NEW BOOKS

Inorganic Physical Chemistry. By G. H. CARTLEDGE, Associate Professor of Chemistry, The Johns Hopkins University. Ginn and Company, Boston, New York, Chicago, London, Atlanta, Dallas, Columbus, San Francisco, 1924. xv + 463 pp. 55 figs. 14.5 × 21.5 cm. Price $4.80.

The solution of the problem of the content of the second year of college chemistry presented by Professor Cartledge is a course in physical chemistry, accompanied by illustrative laboratory work, largely quantitative in the first part of the course, with qualitative analysis in the last. The book under review is offered as a text to be used in that part of the course devoted to theory. Physical chemistry, taught thus early, is to be used as a tool in the more advanced work which will follow. Certain topics, however, intimately connected with the various subdivisions of chemistry are assigned to the corresponding courses and are omitted at this point. Thus, the discussion of vapor pressure of mixtures of volatile liquids is relegated to organic chemistry; the physical properties of liquids and solids and the chemistry of colloids to courses in inorganic chemistry.

There is much that is attractive in this modification of the usual order of the chemical course. It is logical enough, if sufficient coördination is maintained in the instruction of the various subdivisions of the subject so that no important topic ordinarily treated in physical chemistry is dropped between them. But one is not sure that certain disadvantages inherent in the scheme are not so pronounced as to make its effectiveness a matter of doubt. In particular, some degree of skepticism may justly be felt as to the competence of the average student at this stage of his progress to master material such as that here presented. Moreover, the plan does away with the most striking advantage which should be afforded by courses of physical chemistry given at the end of the undergraduate training: the opportunity of synthesizing material already offered in the individual courses and, with the aid of a fresh point of view, binding it together into a homogeneous whole. Nevertheless, Professor Cartledge's plan has its possibilities. It will be interesting to see how it works in practice.

Judged as a text in physical chemistry, Professor Cartledge's book leaves something to be desired. Certain topics of importance are omitted; in some cases conclusions are stated without the reasoning which leads to them; in some others the treatment is too sketchy to be entirely satisfactory. But it would be unfair to judge it from this point of view. For the purpose for which it is written these omissions and condensations are a real necessity. The author has succeeded well in doing what he has attempted to do. The order is logical; the continuity between the various topics is carefully worked out; the style is clear and the explanations are lucid; the mathematical treatment is as little complex as the nature of the material allows; the problems are well selected to bring home the principles which they illus-

trate. Those who look favorably upon the plan of introducing physical chemistry at an earlier stage of the chemical course than is now commonly done will find the text an admirable one upon which to base their work.

LEON B. RICHARDSON

Chemistry and Atomic Structure. By J. D. MAIN SMITH, Ph.D., with an Introduction by Professor G. T. MORGAN, D.Sc. D. Van Nostrand Company, 8 Warren Street, New York, 1924. 221 pp. 20 figs. 22.5 × 14 cm. Price $3.75.

In this book the growth of the ideas of atoms, molecules, valence, electricity, electrons, stereochemistry, classification of the elements, coördination number, subatomic chemistry, radioactivity, atomic physics, the static and dynamic atom, is traced from the earliest glimmerings down almost to the day that the book was published. The atomistic view of matter is traced back even further than to the Greek philosophers, namely to Kanada, a Hindu thinker of about 1000 B.C.

The book is delightful to read from the point of view of the historical development of chemical theories and the author must have done an astonishing amount of searching of the literature to present so comprehensive and orderly an array of facts. When the matters that are suggested by the title are reached the treatment moves along rather too rapidly to be easily followed by one not fairly well versed in recent developments. One who judges the book by the title and reads it to gain an insight into the fundamentals of atomic structure is rather likely to be disappointed.

The author finds his inspiration in the work of Werner, to whom the book is dedicated and, very properly, the influence of Werner's systematization upon the modern ideas of atomic and molecular structure is strongly emphasized.

The author attempts to present impartially the various theories and their development one from another, and this part of his task he achieves most successfully and delightfully. He further attempts to present a critical review of hypotheses, and goes on to give his own interpretation of experimental facts. In the preface he admits that he alone is responsible for certain interpretations—which he specifies; in the text it is true, as he admits, that it is impossible to tell just where the ideas of Werner, Bohr, Sommerfeld and others leave off and the author's own begin. Some of the author's views are rather fantastic, and they do not always appear to be based, as he himself claims, on experimental facts.

The author assails strongly certain features of the atom of Lewis and of Langmuir, his most bitter criticism being directed at the idea of the electron pair constituting the chemical bond of non-ionized compounds. He apparently regards oxygen as bivalent in coördination compounds such as the sulfate ion and osmium tetra-oxide and thinks that the Langmuir theory demands, therefore, a sheath of 16 electrons about the central atom. His reading has been voluminous but it must have been superficial as it

dealt with the static atom. Like most of those who have dealt with the problem of valence he has failed anywhere to define precisely what he understands by the term; apparently he fails to realize that there are different types of valence, each described by a definite whole number, but the same number not always giving both the polar and the non-polar valence of the same atom.

The author compliments Bohr upon having almost achieved a rational periodic classification of the elements in terms of the different electron orbits. He offers a modification of this classification, based on experimental facts which escaped Bohr's attention.

Of his fantastic ideas, that of the spatial, rather than the planar, precession of elliptic orbits, which gives a fixed position of the aphelion, is attractive and is a new suggestion for reconciling the electron orbits and the fixed direction of the chemical bonds.

Altogether, the book is thoroughly praiseworthy and it has accomplished what it set out to do; it inspires with the attractiveness of hypothetical speculations, but throughout the criticism is always based on experimental facts. Even the author's wild flights of imagination are admittedly such and thereby add proof to the principal thesis, namely, "that the acid test of these speculations is, do they classify, correlate and explain the known facts of chemistry."

ARTHUR A. BLANCHARD

Synthetic Organic Compounds. By S. P. SCHOTZ, D.Sc. Ernest Benn, Limited, 8 Bouverie Street, E. C. 4, London, 1925. 412 pp. 110 figs. 18.5 × 25.5 cm. Price 45/- net.

From the immense mass of material available, the author has selected a formidable array of compounds which are of interest not only in themselves, but which also illustrate admirably many of the fields in which synthetic organic chemistry is being applied for the development of important industries, for the security and defense of the state, and for the comfort and happiness of the individual. Solvents, perfumes, flavoring and sweetening compounds, drugs, dyes and dye intermediates, tannins, explosives, chemical warfare material, plastics and artificial silks are included in the list.

Much space is devoted to actual manufacturing details, and numerous illustrations and diagrams of plant equipment, together with flow-sheets, lists of patents, graphs and tables appear, for this is not a laboratory "cook book" of the old and well-known style, but selected chapters of industrial organic chemistry prepared by a man who is both a chemical engineer and a consulting research chemist. The natural inclination has been to give precedence to British plant and practice, but American references and figures (especially from *Industrial and Engineering Chemistry*) are almost as much in evidence.

The subject matter is presented critically and the author points out those directions in which he believes the future to be most promising for the various industries.

Valuable features consist in the frequent references to original articles, patents, bibliographies and the like, and the inclusion of information regarding occupational hazards and the pharmacological properties of many of the products.

The discussions of the manufacture of camphor, of saccharin and related sweetening agents, and of plastic masses (celluloid, bakelite, etc.) are comprehensive and detailed.

In recording the physiological and therapeutic properties of carbon tetrachloride, no mention is made of the fact that it is the most efficient remedy known for hookworm disease. In the chapter on the solvents, normal butyl alcohol and methylethyl ketone, as well as one or two other well-known solvents, might well find places. The chapter on chemical warfare has gathered its information from British and U. S. publications and practice and it includes full details on the manufacture of lewisite ("Dew of Death").

The size of the page makes the volume somewhat cumbrous to handle, but this was probably unavoidable on account of the numerous illustrations and large diagrams. Both paper and presswork are excellent. The proof reading has been remarkably well done and but few typographical errors occur. Some mistakes will be encountered but generally they are such as to be immediately apparent to the reader. The reviewer, however, might call attention to one or two which are not so obvious: ylang-ylang is *not* synonymous with "Spanish orange blossom oil" (p. 82), since a true ylang-ylang is neither derived from an orange tree nor comes from Spain; musk is *not* "an excretion of the musk ox" (p. 123), but of the little musk deer; in discussing ketone musk, the author confuses methoxyl and acetyl groups (pp. 125–7); the formula for phenetidine on p. 176 is labeled "urethane;" the last paragraph on p. 199 apparently does not agree with its accompanying graph; the structural formula assigned to bromobenzyl cyanide (p. 309) is incorrect.

The book is reasonably up-to-date, and presents compact, clear and readable surveys of many important fields. It should prove useful to all organic chemists.

MARSTON TAYLOR BOGERT

The Synthesis of Nitrogen Ring Compounds Containing a Single Hetero-Atom (Nitrogen). By CECIL HOLLINS, with an Introduction by Professor J. B. COHEN. Ernest Benn Limited, 8 Bouverie Street, E. C. 4, London, 1924. xiv + 423 pp. 19 × 25 cm. Price 55 shillings net.

One of the most gratifying developments in the literature of organic chemistry is the steady increase in the number of special treatises which

present limited fields in a comprehensive manner. The volume on the synthesis of nitrogen ring compounds belongs to this class. Its author, confronted by the difficulty of dealing with a field that not only is very extensive, but is also devoid of any natural subdivisions, arbitrarily selected for consideration only those compounds which contain but one atom of nitrogen and no other hetero-atom in the ring. By thus limiting the scope of the work he is able to present, in a single volume of not immoderate size, a complete survey of many of the types of cyclic nitrogen compounds that at present are of most scientific and industrial importance.

The monograph differs from most others which have appeared in that it aims to be not only comprehensive but complete. The author states in the preface, that within the limits indicated it is intended to supply complete answers to the questions: What methods are available for the synthesis of a substance of a given type? and what compounds of that type have been synthesized? Such completeness is difficult to attain nowadays when substances frequently appear under names that but remotely suggest their structure, and papers contain many points not at all suggested by their titles. The reviewer is none the less willing to believe that the work is really complete because a diligent search for omissions, in the class with which he is most familiar and in several extensive private bibliographies which were at his disposal, failed to disclose a single lapse; every substance made before 1924 was there, as well as a reference to every paper or patent dealing with its production.

The book is divided into twelve chapters entitled "Dimethylene-imines," "Trimethylene-imines," "Pyrroles," "Indoles and Indigos," "isoIndoles," "Carbazoles," "Pyridines," "Quinolines," "isoQuinolines," "Acridines," "Phenanthridines" and "Seven-membered and Higher Rings." In each chapter the various synthetic reactions are discussed in separate sections arranged according to the type of ring-closure involved.

Each chapter is also provided with an introductory section which is intended as a guide both to the arrangement of the sections and to the selection of methods available for each type of derivative. These introductory sections have been prepared with much skill, and while necessarily concise they usually give an excellent account of the manner in which an important method, like Fischer's pyrrole synthesis or Hantzsch's pyridine synthesis, was developed, the various views held as to its mechanism, and its inherent limitations.

The book is heartily recommended to all who have any occasion to deal with these nitrogen compounds. Its orderly arrangement, free use of structural formulas, subject, author and patent indexes, and excellent typography make it an attractive as well as an exceedingly useful book of reference.

E. P. KOHLER

Die Methoden der Organischen Chemie. Vierter Band. Spezieller Teil. (**The Methods of Organic Chemistry.** Fourth Volume. Special part.) Second edition, completely revised and enlarged. By Prof. Dr. J. HOUBEN, Professor at the University of Berlin. Georg Thieme, Leipzig, 1924. xxviii + 1046 pp. 26 figs. 26 × 17.5 cm. Price, unbound, Goldmarks 42; bound, 48.

This volume completes Houben's "Methoden der Organischen Chemie," which really is a revised edition of Weyl's "Methoden"—well and favorably known by all organic chemists and long out of print. The main purpose of the new edition, like that of the old, is to provide a guide for the operations of the laboratory; its emphasis is, therefore, on methods of procedure. These are illustrated with countless examples, drawn from nearly every field of organic chemistry, and usually reprinted in sufficient detail to show the amounts of materials employed, the manipulation, method of separating and purifying the products and the yields.

While the examples are quoted with every useful detail it is not the purpose of the author to describe indiscriminately every method by which a given object has been or may be accomplished. The plan, as outlined in the first volume of the new edition is, rather, to present only material that has been critically sifted by men whose work in a given field makes their verdicts authoritative. The entire work, therefore, is composed of a number of chapters prepared by specialists who selected the matter to be presented, organized it into sections for convenient reference and supplied theoretical introductions to serve as guides for using it intelligently. These chapters have been very successfully welded together by the editor.

The final volume deals with many important topics including: the nitroso groups by Schmidt; nitro and amino groups by Houben; tertiary amines, cyclic bases, amino acids and polypeptides by Rosenmund; diazo, azo, azoxy and hydrazo groups by Gerngross. The last chapter is a splendid, 500-page treatise on organometallic derivatives by Schlenk.

No organic chemist familiar with Weyl's "Methoden" will be satisfied without this new edition which is twice the size and contains much more than twice the material of the earlier edition.

E. P. KOHLER

Handbuch der Radiologie. Vol. VI. Die Theorien der Radiologie. (**Handbook of Radiology. Vol. VI. The Theories of Radiology.**) Edited by Dr. ERICH MARX, Professor der Radiophysik an der Universität Leipzig. Akademische Verlagsgesellschaft m. b. H., Markgrafenstr. 4, Leipzig, Germany, 1925. xi + 806 pp. 141 figs. 17 × 25 cm. Price, bound, $10.00; unbound, $9.60.

This excellent and too little known series of handbooks upon the general subject of radiology or the physics of radiation is concluded with this sixth volume upon theories of radiology. Compelling evidence of its scope and of its authoritativeness is afforded by a glance at the titles and the authors of the chapters. These are as follows.

The Motion of Electrons and Ions in Fields of Force, by M. von Laue. The Theory of the Passage of Alpha and Beta Particles through Matter, by M. von Laue. The Magnetic Splitting of Spectral Lines, by P. Zeeman. The Theory of the Zeeman Effect, by H. A. Lorentz. Applications of the Quantum Theory to Atomic Physics, by A. Sommerfeld and G. Wentzel. The Excitation of Atoms to Light Emission, by Georg Joos. Electron Theories of the Galvanic Properties of Metals, by E. Riecke. The Compton Effect, by M. von Laue. The Northern Light, by L. Vegard. The Theory of Electric and Magnetic Properties of Molecules, by P. Debye (condensed material of course of lectures given at the Massachusetts Institute of Technology in 1925).

In a deluge of popular books upon scientific subjects, this compilation stands as a great solid rock. It is the kind of a book which inspires a reader with a mind curious and eager to stretch itself far out to the very outskirts of scientific thinking with these experimental philosophers. If a group of a few such earnest readers sat down together and translated every word, there would be no waste of time nor of energy. Each paper starts from the fundamental beginning and logically develops in a condensed form, so that reference to a great number of disconnected original papers is rarely, if ever, necessary for a complete grasp of the subject matter from its scientific inception to the present day. The *first* impression, even to the trained reader, is that of wonder at the great advances toward the ultimate solution of the immeasurably great problem of radiation; *second*, of the painstaking, clear thinking of these world-renowned continental radiologists, working in one of the fields which mock our feeble attempts to distribute science in these days into definite pigeonholes; *third*, of the vision of the future which these discussions of contemporaneous organizing achievement so clearly give—what further experimental facts are needed? Where are we going now in this quest for the understanding of the infinite and ultimate? So this compilation has been a great service, and will be of even greater future value as a convenient handbook, as an operating basis for graduate seminar courses, and for study by the individual who would dig and not merely scratch the surface, who would build and not tear down, who would give rein to an ordered imagination and not scoff, even though some of the theories should not stand the test of time.

No adverse criticisms of consequence may be lodged against the presentation, though by several writers, if it is remembered that this is a handbook intentionally, and not the limited though unified production of one mind; or against the mechanics of the book. The strong binding, extra large type and general freedom from errors are sources of gratification.

Those who would think and work in terms of the ultimate structure of matter, of radiation, the electron theory, magnetism, ionization, the quantum theory, radioactivity, spectroscopy and related subjects cannot afford to be without this book.

GEORGE L. CLARK