

Silicones and Other Organic Silicon Compounds. By HOWARD W. POST, Department of Chemistry, University of Buffalo. Reinhold Publishing Corporation, 330 West 42nd St., New York 18, N. Y., 1949. 230 pp. 15.5 × 23.5 cm. Price, \$5.00.

The author has set himself the task of abstracting every published article on organosilicon compounds. He has succeeded in making a complete search of the literature through 1947—no small achievement in view of his bibliography of over 700 references. The present extent of organosilicon chemistry has created a need for a handy, up-to-date reference book on the subject. This book could have admirably filled that need, but it has several faults which have somewhat reduced its usefulness.

In the first place the organization of the book is on a historical rather than a chemical basis, which makes it difficult to look up material under a given subject. The first two chapters are introductory, and deal with the inorganic chemistry of silicon. Chapter 3 covers the work of Kipping and others prior to about 1935. Kipping's work is taken up in a more or less chronological order, rather than subject by subject; as it is all in one place, however, it is easy to look through it. Chapter 4 covers the more recent scientific literature on the preparation of organosilicon compounds at moderate temperatures and Chapter 5 covers the patent literature on the same subject. Included here are preparations involving Grignard reagents, hydrolysis, dehydration and other metathetical reactions. The accompanying tables of compounds classified according to the method of preparation may be of value. The physical chemistry of organosilicon compounds is given a rather inadequate treatment, 35 articles being abstracted in 30 sentences near the end of Chapter 4.

Chapter 6 covers reactions carried out at temperatures over about 250°. This includes some of the interesting new industrial methods. Chapter 7, "The Uses of Polymerized Oxosilanes," would have been more valuable if the distinction between silicone resins, oils, rubbers and other products had been made clear. It does, however, give a good idea of the extraordinary versatility of the silicones. Chapter 8 purports to be an extension of the author's previous book, "The Chemistry of the Aliphatic Orthoesters." It is actually a jumble of unrelated material on alkoxy and amino silanes and other derivatives, many of which have no carbon-silicon bonds and are therefore not true organosilicon compounds.

In Chapter 9 on nomenclature Dr. Post has reprinted articles by Sauer and by the A. C. S. Committee on Nomenclature in their entirety. He has thus done justice to the present rules of nomenclature, but he does not follow them himself. Thus the silyl radical is frequently called "silicyl," a term which he also uses for multivalent radicals as in "dichlorosilicyl diisocyanate." His resurrection of the "oxosilanes" seems unnecessary. The strange combination of Greek and Latin roots as in "quadracamethylhexasiloxane" is not in accord with general usage.

Chapter 10 consists of a table of physical properties of compounds. It appears to be reasonably complete, although there are a few omissions, pentamethylphenyldisiloxane, for instance. The boiling point given for tetraphenylosilane is low by 68°.

The haste with which this book has apparently been prepared is regrettable. The organization within each chapter is generally bad. There are innumerable misprints and misspelled words and some of the tables appear without proper explanation or reference in the text.

The serious student will find "Silicones" of some value, despite its shortcomings; he will have to search a little for his information, but it is all here.

RICHARD N. LEWIS

Elsevier's Encyclopedia of Organic Chemistry, Volume 13A, Bicyclic Compounds (Except Naphthalene) Series III, Carbocyclic Condensed Compounds. E. JOSEPHY AND F. RADT, Editors. Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y., 1948. xxvii + 1262 pp. 17.5 X 26 cm. Subscription Price, \$78.00; Serial Price, \$91.00; Single Volume Price, \$104.00.

The general remarks on this new encyclopedia made by L. F. Fieser (THIS JOURNAL, 70, 1294, (1948)) are equally pertinent to the volume here under consideration; these remarks have the whole-hearted approval of the present reviewer. Although the work may eventually assume something of the function of Beilstein, the two should be considered supplementary. Because of different publishing schedules, Elsevier will dominate certain fields and Beilstein others.

Elsevier is in clear English. It has the advantage of a viewpoint some forty years more mature than Beilstein. The wide use of the charts and tables is not only superb from the encyclopedic standpoint, but also makes the work of greater utility as a general reference. Because of these charts the advanced student can study from Elsevier, something which could hardly be done from Beilstein. There is a general criticalness in Elsevier which is lacking in Beilstein, but it is not used to obscure or to evade references, but rather to point out the existence of doubts and controversies.

Specifically, Volume 12 A contains bicyclic compounds, except naphthalene and its derivatives. The bicyclic terpenes, bicyclic sesquiterpenes, indene and its derivatives make up most of the book. The literature has been covered completely through 1941 and references bearing on structure through 1947. No errors of omission were apparent in the terpene fields, and there are surprisingly few typographical errors. The lack of patent references is not a serious handicap in the chemistry here covered; however, this may prove a serious objection in fields of greater industrial activity.

From the standpoint of topography, system, indices and binding, the volume is indeed of very high standard.

Larger libraries should maintain both Beilstein's Handbuch and Elsevier's Encyclopedia. Collections operating on smaller budgets will probably find Beilstein more essential because of its present completeness in the organic field in comparison with Elsevier. Single volumes of Elsevier should certainly find their way into specialized collections and to the desks of practicing chemists, especially those working in fields which have been very active in the last thirty years.

We American organic chemists must be eternally appreciative

of our foreign colleagues who undertake these monumental tasks so successfully.

W. A. MOSHER

Fundamental Processes of Dye Chemistry. By HANS EDUARD FIERZ-DAVID AND LOUIS BLANGEV, Eidgenössische Technische Hochschule, Zürich. Translated from the Fifth Austrian Edition by Paul W. Vitum, Eastman Kodak Company, Rochester, New York. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y., 1949. xxix + 479 pp. 57 figs. 15.5 X 23.5 cm. Price \$9.50.

This book is an excellent translation of the fifth Austrian edition of "Grundlegende Operationen der Farbenchemie" (1943) which constitutes a revision and extension of the earlier Austrian editions. Its primary object, as stated by the authors, is to teach the fundamental principles of dye chemistry to the student and to serve primarily as a laboratory manual; they point out specifically that this book is not intended to compete with the more comprehensive books such as that of P. H. Groggins, "Unit Processes in Organic Synthesis" (1947). To this end, the material has been presented in a most successful manner so that it may be employed either as a text for systematic reading or as a laboratory reference manual.

The major portion of the book (279 of the 479 pages) is devoted to detailed procedures with discussion for the laboratory preparation of dye intermediates and the finished dyes. Many of the examples are taken from industrial practice and much of the descriptive material will be of immediate value not only to the student of dye chemistry but to those chemists interested in unit operations. This includes a discussion, with examples, of the numerous available methods for introducing into the aromatic nucleus the sulfonic acid, nitro, hydroxyl, amino, alkoxy and halogen groups; also a brief treatment of oxidation and reduction reactions with procedures. It provides the student with an excellent appreciation of the many possible routes leading to a single dye intermediate, and furthermore alerts him to the fact that the most direct or the least expensive process from the chemical standpoint is often not the best one when all factors are taken into consideration. The established process may, for example, employ less direct methods in order to avoid producing isomeric or other undesirable products; or excessive corrosion or expensive equipment may rule out what otherwise might be considered a good laboratory process. In this respect the authors are very prone to weigh and compare the laboratory procedures with the industrial operations, and, in fact, one complete chapter (III) is devoted to technical details covering such subjects as vacuum distillation in the laboratory and in the plant, the construction and use of autoclaves, factory management and methods for computing cost calculations for production of a simple dyestuff.

The analytical section provides a treatment of methods employed in dye chemistry and is followed by a most instructive discussion dealing with the determination of the constitution of unknown commercial dyes; also references to published works which have become accepted as basic standards in the dye industry.

One of the main features of this book is the schematic arrangement of approximately six hundred compounds in twenty-one tables. A genetic system is used and clearly presents the general steps involved for the production of dyes and their intermediates from the basic coal tar products. The usefulness of these tables is further increased by cross references to one another and to details of the reactions described in the text, and in some instances to the original literature. In the reviewer's opinion the scope of the book would have been increased appreciably had many more references, especially to patents, been included.

Chapter VI dealing with light fastness of dyes is not so thoroughly treated as the other sections of the book. It seems unfortunate also that less than two pages are devoted to the phthalocyanin class of dyes which have proved so valuable because of their excellent stability to light and

washing. However, the broad scope of the book and the clear manner in which the material is presented makes it most valuable to the beginner whose primary concern is that of learning the basic principles of dye chemistry.

WILLARD D. PETERSON

Colloid Science. Volumes I and II. By A. E. ALEXANDER AND P. JOHNSON. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. (Oxford at the Clarendon Press.) April 14, 1949. xx and viii + 837 pp. Illustrated. 15.5 × 24.5 cm. Price, \$15.00 the set.

This book aims to be intermediate in level between the elementary textbook and the specialized monograph and to give especially the newer methods. A review of the topics discussed will indicate what the book is about and what two young workers in one of the most active centers of colloid research think colloid science is now and is about to become.

The book is divided into three parts. Part I gives in five chapters a general survey with a history of colloids, a review of the present status, thermodynamics with some applications to colloid problems, and the theory of the electrostatic interaction of ions. In Part II, fourteen chapters are devoted to experimental methods: determination of composition and solvation in particular, osmotic equilibria, sedimentation equilibria, translational diffusion, sedimentation, velocity, electrophoresis, viscosity, rotational diffusion, scattering of light, X-rays and electrons, plasticity and elasticity, insoluble monolayers, adsorbed films at fluid interfaces and liquid-solid interfaces. Part III, with nine chapters in a separate volume, discusses the specific colloidal systems: dilute suspensions and sols, gels and pastes, foams, emulsions, colloidal electrolytes, clays and zeolites, proteins, polymers, and membranes.

The index at the end of Volume II is only a third as long as the Table of Contents at the beginning of Volume I. References are given at the end of each chapter. There are about seven hundred, but many of these are duplications, especially among the forty references to books.

As a result of this division and of the disregard of any shortage of paper, a topic may be discussed in any part or in all three of them, and the index is quite inadequate to follow the discussion. For example, the Flory-Huggins theory comes up under thermodynamics, osmotic pressure and high polymers, but I could not find it in the index.

Very few errors have caught my eye, none of them typographical. One glaring error is in equations 4.81 to 4.83 which appear to violate the law of conservation of mass as well as those of thermodynamics.

The use of this book for teaching will be greatly restricted by the authors' decision to pass lightly over surface chemistry since it is well treated elsewhere. There are other omissions which seem important to this reviewer. The treatment of adsorption stops before Brunauer-Emmett-Teller. The discussion of X-rays gives most space to single crystals although they are not of great importance to colloid science. The treatment of the osmotic pressure of proteins overemphasizes the importance of membrane potential at the expense of both the empirical extrapolation of P/C as for non-aqueous solutions and the exact thermodynamic treatment. The electrostatic treatment makes no mention of Kirkwood's treatment of ions which lack spherical symmetry.

One of the important contributions of a book of this kind is to consider many diverse phenomena from a uniform and consistent point of view. In this book we find none of the occultism or of the inferiority complex of many of the older colloidal chemists. Colloid Science does not claim to be an isolated system, but is a branch of Physical Chemistry which merges gradually with the many other branches.

The authors have not always succeeded in carrying their treatment back to fundamentals. For example, there is no indication in the electrostatic theory that the

treatment is limited to spherical symmetry; and the treatment of surface omits the fundamental relation upon which the measurement of surface tension depends. However, it is clear that the authors have tried hard to unify Colloid Science as a true science, and they have succeeded much better than most writers on colloids. The book will be a very useful addition to any reference shelf.

GEORGE SCATCHARD

The Chemical Arts of Old China. By LI CH'IAO'PING. Professor of Chemistry, National Northeastern University, Mukden, China, with a Foreword by Tenney L. Davis. Published by Journal of Chemical Education, Easton, Pennsylvania, 1948. viii + 215 pp. Illustrated. 15.5 × 23.5 cm. Price, \$5.00.

It is probably safe to say that the knowledge of the average American chemist of the chemical arts of China is limited to the discovery of gunpowder and the manufacture of porcelain. It is therefore of especial interest to find so extended and detailed a record of the Chemical Arts of Old China as recorded by the author in this book.

Following quite an extended account of the alchemy of ancient China wherein the desire to acquire the "Elixir of Life" or Immortality seemed to predominate over the desire to produce gold and silver, called the "Art of Yellow and White," the author reviews the following topics: METALS AND ALLOYS.—Here is discussed the smelting and refining of silver, copper, zinc, iron, including steel, tin and lead. SALT.—The driving of wells, the evaporation of the recovered brines and that of sea-water. CERAMICS.—The author naturally gives much space to the description of the porcelains of the various Dynasties, and to the reviewer, unacquainted with the different porcelains of old China, this chapter makes most interesting reading. The porcelains of the Sung Dynasty (960-1126) and the Ming Dynasty (1368-1544) seem to be regarded as outstanding. LACQUER AND LACQUERING.—This work is done with the sap of *Rhus vernicifera*. The processes of both the flat and carved work is described. GUNPOWDER.—The author makes out a good case for China as the originator of gunpowder and places it at the time of the Sung Dynasty (960-1126). Still earlier in various internal revolutions fire weapons called "thunder caps," "fire-arrows" and "fire-balls" had been used. The author states that the gunpowder used at the battle of Crécy (1346) and Augsburg (1353) were later than the time of the Chinese invention in the 12th century. COLORS AND DYES.—This chapter includes the processes of making Chinese ink, lamp-black, vermilion, white and red-lead, stamp-ink, indigo and safflower. VEGETABLE OILS AND FATS.—The author tells of methods of extraction of essential oils, the production of rouge and face-powders dating back to 1100 B. C.! Other chapters discuss Sugar, Paper, Leather and Glue, Soybean Products and Alcoholic Beverages and Vinegar.

The book is illustrated by many fine line drawings in the Chinese style depicting the processes described; it is unique in subject and style, well printed and will be an addition to the History of Chemistry.

H. MONMOUTH SMITH

The Problem of Reducing Vulnerability to Atomic Bombs. (A Report Prepared for the Committee on the Social and Economic Aspects of Atomic Energy of the Social Science Research Council.) By ANSLEY J. COALE. Princeton University Press, Princeton, N. J., 1947. 116 pp. 14 × 21 cm. Price, \$2.00.

In the present plethora of works on the atomic bomb, this sound and solid study of the Committee amounts to a valuable touchstone with which may be tested the validity of many of the statements now being made and the speculations offered as to the employment of the bomb. Often

it seems to elude writers that proposing defenses against the hurtful effects of nuclear fission is analogous to proposing defenses against the operation of gravity. The bomb admits of no genuine defense and restricts all such efforts to what Mr. Coale calls "the problem of reducing vulnerability." Under this proper description, Mr. Coale, with the collaboration of Committee members, canvasses the possibilities of political agreement and of attack prevention. He discusses measures which may be taken before and after bombs are exploded. In extremely small compass this book covers a vast range of material. Its striking and useful purpose lies in its careful organization. It raises far more questions than it offers to solve and in so doing makes clear that all glib and over-simplified atomic bomb "defense" proposals must be regarded with high suspicion.

RUSS SYMONTOWNE

Surface Active Agents. Their Chemistry and Technology.

By ANTHONY M. SCHWARTZ, Harris Research Laboratories, Washington, D. C., and JAMES W. PERRY, Massachusetts Institute of Technology, Cambridge, Massachusetts. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, New York. 1949. xi + 579 pp. Illustrated. 15.5 × 23.5 cm. Price, \$10.00.

Surface active (S. A.) agents are those which, in the authors' words, "have the startling property of altering the surface energy of their solvents to an extreme degree," even when present at low concentrations. The oldest, most familiar and still the most important is soap, but many hundreds of synthetic S.A. compounds have been described within the past twenty years and, to the reviewer's knowledge, this is the first book adequately to cover the subject. The authors have done a splendid job with a difficult assignment.

This book has been limited in scope to S.A. compounds other than soap (soap is discussed very briefly) and their behavior in dilute solutions. Aqueous solutions are, naturally, emphasized almost to the exclusion of others. The book is divided into an introduction and three major parts which cover, respectively, general considerations and classification, synthesis and manufacture, physical properties of solutions and industrial applications.

In the introductory part (18 pp.), S.A. compounds are classified as far as possible on the basis of the ionic character of the hydrophylic group, which leads to the three familiar and logical designations of anionic, cationic and non-ionic compounds. In addition, the authors have quite logically put ampholytes in a fourth class and have included two others which do not fit into the general scheme: water-insoluble emulsifiers (*e. g.*, monoglycerides) and compounds useful in non-aqueous systems (*e. g.*, lubricant additives). Further breakdown is, first, on the basis of the "connecting link," *i. e.*, the atom or group(s) which connect the hydrophylic to the lipophilic portion of the molecule. For example, we have: I. Anionics, B. Sulfuric Esters (Sulfates). 1. Sulfate joined direct to hydrophobic group, a (Simple types such as alkyl sulfates).

Part I (212 pp.) covers the organic chemistry of S.A. compounds—preparation, properties and manufacture—the discussion being arranged as far as practicable to conform to the order of the classification outline in the introduction. Coverage is adequate and complete, and is conspicuously well done when one considers that, except for patents, there is next to nothing in the way of pertinent original literature. In such a situation, it is almost impossible to avoid endowing some types, which have been described but never used, with unwarranted importance, but on the whole the commercially successful types have been singled out for especial mention and others thereby relegated to their proper perspective. For example, the table on page 126 lists 15 aromatic nuclei and 23 alkyl side-chain sources without pointing out that the keryl and tetrapropenyl benzenes probably account for more production than all the rest put together. On the other hand,

the inclusion in the text of trade names and their identification for the most part with the proper active ingredient types (Oronite detergent, p. 123 is one conspicuous exception) tends to emphasize the commercially important compounds and to make the discussion correspondingly more useful. Other features of this section illustrate the careful job the authors have done. For example (p. 153), it is emphasized that cationics have been developed largely for applications where their surface activity is of only secondary importance. Again, description of the important fatty monoglyceride sulfate manufacturing process (p. 71) serves to emphasize this ingenious procedure over the usual sulfation methods theoretically applicable to monoglycerides.

Part II (153 pp.) deals with the physical chemistry of aqueous solutions of S.A. compounds in discussions which are lucid and readable. Here the authors have access to a considerable body of original literature and their coverage is remarkably complete. The collection and coordination of published work on detergency, foaming and other interfacial effects serves a very useful purpose, especially since it is handled in such a realistic manner. For instance, it is repeatedly emphasized that, even though our knowledge of S.A. solution properties has increased enormously in recent years, our understanding of the many complex factors involved in detergency is still far too limited to allow us to make useful performance tests out of any measurements short of actual washing experiments.

Part III (120 pp.) is an interesting discourse on industrial applications of S.A. agents. By the authors' own statement, application patents are not covered completely, but this is a recommendation rather than a criticism and the section is on the whole well done.

Even with the authors' careful handling of their material, some inaccuracies have inevitably crept in, but for the most part they are of minor importance. Mono- and diethanolamines are said to give predominantly amides in reacting with F.A. (p. 182); actually their behavior should be contrasted, since diethanolamine gives mostly ester. The statement that soap shampoos are still the most widely used (p. 444) is misleading, since certainly of products sold as shampoos, synthetic-base products make up the large volume. This reviewer will emphatically take issue with the statement (p. 444) that "... such irritating effect (of coconut oil soap) has been traced, with a high degree of certainty, to the presence of C₈ and C₁₀ fatty acids. . . ." Nonyl naphthalene sulfonate (p. 124) is hardly in a class with the good alkyl benzene sulfonates as a detergent. Isobutene polymers have not proved very suitable for alkylating benzene (p. 125) to form good surface-active compounds. On the other hand, certain other reports from the literature are handled with discrimination. For instance (p. 373) "rosin soap is by itself a poor detergent, but up to 50% can be incorporated into fatty acid soaps without seriously impairing the detergency of the latter"—a very good summary of the situation.

The book as a whole is well set-up, printing is good and no typographical errors have been noted. Indexing is good, which enhances the volume's value as a reference. In short, it is a pleasure to recommend this volume to anyone interested in the subject.

N. B. TUCKER

The Structure of Matter. By FRANCIS OWEN RICE, Professor of Chemistry, The Catholic University of America, and EDWARD TELLER, Professor of Physics, The University of Chicago. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. (Chapman and Hall, Ltd., London) 1949. xiii + 361 pp. 15.5 × 23.5 cm. Price, \$5.00.

In this book the distinguished authors have boldly attempted to describe in words a very extensive range of applications of quantum mechanics with only the barest recourse to mathematics. The topics covered include atomic structure, chemical binding, the solid state, mag-

netic and dielectric properties of matter, molecular vibrations, electronic spectra, nuclear chemistry and even the state of matter in stars. All of these topics are treated in a very original manner, using qualitative statements based on various quantum-mechanical generalizations.

This reviewer found the book profitable reading and believes that there are few who would not likewise at least acquire useful new viewpoints from it. The attack on the subject is tremendously ambitious and the scope covered is very great.

Nevertheless, it is a little difficult to decide upon a class of reader for whom it can be recommended without qualification. It is obviously intended for readers not prepared to undertake the study of the mathematical basis of quantum mechanics. This is a hard task and one should not expect perfection in any such enterprise. It must be reluctantly confessed, however, that this reviewer does not like the general approach which was used. It seems too dogmatic, too ready to jump into rather glib word-explanations of complicated phenomena without a proper discussion of fundamentals, too lacking in clear definitions of concepts or precise statements of basic hypotheses. The reader is not, for the most part, presented with evidence in support of statements made. Although it is not always feasible to present a clean-cut mathematical derivation from definitely stated hypothesis to carefully worded conclusions, it would seem that the basic hypotheses, the results and the experimental comparisons should be given.

It appears doubtful that the reader who cannot even be exposed to the Schrödinger equation is going to be able to grasp the concepts of "coulomb and exchange integrals" introduced on p. 73 without any real explanation, to pick just one example. These are likely to remain mere words, perhaps memorized and repeated back to the teacher, but carrying no useful meaning.

It can be argued that the proper way to introduce the non-mathematical reader to the results of quantum mechanics is the conventional one of using the experimental approach. The observed facts of electron diffraction, spectroscopy, chemical valence, etc., provide a credible framework upon which to hang underived statements of the results of quantum mechanical calculations, but even then much discussion of the nature of the fundamental postulates is desirable and a very definite distinction between those conclusions which follow rigorously from the postulates and those which involve approximations of untested validity.

It is unfortunate that these criticisms seem necessary, because the authors have carried out a really remarkable translation of a vast variety of deductions into word pictures. It is certainly highly desirable for theoretical scientists to uncover the physical meaning of each stage of their mathematical derivations.

In summary, it may well be that this book will be most useful for those who have previously been exposed to some mathematical treatment of quantum mechanics and can, therefore, view the word pictures in the proper perspective. Such readers are sure to learn something new from this challenging work.

E. BRIGHT WILSON, JR.

BOOKS RECEIVED

August 10, 1949–September 10, 1949

- WALTER CRAFTS AND JOHN L. LAMONT. "Hardenability and Steel Selection. Theories, Calculations, Properties, Test Methods." (Pitman Metallurgy Series.) Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y. 1949. 279 pp. \$5.50.
- TENNEY L. DAVIS, Editor-in-Chief. "Chymia." Annual Studies in the History of Chemistry. Vol. II. University of Pennsylvania Press, 3446 Walnut Street, Philadelphia 4, Pennsylvania. 1949. 143 pp. \$4.00.
- G. H. DIEKE AND A. B. F. DUNCAN. "Spectroscopic Properties of Uranium Compounds." (National Nuclear Energy Series. Manhattan Project Technical Section. Division III-Vol. II.) McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, N. Y. 1949. 290 pp. \$2.75.
- JAMES ENGLISH, JR., AND HAROLD G. CASSIDY. "Principles of Organic Chemistry." (International Chemical Series.) First Edition. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, N. Y. 1949. 512 pp. \$4.50.
- MAX JAKOB. "Heat Transfer." Vol. I. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1949. 758 pp. \$12.00.
- J. MURRAY LUCK, Editor, *et al.* "Annual Review of Biochemistry." Vol. XVIII. Annual Reviews, Inc., Stanford, California. 1949. 739 pp. \$6.00.
- KENNETH B. RAPER AND CHARLES THOM. "A Manual of the Penicillia." The Williams and Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, Maryland. 1949. 875 pp. \$12.00.
- A. WEISSBERGER, Editor. "Physical Methods of Organic Chemistry. Part I." Second Edition. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 1072 pp. \$12.50.
- "Bibliography of Research on Heavy Hydrogen Compounds." (National Nuclear Energy Series. Manhattan Project Technical Section. Division III-Vol. 4 C.) Compiled by Alice H. Kimball. Edited by Harold C. Urey and Isidor Kirshenbaum. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, N. Y. 1949. 350 pp. \$3.25.
- "Gmelin's Handbuch der anorganischen chemie." Eighth Edition. System No. 10-B, Selen, (Selenium). Published by Gmelin-Verlag, G. m. b. H., Clausthal-Zellerfeld, Germany. (United States Representative: D. R. Stein, 105 Pinehurst Avenue, New York 33, N. Y.) 1949. 195 pp. \$16.25.
- "Transactions of The Electrochemical Society." Vol. XCII, 1947. Published by The Electrochemical Society, Inc., 235 West 102nd Street, New York 25, N. Y. 1948. 595 pp.