

while the proportion of protein nitrogen is higher in diseased roots than in normal, this being also true of diseased leaves when related to the total nitrogen. This is conceivable since the latter is here *smaller* due to loss through denitrification.

5. In round figures, the spinach nitrogen is made up of 55% protein nitrogen, 4.5% diamino nitrogen, 5.5% monoamino nitrogen, and 6% peptide nitrogen. This means that over 70% of the nitrogenous compounds occurring in spinach have direct nutritive value.

WASHINGTON, D. C.

NEW BOOKS.

The Metals of the Rare Earths. (Monographs on Inorganic and Physical Chemistry.) 1st edition. By JAMES F. SPENCER, B.Sc. (Vict.), D.Sc. (Liverpool), Ph.D. (Breslau), F.I.C., Lecturer in Physical and Inorganic Chemistry at Bedford College (University of London), Reader in Physical Chemistry in the University of London. Longmans, Green & Co.: London, etc., 1919. x + 279 pp., with diagrams. 15 × 22.5 cm. Price, \$4.50 net.

A careful study of this work discloses the fact that the writer is extremely well acquainted with the theory and literature of this group of elements. The book is nicely arranged and is a great advance on many that have appeared in the past. The general plan followed is along similar lines to those of the best kind. The methods of analyses, and the various compounds listed under each element are described at greater length than usual. This in itself is a great recommendation, for it means so much to those who are interested in both research and study upon these metals. It appears unfortunate, however, that there is no chapter devoted to a general discussion of the various types of compounds, for, when we have elements possessing such very similar properties it is very advantageous to consider the salts from a general standpoint by directly viewing tabulated properties, etc.

Another impression gained by reading this book is that it has been written by one who has devoted much more time to the literature than to the practical side, since methods of separation which are absolutely worthless are often placed side by side with the very best without sufficient advice being given to the reader.

In several places we come across statements which indicate without proof that some of the rare earth metals are still complex. This tends to enshroud them in mystery and remove from them their simple nature which has been coming to the front more and more during recent years. It seems better for science that they be considered simple until proved complex beyond a doubt.

This book is so valuable that it is to be hoped that the author will still enlarge the space devoted to the listed compounds and correct all the errors before the next edition appears.

C. JAMES.

Principles of Chemistry. By JOEL H. HILDEBRAND, Ph.D., Associate Professor of Chemistry in the University of California. pp. ix + 313. New York: The Macmillan Company, 1918.

The author in the preface of this book puts forward clearly the reasons for the belief that for both teachers and students of general chemistry and qualitative analysis it is advisable to have a text in which the general principles and the fundamental theories of the science are discussed logically apart from the mass of descriptive detail which necessarily forms a part of these courses. With such a text the teacher can introduce, whenever it appears advisable, such generalizations as he desires, and the student has the opportunity to study a well-rounded discussion of the subject. As a result, the teacher is freed from following a fixed order year after year, and the student is not compelled to piece together the considerations of any principle from here and there in his text.

Acting upon this belief, the author has brought together in a comparatively small space discussions of the principles which beginners in chemistry should master in order to gain a satisfactory knowledge of the facts of general chemistry and qualitative analysis. The subjects treated include the following: kinds of matter, the kinetic theory, gas laws, weight relations, valence, equations, nomenclature, solutions, thermochemistry, speed of chemical reactions, chemical equilibrium, oxidation and reduction, periodic system, the constitution of the atom, and dispersed systems.

The book is unusually well written; the explanations are strikingly clear and simple, and the degree of emphasis put on the several topics well chosen. Many teachers will find in it simplifications of pedagogical methods which will be helpful. The book can well be recommended to students for study, whatever text is used in the course.

JAMES F. NORRIS.

Molecular Physics. By J. A. CROWTHER. 2nd edition. 187 pp. P. Blakiston's Sons and Co., Philadelphia, 1919. Price, \$1.75.

The study of subatomic phenomena has advanced so rapidly in the past 20 years that knowledge in this field is now more definite than was the atomic theory at the opening of the present century. Indeed, the time is at hand when the inductive proof that matter acts "as if" it were composed of atoms will be abandoned in chemical teaching, at an enormous saving of time and confusion, and will be replaced by the study of what Dr. Crowther calls molecular physics. Our present knowledge of the electron and the structure of the atom serves as the simplest basis for the chemical study of the elements, the periodic system, valence, atomic theory, ionization in solution, oxidation and reduction. For such a development books of this type furnish a desirable introduction.

The subjects considered are, the physics of the electron, the positive

particle, positive ray analysis, nature and size of the electron, structure of the atom, electronic valence, radiation from the atom, the molecular theory of matter and radioactivity.

The book is amply and clearly illustrated by photographs taken almost exclusively from the original papers. Mathematics are omitted and the style is simple and comprehensible throughout. Experiments are described fully, and their immediate conclusions are given. The book is weak, however, in the deductions which are particularly interesting to chemists. The theory of electronic valence is very inadequately treated, with reference only to the opinions of English physicists, and without mention of the large amount of chemical thinking on the subject, particularly in this country. Again, only the simplest facts of radioactivity are given, with no mention of isotopy, atomic number, atomic weight, or the relation of the radioactive elements to the periodic system.

While subatomic chemistry is thus ignored, the book gives an excellent survey of subatomic or "molecular" physics and amply justifies a second edition.

GERALD L. WENDT.

Lectures on the Principle of Symmetry and its Applications in all Natural Sciences.

By F. M. JAEGER, Ph.D., Professor of inorganic and physical chemistry in the University of Groningen, Holland. Amsterdam: Publishing Company "Elsevier," London: The Cambridge University Press. xii + 333 pages, 170 diagrams. 17 × 25 cm. (In English).

It may not be apparent from the title of this book why it should be reviewed in *THIS JOURNAL*, for the term "symmetry" probably brings to the mind of the chemist hazy recollections of more or less profitless hours spent during his college days in the study of wooden models of crystals, the country of manufacture of which was betrayed by their accuracy in angle as well as their quite unnatural aspect. Nor is chemistry usually regarded as one of the "natural" sciences. As a matter of fact, however, this book includes much data of great value to chemists, not only by way of summary of past achievements, but also in the suggestion of lines along which work is needed.

In the first few chapters the subject of symmetry is treated from the geometrical standpoint, with numerous illustrations of different types among crystals, animals, and plants. What appears to be a new method of nomenclature of the different types of symmetry is introduced; thus the symmetry of the mineral tourmaline is denoted by C_3^V , the C standing for cyclic, the subscript 3 for the degree of symmetry (3-fold) shown by the unique axis of the crystal, and the superscript V for the presence of vertical planes of symmetry. Other terms used are D for dihedral, T and K for the endospherical cubic symmetry classes, etc.

The subject of space-lattices as related to crystal structure is naturally given full consideration; and the Barlow-Pope theory of packing of spheres

is reviewed, their so-called valency-volume hypothesis being, however, unduly praised. This is followed by a detailed explanation of the principles of the application of X-rays to the study of crystal structure, with an account of some of the results obtained. There is a chapter on mimetic forms and apparent symmetry, in which the grouping of crystals and twinning are discussed, although only a few of the possible types of "pseudo" symmetry are referred to.

The portion of the book which will appeal to chemists most is the last third, which is devoted to a very full consideration of molecular symmetry and asymmetry in chemical compounds. Starting with Pasteur's discovery of the resolution of racemic acid into 2 oppositely rotating compounds, the development of this subject is traced in considerable detail. The methods of separating the antipodes in various cases are fully described. Van't Hoff's explanation of the asymmetry of the carbon atom is shown to be the most satisfactory; and the discovery of optical activity in many other elements with valence greater than 3 is recorded. It is pointed out that configurations differing from their mirror images can be obtained even though the substituting groups are not all different; and that on the other hand it is conceivable that even when all the groups are different there may be no distortion of the central atom, and hence no optical activity. Werner's work on optically active complex inorganic compounds is of course fully reviewed, although certain of Werner's conclusions as to the relation of composition to rotatory power are shown to be improbable. The types of molecular symmetry resulting in internal compensation and impossibility of resolution into antipodes are described in detail. The connection between optical activity and the appearance of corresponding asymmetry in crystal form is discussed, and the apparent lack of agreement in many cases is pointed out.

Asymmetric syntheses form the subject of the bulk of the last chapter. Many experiments are quoted to show that "pre-existing molecular dissymmetry has a powerful guiding influence on the chemical synthesis in which new asymmetric carbon atoms are created * * * the contrast between the natural synthesis by the living organism and that by the chemist, as contended by vitalists, has mostly vanished, since the one-sidedness of natural synthesis is * * * now reduced to a merely relative difference in reaction velocities."

The book is, on the whole, well gotten up, well illustrated, and supplied with an abundance of references to papers upon the subjects discussed. The English is occasionally of a character which might be termed quaint, as for instance in the following: "As long as no exacter data about the configuration of inorganic salts are at our disposal, such applications of Werner's theory are not much promising." EDGAR T. WHERRY.

Technical Handbook of Oils, Fats and Waxes. Vol. II, Practical and Analytical. By PERCIVAL J. FRYER, F.I.C., F.C.S., Chief Chemist and Director, Yalding Mfg. Co., Ltd., Lecturer in Oils, Fats and Waxes at the Polytechnic, Regent St., W. London Institute, and FRANK E. WESTON, B.Sc. (1st Hons.), F.I.C., Head of the Chemistry Dept., the Polytechnic, Regent St., W. Cambridge University Press, London, England, 1918. xvi + 314 pp., 69 figures. 14.5 X 22.5 cm.

This is the second volume of a very excellent work which will probably find its chief use among special students of the chemistry of oils, fats and waxes and to a lesser extent as a quick reference work in technical, consulting and industrial laboratories. The subject matter is very well planned, systematized and coördinated. The material is well selected and the sins of inclusion and omission are few. Complete references to the literature are absent, although there are some selected references no doubt judged by the authors to be the most important. The work is a valuable addition to text-books on oil and fat chemistry and will be found useful by both works analysts and students.

W. D. RICHARDSON.

Organic Chemical Reagents. By ROGER ADAMS, O. KAMM and C. S. MARVEL, University of Illinois Bulletin, Vol. XVI, No. 43, 1919. 79 pp., 6 ill. Price, \$0.50.

Everyone will recall with gratitude how, in the dark days of 1916 and 1917, the Chemical Laboratory of the University of Illinois offered to supply the various research institutions in this country with pure organic chemicals the importation of which from abroad had been cut off. Dr. Adams and his co-workers have done pioneer work in insuring the domestic production of organic chemicals, and it is gratifying to learn from the latest catalogue of the Eastman Kodak Company that the list of these, available at the present time, contains the names of nearly 700 chemicals.

The authors of the pamphlet under review say: "During the past two years, at the University of Illinois, the methods of preparation for some of the less common organic chemicals, especially reagents in lots of one-half to five pounds, have been studied. This pamphlet contains some of the results obtained and has been printed in order that it may aid any laboratory which for one reason or another desires to manufacture these substances. The methods described are in only a few cases new ones; they are in general those which already appeared in the literature, but with such details added as will enable a man who has had a reasonable amount of experience in organic chemistry to duplicate the results without difficulty. Especial attention has been given to the explanation of why it is necessary to hold to the conditions given and what the results are providing these directions are not followed. An endeavor has also been made to use procedures adaptable to large scale production, for example, the avoiding of extractions wherever possible; the substitution of a cheap solvent for a more expensive one; or the introduction of mechanical agitation, an extremely important

factor in the success of many commercial processes." Twenty-eight preparations are covered: furfural, trimethyl-amine, amylene, trimethyl-ethylene, alkyl iodides, methylene iodide, benzoin, benzyl, benzoic acid, caproic acid, capryl alcohol, chloro-carbonic ester, α -phenyl-hydroxylamine, cupferron, isoamyl nitrite, *n*-butyl nitrite, hydroxylamine, dimethylglyoxime, *p*-bromophenol, 2,4-dibromophenol, diphenyl-carbamine chloride, benzene sulfonyl chloride, thiophenol, allyl alcohol, acetyl chloride. The treatment of every compound embraces: (a) introduction, including a full bibliography; (b) preparation, or experimental part; (c) discussion of the reaction—this being based upon the personal experience of the authors with the respective compound, and is, therefore, the more welcome.

May the plans of the authors be speedily realized, and we shall look forward to the publication by them of the second pamphlet now in preparation containing the directions for 30 or more additional compounds.

M. GOMBERG.

The Preparation of Organic Compounds. By E. DE BARRY BARNETT, B.Sc., A.I.C. P. Blakiston's Sons & Co., Philadelphia. 2nd edition, 1920. pp. xiv + 273. Price, \$3.25.

This work, the first edition of which appeared in 1912, occupies a position intermediate between the well-known "Methods of Organic Chemistry" of Weyl and the more recent handbook of "Preparative Chemistry" by Varino, the former of which consists for the most part of discussions of organic chemical methods, the latter almost exclusively of recipes compiled from the literature. For a volume of such small size, its scope is wonderfully wide; and the discussions between the descriptive matter are condensed to the smallest possible volume.

There is no question that this work should form an indispensable member of the libraries of all technical laboratories, especially of those in which the list of standard journals is incomplete. It should also be of great value to organic research workers in university laboratories; though it might be unwise for professors to encourage too free a use of it by students who are just beginning research work, as an important part of the training value of such work consists in acquiring the habit of turning directly to the original literature. "Although the present chemical curriculum is capable of very great improvement, it is to be hoped that it will not be reduced to the mere acquisition of 'useful' facts." Thus Mr. Barnett in his preface to the second edition; and it is obvious that more insight can be gained by a study of an original paper than from extracts, even when they are as carefully prepared as in the work under review.

The author has introduced a little new matter into the second edition, and it is to be hoped that a place will be found in the next for some of the synthetic work which has appeared since 1912, such, for instance, as the elegant methods of E. A. Werner for the preparation of amines. A new

and valuable section has been added on apparatus for small-scale technical or large-scale laboratory preparations.

Certain errors may be noted, some of which are to be found in the earlier edition. Thus, on page 55, the boiling point of α -bromonaphthalene is correctly stated to be 280° , whereas on p. 53 it is given as 208° , the directions calling for the collection of the fraction $200-210^{\circ}$ (in the original paper the range is given as $270-280^{\circ}$). On p. 120 "acetophenone" is made to read "benzophenone." While desiring not to be pedantic, we would quarrel with the author's nomenclature in certain cases; thus, on p. 152 ethyl ethylmalonate is described as "ethyl diethyl malonate," and on p. 50 there is a particularly glaring instance of the indiscriminate use of "benzene" and "benzole."

The book is well set up and fairly free from misprints, and with its thinner paper and larger format it is a marked improvement over the first edition.

H. T. CLARKE.