

NEW BOOKS

The Properties of Electrically Conducting Systems, Including Electrolytes and Metals.

By CHARLES A. KRAUS, Professor of Chemistry in Clark University. American Chemical Society Monograph Series. The Chemical Catalog Company, Inc., 1 Madison Avenue, New York, U. S. A., 1922. 415 pp. 70 figs. 23.5 × 16 cm. Price \$4.50.

The need for a comprehensive and systematic account of the more important recent developments of the ionic theory has become so acute that the appearance of this volume, the largest to date of the American Chemical Society Series of Scientific Monographs, is exceptionally opportune. The student now entering upon research work in this field finds little of value to bridge the gap for him between the platitudes of elementary text-books and the obscurities of journal articles, and even an experienced investigator in related topics is apt to collapse under the strain if he attempts to gain unassisted a clear idea of the various new theories that have threatened of late to supplant the original hypothesis of Arrhenius. The old reliable of a previous generation—Kohlrausch and Holborn's "Leitvermögen der Elektrolyte"—is now quite antiquated, and essays upon special lines such as Carrara's "Elektrochemie der nichtwässerigen Lösungen" have appealed only to the few. This monograph by Professor Kraus will consequently be examined with the greatest interest by all physical chemists desirous of keeping abreast of the times in the broad field of conducting solutions.

The actual scope of the volume may be indicated by the chapter headings: I, Introduction; II, Elementary Theory of the Conduction Process in Electrolytes; III, The Conductance of Electrolytic Solutions in Various Solvents; IV, Form of the Conductance Function; V, The Conductance of Solutions as a Function of their Viscosities; VI, The Conductance of Electrolytic Solutions as a Function of Temperature; VII, The Conductance of Electrolytes in Mixed Solvents; VIII, Nature of the Carriers in Electrolytic Solutions; IX, Homogeneous Ionic Equilibria; X, Heterogeneous Equilibria in which Electrolytes are Involved; XI, Other Properties of Electrolytic Solutions; XII, Theories Relating to Electrolytic Solutions; XIII, Pure Substances, Fused Salts, and Solid Electrolytes; XIV, Systems Intermediate between Metallic and Electrolytic Conductors; XV, The Properties of Metallic Substances.

Many readers will doubtless be disappointed to discover that the monograph is restricted almost entirely to conductance and properties directly dependent thereupon, only very brief treatment being accorded to other matter of primary importance, such as solvation and electrode potential measurements. In view of the complexity of the subject, however, it must be admitted that the author was wise not to attempt to cover the whole field. Even in the topic of conductance a certain amount of selection is obvious, the work of the American school during the past 15 years being particularly stressed. Here again, while one may regret the

exclusion of references to the researches of earlier investigators of such rank as Bredig, Lundén and Walker, the author's choice of material cannot be seriously criticized. The tendency has long existed outside of this country, except in one or two isolated laboratories, to regard the ionic theory as hopelessly deadlocked upon the anomaly of strong electrolytes, and systematic work on the subject has been extremely meager. In America, on the other hand, men of the caliber of A. A. Noyes, E. C. Franklin, G. N. Lewis and E. W. Washburn (to mention only a few out of many) have spent years of patient research upon the properties of conducting solutions, and a vast amount of valuable experimental material has been accumulated. The reviewer remembers that when he was a student in Stockholm in 1912, Arrhenius used to await the arrival of the monthly *Journal of the American Chemical Society* more eagerly than that of any other publication, and a glance at almost any recent issue will show that interest in the ionic theory has not evaporated in this country since.

Professor Kraus himself, as is evident from the frequent references to his own researches in the text, approaches his task with a rich background of first-hand experience, and the touch of the master is apparent on practically every page. The whole book is surprisingly easy reading, the numerous tables and diagrams which illustrate each point under discussion affording great assistance. The most striking feature of the monograph is the insistence upon the application of graphical methods to experimental data for deducing and testing general relationships. Especially interesting examples of the practical utility of such plots will be found in the examinations of the results of Schlesinger for solutions of formates in formic acid (p. 102) and of the theory of Ghosh (p. 341). In using graphical methods, however, the danger always exists of subordinating the data to the equations, and when the author suggests that the accepted value for Λ_0 for potassium chloride in water is too high, and that for hydrochloric acid too low, because they do not fall in line with his formulas (pp. 98-100), not all of his readers will be ready to agree. The statement on p. 377 that the ratios obtained by conductance and electromotive force measurements for the carrying capacities of the negative and positive ions of sodium in liquid ammonia at low concentrations are in excellent agreement (6.8 and approximately 7) is also scarcely justified by the data in Table 149 and Fig. 64.

The introductory chapters are admirably clear and concise. In the main body of the text, dealing with electrolytic solutions, a few points call for special comment. Thus the demolition of two currently accepted generalizations by Walden on p. 93 and p. 110 will come as a shock to many chemists. The author's theory that the hydration of rapidly moving ions *increases* with rising temperature, although ably supported by argument (pp. 125-126), is certain to meet with much opposition. The dis-

cussion of the variation of the ionization constants of weak electrolytes with temperature (pp. 149-150) could be improved by reference to the work of Arrhenius ("Theories of Solutions," Yale University Press, 1912, Lecture XI). Similarly the use of the results of Anderson [*J. Phys. Chem.*, **19**, 733 (1915)] on the conductance of inorganic salts in pyridine at 25° would have simplified the argument against the abnormal conducting power of the pyridonium ion in that solvent (p. 208). In general, however, the data presented are excellently chosen with reference to the text.

The description of recent theories relating to electrolytic solutions in Chapter XII is very fragmentary. Professor Kraus is clearly not in sympathy with the majority of new developments in this field, stating in his introduction, indeed, (p. 8) that "such theories as have been advanced in recent years give evidence of having been adapted to fit particular cases." This appears somewhat scathing as a general indictment, true as it may be in certain instances.

The short section on solid electrolytes contains some very interesting new material, as may be seen from the following quotation (p. 363): "It has been shown that for silver iodide, silver bromide, silver chloride, silver sulfide above its transition point, and copper sulfide (Cu_2S), Faraday's law holds and that in these salts the current is carried entirely by the positive ion. These results are very significant in that they show that one set of ions in these solids forms a fixed framework through which the other ions move with considerable facility. In the above salts, the negative ions form the framework through which the positive ions move. In lead chloride, however, the current is carried by the negative ion; the positive ions form the framework through which the negative ions move. These facts have an important bearing on the theory of the structure of solid salts."

The final two chapters, which take the subject from electrolytic to metallic conductors through those of intermediate type, also contain a great deal of highly-significant matter which will be new to most readers. Much of the discussion in these chapters, as indeed in many earlier sections of the book, is based upon the investigations of Professor Kraus himself and his collaborators. One cannot but feel that very important results must eventually accrue from the careful work which is now being done in this hitherto neglected field.

It is possible that some may raise objection to the fact that the volume as a whole is so largely written around the author's own research problems. The retort is obvious that, since Professor Kraus has preëmpted only a fraction of the field, the way is left perfectly open for anyone who feels hurt at the exclusion of his own pet topics to take up what has been left untouched in just whatever style he pleases. If he succeeds one half as well as Professor Kraus has done, he will have rendered a real service to American chemistry.

JAMES KENDALL

Les Colloïdes (Colloids). By J. DUCLAUX, Director of the Laboratory at the Pasteur Institute. Second edition. Gauthier-Villars and Company, Paris, 1922. x + 305 pp. 8 figs. 18.5 × 12.5 cm.

In this second edition, the author adheres to his original intention of presenting a simple, rather than detailed and complete account of his subject. He says in the Preface: "When one is dealing with a science so slightly advanced as Colloid Chemistry, it is far better to present to the reader selected facts which form a coherent whole, than to pile all the facts upon his plate and ask him to sort them out." Our only comment is that while simplicity is indeed a major virtue, *over*-simplification is a very heinous sin.

In this edition there has been added as an eleventh chapter an account of the recent work of Sørensen and of Loeb, of the recent studies on the structure of colloids using X-rays, and of the constitution and peptization of gels. On the other hand, some of the general discussion of physico-chemical principles has been omitted so that the present edition is only 12 pages longer than the first. We note that there is no index, and that this work has been "crowned" by the Academy of Sciences.

ARTHUR B. LAMB

Laboratory Manual of Colloid Chemistry. By HARRY N. HOLMES, Professor of Chemistry in Oberlin College. John Wiley and Sons, Inc., New York; Chapman and Hall, Limited, London, 1922. xii + 127 pp. 32 figs. 23.5 × 15 cm.

As stated in the preface this manual was written at the request of the Colloid Committee of the National Research Council. So successful has the author been that the work bids fair to become a classic in Colloid Chemistry.

The manual is divided into 16 chapters. The chapters take up respectively: Suspensions, Dialysis and Diffusion, Condensation Methods of Preparation, Dispersion Methods, Coagulation, Protective Colloids, Solvated Colloids, Surface Tension, Emulsions, Viscosity, Adsorption and Solution, Adsorption of Gases, Reactions in Gels, Experiments with the Ultramicroscope, Soils and Clays, and finally Special Topics. Under the last named many technical processes are exemplified by experiments which have been contributed by well-known colloid chemists as follows: Jerome Alexander on the ultramicroscope, W. D. Bancroft on dyeing, Ellwood B. Spear on rubber, S. E. Sheppard on silver nuclei, J. A. Wilson on tanning, Leon Parsons on varied topics.

Over 180 experiments are accurately described and a great many others suggested. These experiments are so arranged that excellent courses may be selected by the instructor for students engaged in special lines as well as for those who wish a general training in Colloid Chemistry. Students following courses in medicine, agriculture, ceramics, geology and industrial chemistry will find work best adapted to further their immediate

aims. Most of the experiments have been thoroughly tested by students under the author's supervision.

A particularly commendable feature of the work is the excellent use the author has made of the existing literature. The student is referred continually to standard works on the subject of Colloids or to specific articles in the Journals. A fairly comprehensive bibliography of the subject is appended.

The manual will undoubtedly supply a long felt want in instruction in Colloid Chemistry. The author's fundamental knowledge of, and long experience in the subject has enabled him to choose experimental material that illustrates the point under discussion, and also stimulates the student to independent thought.

Not only students of limited experience but also those relatively familiar with the subject will find the book interesting and instructive. The style is very pleasing and direct, but not concise to the point of obscurity. The work is a very distinct contribution to the literature of Colloid Chemistry and will be welcomed by industrial chemists as well as by students and teachers who are interested in the subject.

E. B. SPEAR

Anorganische Chemie (Inorganic Chemistry). By DR. FRITZ EPHRAIM, Professor at the University of Berne. Theodor Steinkopff, Dresden and Leipzig, 1922. viii + 727 pp. 53 figs. 23 × 15.5 cm. Price, bound, sh. 24.

According to the Preface, the object of this book is to bring together, without any considerable expansion in size, a substantially greater body of facts than has been done in previous textbooks and at the same time to present this material in a form so easy to grasp that its mastery will not make too great demands upon the reader. The attempt has also been made to relate the myriad isolated facts of inorganic chemistry logically to one another by an intelligent arrangement, so that they may be more easily understood, and also more interesting.

In order to accomplish this, the author has assumed that the reader already possesses an elementary knowledge of chemistry. On this basis he has abandoned the time-honored method of describing one element after another, and instead discusses related compounds together, bringing out primarily their comparable and unifying characteristics. Much repetition is thus avoided, as well as the tiresome dictionary-like impression made by so many textbooks of chemistry.

The titles of the nine chapters indicate this method of treatment. They are I, The Elements; II, The Compounds of the Halogens; III, The Oxides of Hydrogen and of the Metals; IV, The Compounds of Sulfur, Selenium and Tellurium; V, The Nitrogen, Phosphorus and Arsenic Group; VI, The Fourth Group of the Periodic Table and Boron; VII, The Rare Earths; VIII, The Inter-metallic Compounds; IX, The Radio-active Elements.

The author has certainly achieved a real success. He has collected within a small compass a great quantity of material hitherto inaccessible except in the periodical literature or in monographs, or in Abegg's or Gmelin-Kraut's encyclopedias of inorganic chemistry. The treatment is modern throughout, everything being presented from the point of view of the concentration law and of Werner's coordination theory, etc. For the first time in a textbook of this scope, adequate treatment has been given to the chemistry of inorganic complexes, to the acids of the metals, to the acid amides, and to inter-metallic compounds.

We have only two minor, unfavorable criticisms. First, the author lapses occasionally from his guiding principles. Thus, for instance, an inadequate and practically useless 4-page discussion of the phase rule is injected well along in the book, long after a much more thorough understanding of the matter has been assumed in connection with a study of the allotropy of the elements. Second, the paper used is very poor.

It is on the whole an excellent book. It will be stimulating and instructive to anyone who wishes to continue his study of inorganic chemistry beyond what is given in the conventional elementary textbook. Its perusal will show what a rich, variegated and alluring field for research is offered by this too little appreciated branch of chemistry.

ARTHUR B. LAMB

Organic Chemistry or Chemistry of the Carbon Compounds. By VICTOR VON RICHTER. Edited by Professor R. ANSCHÜTZ and Dr. H. MEERWEIN. Vol. II. Chemistry of the Carbocyclic Compounds. Translated from the 11th German edition by E. E. Fournier D'Albe, D.Sc., A.R.C.Sc. P. Blakiston's Son and Company, 1012 Walnut St., Philadelphia, 1922. xvi + 760 pp. 23 × 15.5 cm. Price \$8.00.

Organic chemists will welcome the new English translation of Vol. II (Chemistry of the Carbocyclic Compounds) of Richter's Organic Chemistry. This book and Vol. I (Chemistry of the Aliphatic Compounds), the latest English translation of which appeared in 1919, are well known to most chemists who have made anything more than an elementary study of organic chemistry. The subject matter of Vol. II covers a general description of practically every type of carbocyclic compound and is carefully divided into groups which in turn are systematically subdivided into various classes. The commoner specific members of each class are also described and references to the original literature are given. Both Vol. I and Vol. II may be used as very advanced text books, but they are of more value as general reference books. The student or investigator who desires the important facts about any except the rarest of the classes of aliphatic and carbocyclic compounds may obtain in these this information, thus eliminating the necessity of consulting the very large and comprehensive reference books which are too expensive for the average private library, or of consulting the original literature.

It is unfortunate that, unlike the previous English edition of Vol. II, this new one does not contain the chemistry of the heterocyclic compounds, though it is considerably larger and more extensive as regards the chemistry of the carbocyclic compounds. It is also to be regretted that a translation of the eleventh German edition published in 1913, has not appeared until 1922, since almost a decade has brought many new developments in the field of carbocyclic compounds which are not included.

ROGER ADAMS

Smith's Intermediate Chemistry. Revised and rewritten by JAMES KENDALL, Professor of Chemistry, Columbia University, and EDWIN E. SLOSSON, Editor of "Science Service." The Century Company, New York, 1922. xv + 566 pp. 125 figs. 15 plates. 20.5 × 13.5 cm.

The revision of this text consists in the addition of new material marking the progress of chemistry since the publication of the first edition; in a considerable expansion of old material; in a re-division and re-arrangement of a number of chapters; in the attempt to make more satisfactory explanations which experience has shown to lack clearness; in a new series of plates; and in better form and typography.

Such revisions by other hands than those of the author are always dangerous. The logical plan of the work is likely to disappear and the final result to be a sort of patchwork which is far from effective. The revisers of this text are to be congratulated upon their success in avoiding this difficulty. The book is still a characteristic Smith text, but greatly improved and clarified. The numerous changes in order and in chapter arrangement are changes in accord with the logical development of the subject. The expansion and rearrangement of material generally makes for clearness. If one compares the reasoning leading to the development of the ionic theory in the previous edition with that adopted by the revisers in the present one, it will be seen that the improvement is of no mean order. In fact the changes are so much for the better that it is to be regretted that more were not made, particularly in the development of the conception of the atom and of atomic weights, always a weak point in the Smith texts.

The new material intended to bring the book up-to-date is in general well selected and logically presented. One may, however, be permitted to extend sympathy to the Freshman who finds treated in the last chapter, within the limits of 14 pages, the following topics: "Discovery of Radium;" "Nature of the Rays;" "Disintegration;" "Uranium Series;" "Transmutation of the Elements, Atomic Energy;" "Atomic Numbers;" "Isotopes;" "Isotopes of Common Elements (work of Aston);" "Atomic Structure;" "Valence and Atomic Structure (including Lewis-Langmuir theory);" "Co-Valence;" "Polar and Non-Polar Compounds;" "Atomic

Structure and Chemical Affinity." Perhaps the daze into which the student must be thrown upon reading this chapter is the condition in which the authors think it proper to leave him at the end of his first course in chemistry. He may wish to continue the subject to gain some insight into what appears to be so perplexing.

Peculiarly refreshing is the introduction, "Why Study Chemistry?" unmistakably from the pen of Dr. Slosson. Here is nothing of the restraint or conservatism of the ordinary writer of chemical texts; the importance and merits of chemistry are stated at their full value. Understatement is perhaps an over-rated virtue among scientific writers of all types; and particularly among those who are striving to introduce the boy and girl to a science of the very nature of which they are likely to be entirely misinformed.

The general position of the series of Smith texts is too well known to need any comment here. The fact that they have maintained their position so long despite objection of many prominent teachers to their methods as a whole, and despite the objection of nearly all teachers to certain portions of them, shows their intrinsic worth. The Intermediate Chemistry was, perhaps, the weakest of the four texts. In the hands of Professor Kendall and Dr. Slosson it has become their equal, if not their superior. It should be taken into consideration, in the selection of a text, by college teachers who have to do with students with no previous training in chemistry.

LEON B. RICHARDSON

The Fundamental Processes of Dye Chemistry. By Dr. HANS EDUARD FIERZ-DAVID, Professor of Chemistry at the Federal Technical High School, Zurich. Translated by FREDERICK A. MASON, M.A., (Oxon.), Ph.D. (Munich); Research Chemist with the British Dyestuffs Corporation, Limited. J. and A. Churchill, 7 Great Marlborough Street, London; D. Van Nostrand Company, 25 Park Place, New York, 1921. xiv + 240 pp. 45 figs. 15 × 24 cm. Price \$6.00.

Of the numerous books on dyes published during the past few years, Professor Fierz-David's surpasses all in practical value for the research and development chemist in this field. The author has made an especial effort to describe with utmost care typical examples of the various fundamental operations in dye chemistry not only on a laboratory but also on a semi-works scale. The inexperienced chemist has thus an opportunity to become acquainted with the necessary alterations in a process when changing from small to larger quantities. Unlike most books of a similar nature, there are chapters devoted to the best kind of apparatus to use both in the laboratory and on a semi-works scale and to the construction of, as well as to the structural material used in the larger apparatus. There is also given a discussion of the organization, expenses, type of products and other essential features in the success of a dye plant. The scope

of the book is best illustrated by an outline of its contents. The four main parts are (1) Intermediate products, subdivided into (a) sulfonation, (b) nitration and reduction, (c) chlorination, (d) oxidation, (e) condensation; (2) Dyes, subdivided into (a) azo dyes, (b) triphenylmethane dyes, (c) sulfur melts, (d) miscellaneous dyes, (e) summary of most important methods; (3) Technical details, subdivided into (a) vacuum distillation in the laboratory and in the works, (b) notes on the construction and use of autoclaves, (c) structural materials used in dye chemistry, (d) technical notes on works management, (e) example of costing of a simple dye; (4) Analytical section. In addition there are 45 cuts representing the different kinds of apparatus for the laboratory and semi-works.

Every process described has been actually tested by the author and is the result of his personal experience. Moreover, the majority of the processes have been carried through to the large manufacturing scale so that they are dependable for practical application in the industry. It is gratifying to see a book appear in which the methods of preparation of substances of commercial importance are given with such painstaking and accurate details. Aside from its primary value for dyes and intermediates, the book will prove of general value to the organic chemist because many details employed in the operations are applicable to the preparation of other organic chemicals. It may, therefore, be highly recommended to every university and technical laboratory.

Not only has the book been well translated from the German by Dr. Mason, but a few errors which appeared in the original Swiss edition have been corrected.

ROGER ADAMS

Food Products: Their Source, Chemistry, and Use. Second revised edition. By E. H. S. BAILEY, Ph.D., Professor of Chemistry and Director, Chemical Laboratories, University of Kansas. P. Blakiston's Son and Company, 1012 Walnut Street, Philadelphia, Pa., 1921. xvi + 551 pp. 92 figs. 14 × 20 cm. Price \$2.50 net.

The first edition of this book appeared in 1914. To the new edition there have been added brief discussions of such subjects as the vitamins, bread from mixed flour, and peanut products. Some additional tabular matter has also been included, such as statistical matter on the production of different cereals in the United States, and the composition of proprietary foods. The chapters on animal and vegetable fats and oils, and nuts and cereals have been revised, for it is the trade in these products that the World War has peculiarly affected. The actual additions to the volume are greater than the 30 odd page increase in size would indicate, for the reason that the treatment of such subjects as the alcoholic beverages has been shortened.

C. I. ALSBERG