

these difficulties in a simple manner through an appropriate reconstruction of the saccharimeter of Einhorn.

When one found it necessary to grow micro-organisms on a suitable nutrition medium in a nitrogen-containing or other atmosphere, it was not possible to carry out this investigation in the present form of the saccharimeter because it does not allow the passing through of another gas. If, therefore, we add a stopcock (Fig. 1) to the longer arm of this tube, it will be possible, by simultaneously inserting a single-holed rubber stopper in the shorter end of the tube, to pass through the nutrition medium and, if necessary, to keep in the space above it whatever gas is wanted. The open surface of the liquid has to be covered simultaneously with liquid paraffin. In the case of nitrogen, the purification of this gas by passage through an alkaline pyrogallol solution is not satisfactory enough for biological purposes. Such nitrogen still oxidizes reduced methylene blue and therefore it is necessary for this purpose to pass it over hot (dark, gleaming) copper spirals.

A fermentation tube constructed in this way can of course also be used as a common saccharimeter; with such a tube, a fermentation may be carried on during which the expected quantity of carbon dioxide produced exceeds several times the capacity of the long arm of the tube. A repeated simple opening of the stopcock renders this possible. It also enables one to investigate the capacity of micro-organisms for nitrogen fixation.

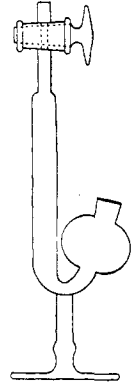


Fig. 1.

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RECEIVED MAY 31, 1927
PUBLISHED AUGUST 5, 1927

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NEW BOOKS

Magnetism and Atomic Structure. By EDMUND C. STONER, Ph.D., Lecturer in Physics at the University of Leeds. E. P. Dutton and Company, 681 Fifth Avenue, New York City, 1926. xiii + 371 pp. 56 figs. 22.5 × 14.5 cm. Price \$5.00.

According to the author's statement, this book is to be regarded as a supplement to ordinary works on magnetism, rather than a comprehensive treatise. The general method adopted is "to give tolerably complete outlines of representative researches, and to base discussions on these. Prominence is given to work which is thought to be of most importance and lasting value, but the selection involved is necessarily arbitrary." This mode of treatment makes possible the logical discussion in a book of moderate size of those phenomena of magnetism which bear most directly upon the problems of atomic structure. A more

coherent and readable presentation of the material is thus secured than was attainable in the more comprehensive Bulletin of the National Research Council on "Theories of Magnetism" by several collaborators. Moreover, since the publication of this report, much has been done to advance our knowledge, notably, the fundamental experimental investigations of Gerlach and Stern, and the further development of the Bohr theory of atomic structure. The significance of much of the older material is now apparent in the light of the new, but one is impressed by the fact that, in spite of the vast amount of work that has been done in the field of magnetism, only a beginning has been made in the disentangling and explanation of the complex phenomena involved. The necessarily mathematical treatment of the material may make many of the details difficult of comprehension to some readers but will not prevent their appreciation of the general significance of the relations. The correlation of information, the indication of problems for research, and the literature references should be valuable to the investigator. The author is to be congratulated on the production of a book suggestive to the specialist and informative to the general reader.

CHARLES P. SMYTH

Handbuch der Anorganischen Chemie. (**Handbook of Inorganic Chemistry.**) By Dr. R. ABEGG. Vol. IV, first part, first half. Oxygen, Sulfur, Selenium, Tellurium and Polonium. By Dr. FR. AUERBACH and Dr. I. KOPPEL. S. Hirzel, Königstrasse 2, Leipzig, 1927. xii + 966 pp. 61 figs. 17 × 24 cm. Price, unbound, M. 60; bound, M. 64.

The appearance of this already long overdue instalment of the "Handbook" was still further delayed by the death of its editor and chief author, in 1925. At that time about five-sixths of the volume was in type. The task of completing it has evidently been performed with energy and dispatch by I. Koppel, its present editor.

This volume, dealing with elements of such capital importance as oxygen and sulfur, is particularly welcome, not only because it fills a serious gap in the present Handbook, but because these elements and the others of this group have not yet been reached in the new edition of the Gmelin "Handbook" or, with the exception of oxygen, in Mellor's "Treatise." It appears to adhere to the excellent traditions and high standards of the earlier volumes. It does not aim merely to collect every relevant statement in the literature, but rather to present a critical, connected and logical survey of the chemistry of these elements, illuminated by the application of the principles of theoretical and physical chemistry.

ARTHUR B. LAMB

Die seltenen Erden vom Standpunkte des Atombaues. (The Rare Earths from the Point of View of Atomic Structure.) By Dr. GEORG V. HEVESY. *Struktur der Materie in Einzeldarstellungen*. V. Julius Springer, Berlin, 1927. viii + 140 pp. 15 figs. 22 × 14.5 cm. Price, unbound, Reichsmark 9; bound, Reichsmark 10.20.

This fifth of the new German monographs on the structure of matter is a worthy successor of the excellent works with which the series began. The earlier books make their appeal more exclusively to physicists and to those chemists who follow the bewildering complexities of modern spectroscopy and quantum mechanics, but the present booklet should find a wider circle of chemical readers.

The first part deals with the (Bohr) theory of the constitution of the rare-earth atoms, and the placing of the elements in the periodic table. A rapid survey of the chemical properties and the molecular volumes of the various types of compounds gives many opportunities to relate known regularities to the general features of the Bohr model. The theory is then further elaborated in line with the work of Stoner, Hund, etc., and the absorption spectra and paramagnetism of the ions are discussed in relation to the newer views.

In the second part of the book the more detailed chemistry of the elements is surveyed, including all methods of analytical determination, and the separation processes. The ionic sizes in the sense of Grimm and of Bragg, the geochemistry and the relative abundance of the elements are the next subjects treated, and the book closes with a short historical chapter.

Professor von Hevesy has made a real contribution to systematic chemistry in showing how beautifully the facts of spectroscopy and magnetism, x-rays and densities are related to the more "purely chemical" characteristics of the elements, such as relative base strengths, crystalline form, valence, etc., as soon as both types of regularities are interpreted in terms of the Bohr theory.

Professor Bohr is reported to have remarked that had there been no rare-earth group beginning with lanthanum and ceasing with cassiopeium, his theory must have been abandoned, and certainly in this group we have at once a searching test and a brilliant triumph of the qualitative aspects of that theory.

In these days of Heisenberg and Schrödinger, it is not very clear just how such intimate prying into the atom's internal affairs as the following may need to be rephrased (p. 33). "Now the 4_4 electrons move within the region where the 5_1 and 5_2 electrons are moving throughout the greater part of their paths, with the result that the added 4_4 electron is able to compensate very considerably for the effect of the simultaneous increase of one unit in the nuclear charge."

Compactly and interestingly written, von Hevesy's book is the best short account of rare-earth chemistry available today, whether one is looking merely for experimental facts or for an attempt at coördination in terms of theory.

NORRIS F. HALL

Radioaktivität. (Radio-activity.) By DR. STEFAN MEYER and DR. EGON SCHWEIDLER. Second, enlarged and partially revised edition. B. G. Teubner, Leipzig, 1927. x + 721 pp. 108 figs. 23.5 × 16.5 cm. Price, bound, RM 36.

In the introduction, the authors defend the subject of radio-activity against the charge of having reached quasi-completeness in 1916, alleging that many really new lines of attack have been laid down in subsequent years. Quantization of nuclear processes, artificial decomposition (and perhaps upbuilding) of atoms are certainly new, and there have been new radio-active elements discovered, new models proposed and much elaboration of detail.

One learns with a certain melancholy that it has been necessary to cite 6430 references in this edition, as compared with 3080 in the earlier one, and the solid, meaty pages which follow (seven hundred of them) testify that radio-activity is no longer a little corner of a subject tucked away somewhere between chemistry and physics, but a field already assuming ample proportions in its own right.

The successive chapters comprise: Historical Introduction, The Processes of Radio-active Change, The Processes of Radio-active Radiation, The Effects of Radio-active Radiations, Measurements and Methods of Measurement, The Individual Radio-active Substances, Radio-activity in Geophysics and Cosmic Physics, Appendix.

The book is valuable for its many up-to-date tables of constants, the painstaking thoroughness of its documentation, and the wide range of the subjects covered. There seem to be no important omissions. Perhaps the least valuable part is that devoted to atomic-structure theory, which is so briefly and uncertainly treated as to be practically useless. This is, of course, a book indispensable to the specialist—others may find that shorter treatments, several of which have recently appeared in English, are adequate to their needs and more convenient to use.

NORRIS F. HALL

The Evolution and Development of the Quantum Theory. By N. M. BUGH. With a foreword by Professor MAX PLANCK. Longmans, Green and Company, 55 Fifth Avenue, New York City, 1926. 112 pp. 6 figs. 22 × 14.5 cm. Price \$3.00.

In this small book of about one hundred pages the author attempts an account of the quantum theory from its introduction by Planck up to, but not including, the beginnings of the so-called new quantum theory of Heisenberg, Born, Jordan and Schroedinger.

This is a difficult task. The quantum theory still contains so many uncertainties that a convincing elementary exposition is not yet possible, and one hundred pages is too short for any serious contribution to the extensive field that the author covers. The book, however, fulfils the author's own intention of giving a rapid survey of the whole field and contains references to a very considerable number of original contributions.

RICHARD C. TOLMAN

Die Verwendung der Röntgenstrahlen in Chemie und Technik. Ein Hilfsbuch für Chemiker und Ingenieure. (The Application of X-rays in Chemistry and Technology. A Reference Book for Chemists and Engineers.) By Dr. HERMANN MARK. Johann Ambrosius Barth, Salomonstrasse 18B, Leipzig, Germany, 1926. xv + 528 pp. 328 figs. 25.5 × 18 cm. Price, unbound, Rm. 48; bound, Rm. 50.

Among a list of great books already published on the various ramifications of x-ray science, there always seems to be a place for a new contribution, particularly if it emphasizes the new practical applications of a fundamental research tool. No one is better qualified by training, experience and personality to prepare a great treatise than Dr. Mark. His x-ray experiments have ranged from the purest physics to the most practical (but always thoroughly scientific) studies of the structure of rubber, worked metals and engineering materials; he assisted Polanyi in working out the complete interpretation of fiber structures which play so important a part in natural and manufactured materials.

The book is really magnificently painstaking, authoritative and complete. The advances which have been made in so few years since crystals were found to serve as diffraction gratings for x-rays are most picturesquely set forth by a comparison of the content of this encyclopedic book with the first edition of the pioneer book on x-rays and crystal structure by the Braggs, published scarcely more than a decade ago. The observer has the same feeling that he has in comparing side by side a modern, mountain-climbing super-locomotive with a courageous little "Dewitt Clinton."

The title of Dr. Mark's book is somewhat of a misnomer. The applications of x-rays in chemistry and industry are not set forth as present achievements and future possibilities so that an executive or research director might learn whether or not he had an x-ray problem. There is nothing which may be classed as introductory, popular or missionary about this contribution. It is distinctly a methodology, and as such leaves nothing to be desired, for it is doubtful if more solid "meat" was ever crammed into 528 pages.

The first section on the production of x-rays is certainly the most detailed and complete exposition of high-tension apparatus and x-ray tubes to be found anywhere. In some respects this is the best and most

original part of the book. The second section on the spectroscopy of x-rays shows the strong influence of Siegbahn's book, as is to be expected for this subject. The third section on crystal structure analysis with the help of x-rays follows the scheme of presentation in Ewald's great book, but of course goes far beyond upon the basis of recent developments. Mark's presentation of crystal symmetry, space groups and interpretation is the most logical and complete thus far published, although a chemist or engineer untrained in the subject would make difficult progress through the material. The fourth section on the determination of crystal grain orientation and particle size is disappointing in that it is not as thoroughly complete as might be hoped from an experimenter who has had a large hand in the development of these subjects. It will still be necessary to consult the series of original papers by Polanyi, Mark and others on fibering and deformation, for information as to mathematical interpretation. The last section on literature references and notes is interesting and valuable for those engaged in research.

The student (he must be this, rather than a reader) will often have the wish that more actual examples of analysis and application were given. This would, of course, prolong a book already voluminous, but it might have been done very advantageously at the expense of some of the spectroscopic data easily available elsewhere. The fact remains, however, that as a thorough handbook of experimental and interpretational methods to be used by relatively well-trained scientists, Dr. Mark's work has no equal, and if later editions keep the subject matter up to date (at the present rate of discovery a revision will certainly be required every year) it may well continue to dominate in the training of those who attempt to apply x-rays to problems of chemistry and industry.

GEORGE L. CLARK

Forschungen zur Kristallkunde: I. Trachten der Kristalle. (Researches in the Science of Crystals: I. The Habit of Crystals.) By H. TERTSCH, University of Vienna. Bornträger, Berlin, 1926. viii + 222 pp. 58 figs. 17 × 25 cm. Price 15 M.

This is the first of a new series of monographs on crystallography and related subjects, under the editorship of Professor Arrien Johnsen, of the University of Berlin. It comprises chapters on the domain of the work, methods of measurement, observations on influencing habit, the habit significance of forms, peculiarities of surface development, and the theory of the subject. There is a bibliography of 181 titles, practically all of German articles, although in some way two or three references to American journals have managed to creep in, and 12 papers by Gaubert in French are included.

Bringing together as it does material widely scattered through the

literature, this book serves a useful purpose. Chemists will be especially interested in the discussion of influencing habit by physical and chemical means, and in the theoretical treatment on the basis of the space-lattice arrangement of atoms or molecules in crystals.

EDGAR T. WHERRY

Die Herstellung kolloider Lösungen anorganischer Stoffe. (The Preparation of Colloidal Solutions of Inorganic Substances.) By Dr. JOSEF REIRSTÖTTER. Theodor Steinkopff, Dresden and Leipzig, 1927. 62 pp. 2 figs. 25.5 × 18 cm. Price, unbound, M. 3.

The first fourteen pages are devoted to a brief discussion of methods of forming colloidal solutions, and the function of protective colloids. The methods are classified according to Svedberg's classification into dispersion and condensation methods. The rest of the book enumerates the methods which have been used to make colloidal solutions of various inorganic substances. The arrangement followed is to discuss each element and its most important compounds in the order of its occurrence in the periodic table rather than grouping together similar methods of preparation for different substances. This arrangement, the numerous references to scientific and patent literature and the adequate indexes make it convenient and valuable as a reference book.

NORMAN D. SCOTT

A Handbook of Organic Analysis. Qualitative and Quantitative. By HANS THACHER CLARKE, D.Sc., F.I.C., with an introduction by J. NORMAN COLLIE, Professor of Chemistry in University College, London. Fourth edition. Longmans, Green and Company, 55 Fifth Avenue, New York City, 1926. xii + 363 pp. 23 figs. 19 × 12.5 cm. Price \$3.00.

The first edition of this excellent book appeared fifteen years ago, the present edition being the fourth. An extensive revision has been necessary owing to the progress made in the meantime in organic chemistry.

The first chapter deals with such topics as purity, general characteristics, methods for examination for the elements, determination of the approximate constitution and a tabular summary of preliminary tests. The second takes up the examination for various radicals and this is followed by a chapter on the separation of mixtures. Chapter IV (287 pages) gives classified tables of organic compounds, the members of each group being arranged according to melting point or boiling point. The characteristic behavior of each substance is indicated, that is, reactions particularly useful in identification.

Chapter V describes quantitative methods for the most important elements, followed by a chapter on the quantitative determination of certain radicals. The last chapter describes the methods for determining molecular weight, vapor density, density of liquids and optical rotation.

I believe a more thorough-going dependence on solubility relations would give a better system of analysis. I would also considerably abbreviate the section of compounds and their behavior so as to compel the student to rely more on the library. Quantitative methods might be left out entirely as we have satisfactory descriptions in organic laboratory manuals. As this is a book for beginners in analysis, it should be reduced to the smallest size possible.

ALVIN S. WHEELER

The Preparation and Analysis of Organic Compounds. By J. BERNARD COLEMAN and FRANCIS ARNALL. P. Blakiston's Son and Company, 1012 Walnut Street, Philadelphia, 1926. xvi + 352 pp. 42 figs. 22.5 × 14.5 cm. Price, \$4.00.

In 352 pages the authors have succeeded in presenting the important fields of organic chemistry laboratory work. This is done in five sections and an appendix. I. General processes dealing with the purification of compounds and the determination of physical constants. II. Directions for the preparation of 89 individual compounds arranged according to types of compounds prepared. The directions are preceded by brief statements of the theory and by the chemical equations involved. III. Qualitative analysis. The scheme involves grouping compounds in classes according to their elementary composition. The method, although much less extensive, has many points of resemblance to that of Mulliken, particularly noticeable in the group containing carbon and hydrogen (and oxygen). It is difficult to determine without actual trial if this scheme will in general take less time than the Mulliken procedure and if so whether or not this will outweigh the greater precision of the latter. IV. Ultimate analysis. V. Determination of molecular weights and the estimation of typical groups.

The book is well worth looking over, particularly by those who wish to have a limited treatment of the fields of organic laboratory work included under one cover. In general, the experiments are well chosen but the description of apparatus, particularly in the section on quantitative analysis, is in a few cases not strictly modern.

R. R. RENSHAW

Organische Molekülverbindungen. (Organic Molecular Compounds.) Second, revised edition. By Dr. PAUL PFEIFFER, Professor of Chemistry at the University of Bonn. Ferdinand Enke, Stuttgart, 1927. xvii + 470 pp. 4 figs. 16.5 × 25.5 cm. Price, unbound, M. 40; bound, M. 42.20.

This edition, though considerably enlarged, follows closely the lines of the first edition. There is an introductory section setting forth the Werner coordination theory, first as applied to inorganic and then to organic molecular compounds. The second section discusses at length mixed inorganic-organic molecular compounds, classified primarily according to the inor-

ganic element whose residual affinity is involved. The third section presents the purely organic molecular compounds. There are two new chapters in this section: one on the detection, preparation and properties of purely organic molecular compounds, and another on the significance of these compounds in the theories of adsorption, solution and crystal structure. The fourth and last section discusses the mechanism of chemical reactions on the basis of molecular compounds as intermediate steps.

This book is on the one hand a valuable systematic compilation of organic molecular compounds, previously for the most part widely scattered through the voluminous literature of organic chemistry, and on the other an instructive discussion of their theoretical relationships.

ARTHUR B. LAMB

Practical Organic and Bio-Chemistry. By R. H. A. PLIMMER, D.Sc., Professor of Chemistry in the University of London. New Edition. Longmans, Green and Company, 55 Fifth Avenue, New York City, 1926. x + 568 pp. 67 figs. 25.5 × 16 cm. Price \$7.50.

In the course of several editions this work, "originally compiled as a handbook of practical work for medical students," has been enlarged to serve "as a textbook and practical book" on organic chemistry, and in this revision "additional matter has been added to the section on physiological chemistry." The formidable task of condensing the essentials of what are usually regarded as two fields of science into less than 550 pages has been accomplished by virtue of a logical arrangement of material, the detailed discussion of only those portions of organic chemistry of interest to physicians, and a clear and concise style. The direct, positive statements which serve well in the exposition of the established facts and classifications of organic chemistry are not, however, suited to the discussion of some of the newer and more controversial topics treated in the physiological section, where detailed evidence and a critical attitude are demanded. For example: "Shortage of vitamin C is associated with a sallow, muddy complexion and pseudo-rheumatic pains." (p. 507.)

The book is unusual among biochemical texts in that the symbol *PH* appears but once, and then without explanation. In general, the contributions of physical chemistry to biochemistry are given but slight attention, and the discussion of the blood as a carrier of gases is consequently inadequate. There is a chapter of seventeen pages on colloids and colloidal solutions.

The presence of the formulas of Harrington for thyroxin, and of Stewart and Tunnicliffe for glutathione indicates that the present edition contains much recent material on the organic side of the subject. The directions for practical work are embodied in direct statements of fact rather than in questions to be answered by experiment.

F. F. HEYROTH

Lehrbuch der Enzyme. Chemie, Physikalische Chemie, und Biologie. (Textbook of Enzymes. Chemistry, Physical Chemistry and Biology.) By Professor CARL OPPENHEIMER with Dr. RICHARD KUHN. Georg Thieme, Leipzig, 1927. iv + 660 pp. 18 figs. 25 × 17 cm. Price, unbound, RM 33; bound, RM 36.

This is offered by the authors and publisher both as an essentially new book and as a fifth and completely rewritten edition of Oppenheimer's well-known textbook on enzymes. The main divisions of the book are: I, General chemistry of enzymes, 150 pages; II, Biology of enzymes, 54 pages; III, The hydrolases, 250 pages; IV, The desmolases, 195 pages. Of these, Sections I and II constitute the "general," and III and IV the "special" parts. Section I includes general introductory matter, the classification of enzymes, their descriptive chemistry, the influence of various factors upon enzymic activity, its physical chemistry and kinetics; Section II, the occurrence and formation of enzymes in nature and their significance in the economy of the living organism; Section III describes the esterases, carbohydrases, nucleases, amidases and proteases; Section IV, the general conceptions of oxidation-reduction enzymes, the zymases, dehydrases and catalases.

Notwithstanding the size and scope of this book, much of it gives the impression of expression of the authors' views rather than of mere compilation; but it can hardly be said that these views appear always to have been formed from an even weighing of all the evidence. The authors have evidently given much more attention to the original work which has been published in the German language than to that which has been published in English.

The book is written in the style in which one addresses advanced readers, the names of investigators appearing freely in the text, but in most cases the references to original papers are unfortunately not given, so that the book, while comprehensive and suggestive, does not serve effectively to put the reader in touch with all the more important of the original literature.

It would seem that this paucity of references must detract rather seriously from the value of a book of this size to many of its readers, but to those who are already accustomed to following the original literature of the enzymes this work will be of interest for its suggestiveness and as a summary of the views of its authors. It seems unfortunate that these writers should adopt so dogmatically and emphasize so often the view that Willstätter's purified enzyme preparations contained neither protein nor carbohydrate, when a study of the actual experimental evidence of Willstätter's and other investigations bearing upon the question would have shown them that no such general negative is proved. The authors' views upon the recent physical chemistry of the enzymes are well summarized in this work.

H. C. SHERMAN