used and the sodium hydroxide was the clear liquid decanted from a well-settled 1:1 solution of the C. P. substance. The mixtures were frequently agitated during 0.5 hour and then stood 1.5 hours longer before ether was added. Then they were left overnight before the ethereal solution was pipetted out for analysis. In other respects the procedure was the same as in Experiment 1. The residue of anhydrides from the preparation in which calcium chloride was added weighed 0.9871 g.; that from which calcium chloride was absent weighed 0.9723 g.

The third line of evidence was based on the claim that when a solution of pure nicotine, which naturally was alkaline, was added to a neutral solution of calcium chloride, the resulting mixture showed an acid reaction. Such a simple, yet spectacular experiment, ought to afford no difficulty, but in fact the writer has been wholly unable to observe any such effect. Into one of a pair of matched test-tubes was brought a measured portion of neutral solution of calcium chloride and into the other the same volume of water. One drop of phenolphthalein indicator solution was added to each tube and both of course remained colorless. Equal volumes of a 4 per cent. aqueous nicotine solution were then added to both tubes. A rose color developed in both, but neither immediately after mixing nor after the expiration of 24 hours did the tube containing calcium chloride show a paler color than the check tube. Both 0.5 *M* and *M* calcium chloride solutions were used and the proportion of nicotine solution to calcium chloride solution was varied progressively from 1:1 to 1:20.

The only conclusion to be drawn from the above data is that no evidence exists for the calcium-nicotine combination claimed by Graham and Carr.

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NEW BOOKS

The New Theories of Matter and the Atom. By ALFRED BERTHOUD, Professor of Physical Chemistry at the University of Neuchâtel. Translated from the French by Eden and Cedar Paul. The Macmillan Company, New York, 1924. 259 pp. 21 figs. 22.5 × 14.5 cm. Price $3.50.

In its practical demonstration of the value of ordered thinking, science has offered an example of the attitude which humanity must bring to bear upon its problems if it is to survive and develop. To those of us who thus find the "scientific method" more important than its individual results can ever be, any book must be of interest which endeavors to "get across" to others than specialists not only the new facts in a field but some of the essential thought by which those facts have been obtained.

Professor Berthoud's book is good for this very reason. He apparently has had the aim, which must be the goal of all popularizers of the scientific method, to write a book that is not a substitute for light fiction but nevertheless can if attentively read be understood by educated persons. Popularizers of the scientific method, as opposed to the facts of science, can legitimately do no more. They may simplify the terminology of a branch of learning and they may restate in these simple terms its essential facts but they cannot alter materially the essential thought which is woven about these facts without loss of the very quality they are trying to teach and emphasize.

Professor Berthoud has tried to trace from early times the growth of our theories of matter and especially to show how profoundly and widely these theories have been altered by the modern developments of physics and chemistry. After a short introductory chapter dealing with the origins and the development of the atomic theory up to recent times, treatment is given to the electromagnetic and electronic theories, relativity, X-rays, radioactivity, present-day atomic theories and their bearing upon chemistry itself. In a book with as wide a scope as this it is natural that some parts should be much better done than others. Less adherence to the order of historical development probably would have obviated repetition in many cases and would have resulted in a clearer presentation. The translators have introduced here and there expressions which are neither in common scientific use nor are likely to be familiar to educated Americans.

In its discussion of those phases of modern physics which, like the theories of atomic structure, are changing with extreme rapidity, the book is already out of date. The fact that its English translation appears two years after the book itself does not make this surprising. If so transitory a book as the present one must inevitably be is worth translating at all, why can it not be brought out when the things it has to say have the added advantage of being new? In spite of such limitations to its greatest usefulness, this work appears to the reviewer to be the best general statement of physical theory and its growth that he has read.

RALPH W. G. WYCKOFF

Isotopes. By F. W. ASTON, Sc.D., Trinity College, Cambridge. Second edition. Longmans, Green and Company, New York; Edward Arnold and Company, London; 1924. xi + 182 pp. 23 figs. 22 × 14 cm. Price $3.50 net.

The second edition of this admirable monograph, appearing but two years after the first, is a continuation of the remarkable record of the investigation of additional elements for the existence of isotopes. Of the 80 non-radioactive elements known, 53 have now been analyzed—almost double the number reported in the first edition. The new results have been largely attained by means of the method of "accelerated anode

rays" worked out by Aston in 1923, which immediately added greatly to the number of metallic elements accessible to analysis. Of the newly reported elements, 10 (Al, Sc, Ti, V, Cr, Mn, Co, Y, Zr and Ba) are simple; 7 (Ca, Fe, Cu, Ga, Sr, Ag, Sb) consist of 2 isotopes, 1 (Ge) of 3, 1 (Zr) of 4, 1 (Se) of 6 and 1 (Sn) of 7 or 8.

The author has been able to introduce a large amount of new material without markedly changing the form of the work. Among the new subjects dealt with are divergence from the whole number rule of atomic mass, the disintegration of nuclei by alpha particles, the abundance of different atomic species in nature, and the newer work on the separation of isotopes.

It is rare that the exploration of so important a field can be carried on by a single investigator with the dispatch and thoroughness that has characterized the work of Dr. Aston in the isotopic analysis of the elements. It is therefore all the more fortunate for the reader that he has again been able to collect the results of his researches into a form at once so compact and readable.

S. C. LIND

Introduction aux Principes de la Chimie Physique, du Point de Vue de l'Atomistique et de la Thermodynamique Modernes. (Introduction to the Principles of Physical Chemistry, from the Standpoint of Modern Atomistics and Thermodynamics.) By EDWARD W. WASHBURN, Editor-in-Chief of the "Critical Tables of Constants," of the National Research Council of Washington. Translated into French from the second American edition, by HENRI WEISS of the Faculty of Sciences, Paris, and W. ALBERT NOYES, JR., Assistant Professor of Physical and Analytical Chemistry at the University of Chicago. Preface by M. JEAN PERRIN, Professor of Chemistry, of the Faculty of Sciences, Paris. Payot, 106 Boulevard Saint-Germain, Paris, 1925. xvi + 574 pp. 83 figs. 22.5 × 14 cm. Price 40 francs.

What American has not felt a thrill of national pride when, barely escaping the homicidal skill of a Parisian motor car, he has observed in the dwindling rear end of his attacker the familiar outlines of the ubiquitous Ford? Or who, imbibing strange alcoholic mixtures on an alien sidewalk, has failed to order another when his eye fell upon the flattering legend: "Bar Américain?" So we may proudly picture the Traveling Fellow in Chemistry at the Sorbonne in years to come asking his fellow students to recommend a physical chemistry text, and being told "Il n'y a que les 'Principes' de Washburn."

In fact this text should readily make a place for itself, for the reviewer knows of no modern French work which even approximately fulfills the mission of "Washburn," and in spite of the modest disclaimers of the translators, they seem to have done a first-rate job. The reviewer shares the confidence of Professor Perrin, expressed in his preface, that the book will be welcome and useful to French students.

Although at least in this work the subscripts are not written as exponents, the reviewer still feels an almost British bewilderment at French methods

of writing formulas. Why must there be, on the same page (317), HNO_3aq and NO_3Haq, KNO_3aq and NO_3Liaq? One hopes that accident, not a well-considered policy, is responsible.

NORRIS F. HALL

Principles and Applications of Electrochemistry. Volume I. By H. JERMAIN CREIGHTON, Associate Professor of Chemistry, Swarthmore College. John Wiley and Sons, New York, 1924. ix + 446 pp. 16 × 23.5 cm. Price $4.00. Volume II, by COLIN G. FINK, in preparation.

The purpose of this work is to present a systematic course of instruction in electrochemistry for chemical students, and at the same time to provide a reference book for others interested in this field. Volume I, by Professor Creighton, deals with the principles and general theory of the subject. The term electrochemistry has been used in its broadest sense to include not merely the various phases of conductance and of electric cells, but also many of the typical homogeneous and heterogeneous equilibria of electrolytes, such as hydrolysis and the solubility product. A chapter entitled "The Electrochemistry of Gas" discusses ionization and resonance potentials, positive-ray analysis and other phenomena of the vacuum tube.

The book is carefully written. The system of references to original papers is excellent and, on the whole, very complete. The author has endeavored to present the most recent viewpoints in each branch of the subject; for example, in discussing the anomaly of strong electrolytes, the theory of Ghosh is outlined as well as the objections to and discussions of the theory by Kendall, Lewis and others. The author appears to have been successful in presenting the general theory in a manner easily grasped by the student. Numerous problem sets are introduced in order to check the student's mastery of the fundamental conceptions.

The reviewer is inclined to criticize the distribution of space in some portions of the book. Thus, the treatment of electrometric titrations seems altogether too brief for such an important phase of electrochemistry. Also, it is difficult to understand why the treatment of the activity of ions and the activity coefficient should not occupy more space than the objections of Kahlenberg and others to the theory of electrolytic dissociation or the discussion of electrolytic solution pressure. The thermodynamic derivations are somewhat sketchy, but this is doubtless justified from the standpoint of the objects of the text. In connection with the treatment of thermodynamics, it seems to the reviewer very unfortunate that the relation between concentration and electromotive force is developed from the conception of osmotic pressure rather than that of Raoult's law. It is indeed surprising that the index contains no reference to Raoult's law, or to free energy.

The book covers a field in which no first-rate texts have been written in English and, as a text, will doubtless meet with a good reception from many

teachers, especially in schools where a course in electrochemistry is given in addition to a general course in physical chemistry.

WENDELL M. LATIMER

Proteins and the Theory of Colloidal Behavior. By JACQUES LOEB. International Chemical Series, H. P. Talbot, Ph.D., Sc.D., Consulting Editor. Second edition. McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y.; 6 and 8 Bouverie St., E. C. 4, London; 1924. xiv + 380 pp. 115 figs. 21 × 14 cm. Price $3.50.

This book represents the most successful attempt yet made to explain colloidal behavior quantitatively on the basis of classical physical chemistry. The first edition, which appeared in 1922, created very widespread interest and discussion and was quickly followed by editions in French and German. In the second edition, the book has been increased in size by 80 pages and 35 figures, much new material has been added and the general presentation has been improved.

There has long been an atmosphere of mysticism about that branch of the science known as colloid chemistry, chiefly, perhaps, because many of the recorded measurements seemed not to follow any known rules or to be quantitatively reproducible. The original conception of two kinds of substances, colloidal and crystalloidal, has gradually been replaced by that of a colloidal state, which any substance may assume by so changing its degree of subdivision that the average size of its particles lies between certain more or less clearly defined limits. The apparent finding that substances in the colloidal state did not combine with other substances in stoichiometric proportions was attributed to variations in particle size that could not easily be controlled. This made previous attempts at quantitative treatment very unsatisfactory.

The discovery which gave Loeb the starting point for the great work described in his book was that proteins, those substances exhibiting typical colloidal properties, actually do combine with acids and alkalies according to the stoichiometric laws of classical chemistry when the hydrogen-ion concentrations of the systems are duly measured and considered. Variations in earlier findings were simply the result of variations in hydrogen-ion concentration and not of particle size.

With this as a basis, Loeb was able further to demonstrate in protein-water systems that those variations in osmotic pressure, viscosity, swelling, and cataphoretic potentials which had come to be known as colloidal properties were, after all, merely the results of relatively simple equilibria analogous to that first described by Donnan for two solutions of electrolytes separated by a membrane permeable to all but one kind of ion. By recognizing all of the phases present in any protein system and measuring the concentration of ionogens present in each, it was found possible to explain the behavior of the system quantitatively on the basis of orthodox

physical chemistry, thus banishing much of the mystery usually associated with the name colloid chemistry.

At least so far as the proteins are concerned, Loeb shows that the term colloidal state is no more descriptive of the facts than the older term colloidal substances. He replaces these by the term colloidal behavior which may be exhibited even by substances present in what has been known as the crystalloidal state. In any system of two or more phases, colloidal behavior results whenever one kind of ion is prevented from diffusing freely from one phase to another. For example, if a solution of the chlorides of sodium and calcium were separated from pure water by a membrane impermeable only to calcium ions, the system would show colloidal behavior in respect to the influence of added electrolytes upon membrane potentials and osmotic pressure.

The book contains a huge mass of valuable experimental data, most of which are the result of Loeb's own work. He has presented his views in a style so bold and yet so simple and logical as to command the respect even of his severest critics. To many it will prove a source of great inspiration. Whether he has really picked order out of chaos in this most fertile field of chemical thought remains for the future to prove. The reviewer believes he has.

JOHN ARTHUR WILSON

The Chemistry of Enzyme Actions. By K. GEORGE FALK, Harriman Research Laboratory, The Roosevelt Hospital, New York. Second and revised edition, American Chemical Society Monograph Series. The Chemical Catalog Company, Inc., 19 East Twenty-fourth Street, New York, 1924. 249 pp. 33 figs. 15.5 × 23.5 cm. Price $3.50 net.

The second edition of this book contains much new material, including a chapter on some recent work on enzyme actions of tissues and tumors. The beginning of the story is that "Enzymes may be defined as catalysts found in living matter;" this, however, is only the beginning, for we find that enzymes are colloidal substances and many reactions catalyzed by enzymes are between dissolved substances; hence, the study of enzymes contains all the difficulties associated with both homogeneous and heterogeneous catalysis as well as those associated with colloid chemistry. In a logical scheme of development, the author shows how the whole armament of modern chemistry and physics is brought to bear on these problems.

The early chapters consist of discussions of homogeneous catalysis, reaction rates, mechanisms, etc. "The three concepts, chemical reaction, chemical equation, and mathematical equation, are supposed to describe the same phenomenon in any given case. Actually, they do so only as an ideal condition, and the possibility of deviation becomes greater with increasing complexity of the reactions and with decreasing care in the use of terms and expressions." Then follows a discussion of the colloidal

nature of enzymes and their purification, which leads to a study of their chemical properties and the mechanism of enzyme actions. The reaction mechanisms given on p. 154 are not very convincing, for the author omits any reference to the rate of diffusion of products away from the surfaces of the enzyme catalyst; this diffusion may, after all, be the factor which determines the rate of the complete reaction.

The book gives an authoritative and complete account of the chemistry of enzyme actions.

F. O. RICE

An Introduction to Organic Chemistry. By ALEXANDER LOWY, Ph.D., Professor of Organic Chemistry, University of Pittsburgh, and BENJAMIN HARROW, Ph.D., Associate in Physiological Chemistry, College of Physicians and Surgeons, Columbia University. First edition. John Wiley and Sons, New York; Chapman and Hall, London; 1924. ix + 389 pp. Illustrated. 23.5 × 15 cm. Price $3.00.

The authors have written an elementary text designed for a course of two hours per week for two semesters. Many of the more recent applications to industry and to biological sciences are given. There is included a number of charts indicating methods of manufacture and uses of some of the important organic chemicals. Of special note are brief chapters on "Foodstuffs and Their Changes in the Body," "Plant and Animal Pigments" and "Enzymes, Vitamins and Hormones." The 15-page chapter on Nomenclature of Organic Compounds and the glossary of medical terms undoubtedly will be found convenient. A human touch is given to the subject by the reproduction of pictures of several eminent chemists. At the end of each chapter a list of "Reading References" is given, and a whole catalog of books on organic chemistry and related subjects is published in the back of the text.

It can be seen from the foregoing statement that the authors have introduced several novel and interesting features. The usual type reactions are plainly given and the applications interestingly stated. The copious use of graphic formulas and charts undoubtedly will be welcomed by the student.

The reviewer was disappointed that the authors, who had to such a degree tried to make the material interesting and easy for the student, had not discussed mechanism of reactions to a greater extent. Many of these have been sufficiently elucidated to belong to the category of "well-recognized basic principles of organic chemistry." He would hesitate long before giving up entirely or even largely curtailing, as the authors have, the discussions on tautomerism, mechanism of reactions, bases for and methods of elucidating structures and the application of physics and of quantitative methods for some of the new material presented. Even if the book were used mainly for pre-medical students the criticism in the mind of the reviewer would still hold for he believes that the most important organic

chemical phenomena in physiology involve spacial configuration, tautomeric change and equilibrium considerations.

The value of the book will depend largely upon the point of view of the particular instructor. If he wishes one from which the student can quickly check up the general results of type reactions, as well as the accuracy of structural formulas and the applications of the subject, he will find the book valuable, for these are plainly stated and conveniently arranged (excepting the chapter on proteins, which are taken up before aromatic compounds and heterocyclic derivatives have been considered). The applications in general, and particularly the applications to biology, are strictly up to date.

R. R. RENSHAW

Arbeitsmethoden für Organisch-chemische Laboratorien. (Laboratory Methods for Organic Chemistry.) By Professor Dr. LASSAR-COHN. Fifth revised edition. Leopold Voss, Leipzig, 1923. General Part. x + 362 pp. 187 figs. Special Part. xii + 1144 pp. 10 figs. 25 × 16 cm. Price, unbound, $10.75; bound, $12.10.

Organic chemists will welcome a new edition of this well-known treatise, which at one time stood alone in its field. On account of the fact that the last revision appeared in 1906, the book in recent years has been used less and less, and Weyl's "Die Methoden der Organischen Chemie" has taken its place. Unlike this latter publication, in Lassar-Cohn's book the different organic processes, such as condensation, nitration, oxidation, etc., are discussed under the sub-heads of various reagents rather than under the particular reactions involved.

The new edition has an author index in both the general and special parts. In the special part fewer structural formulas appear than in the last edition; it is obvious that in order to save expense only those which were absolutely necessary were inserted. Because of its smaller size this publication is necessarily much less complete than that in the same field by Weyl; but in spite of this fact it is a very handy reference book, particularly for obtaining a summary of the more important laboratory methods and of the uses of the common reagents in organic chemistry. It is essential for every well-equipped organic chemistry library.

ROGER ADAMS

A School Chemistry. By O. J. FLECKER, Teacher of Chemistry at Dean Close School, Cheltenham. Oxford University Press, American Branch, New York, 1924. viii + 238 pp. Illustrated. 19 × 12.5 cm. Price $1.20.

This English book is as conservative as one would expect from the nationality of its author. It is essentially a set of laboratory exercises, with enough condensed discussion of the experiments to make it usable also as a text, in conjunction with more detailed explanation by the teacher.

There is much in favor of this method of presenting elementary chemistry, namely, the method of building up the science around the actual experimental experiences of the student, rather than of making the laboratory work merely illustrative of the text of the course. This method, however, demands so much close supervision on the part of the teacher that it offers practical difficulties in the case of the large classes which exist in our high schools today.

The book is well written and comprehensive. While it probably would not make a strong appeal to American teachers because of its lack of references to the applications of chemistry and because of its omission of pretty pictures, it is an excellent work of its type.

KENNETH L. MARK

Experimentelle Einführung in die Unorganische Chemie. (Experimental Introduction to Inorganic Chemistry.) By HEINRICH BILTZ. Fourteenth edition. Walter de Gruyter and Co., Berlin and Leipzig, 1924. vi + 130 pp. 15 figs. 22.5 × 15 cm.

A text which is entering upon its fourteenth edition and which has been deemed worthy of translation into other languages, as has this one, needs no further word of commendation from a reviewer. No marked change from former editions has been made in this one.

The book is a combination of laboratory directions and descriptive information, in which some of the acid-forming elements are first considered, then the base-forming elements, and finally the remainder of the first group of elements. Brief discussions of chemical equilibrium, the theories of solution and precipitation, hydrolysis, complex salts, oxidation and reduction, electro-affinity and colloidal solutions are interpolated.

The material is suitable for use in advanced courses in preparatory schools and colleges, as a preparation for analytical chemistry, and it is available in English through the excellent translation of an earlier edition by William T. Hall and Joseph W. Phelan (John Wiley and Sons, New York, 1909).

KENNETH L. MARK