

appreciable quantities of metallic zinc were deposited upon the cathode. The zinc deposit was smooth, firmly adherent and not of as brilliant a luster as the magnesium deposits obtained in the earlier experiments. The products at the anode dissolved in the solution and were not satisfactorily identified but there can be little doubt that the ethyl radical was liberated at the anode.

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NEW BOOKS

The Collected Works of J. Willard Gibbs, Ph.D., LL.D. Formerly Professor of Mathematical Physics in Yale University. Edited by WILLIAM RAYMOND LONGLEY and RALPH GIBBS VAN NAME. Two volumes. Longmans, Green and Co., 55 Fifth Avenue, New York, N. Y., 1928. xxviii + 434 pp. xviii + 284 pp. 15.5 × 23.5 cm. Price, \$6.00 per set.

This is the first complete edition of the writings of J. Willard Gibbs. It is a reprint of the 1906 publication, with the addition of "The Elementary Principles of Statistical Mechanics." The first volume contains the various contributions to thermodynamics, while the second comprises Statistical Mechanics, Dynamics, Vector Analysis and Multiple Algebra, Electromagnetic Theory of Light and some shorter papers, including a biographical sketch of Clausius and of H. A. Newton.

When the 1906 edition appeared, a very eulogistic foreign review expressed regret that the price of the volumes was so high; it was felt that the University or the Nation whose privilege it was to claim Gibbs as their own should have offered the world this fundamental contribution to science at a nominal price, "as a duty of honour." This reproach is now removed by the publication of the present collection at a price which "has been made possible by the generosity of Professor Irving Fisher of Yale University, a former pupil of Willard Gibbs, and by the economy resulting from the use of photographic reproduction, which was also desirable as a means of avoiding typographical errors."

It is now fifty years since the last of the articles on the "Equilibrium of Heterogeneous Substances" was published in the *Transactions of the Connecticut Academy*. The reviewer cannot help wondering how many books on thermodynamics written at the present day will bear republishing fifty years hence, without apology, without adaptation and without a single verbal change. Gibbs' thermodynamics has not been changed by other writers during this period, but the attitude of chemists has been changed profoundly. The durability characteristic of Gibbs' work is due to the

complete absence of all matter extraneous to thermodynamics, which is nowadays often slipped in unawares or unannounced. The change in the public has been brought about by the very thing Gibbs so deliberately avoided, for the great number of less durable, but also less difficult, books which have been published since have had the very useful effect of popularizing thermodynamics, and the time is now ripe for a return to the master. The reviewer's advice to any chemists who may have, long ago, given up Gibbs in despair, is: Try him again, he's much easier than he used to be.

FRANK B. KENRICK

Kurzes Lehrbuch der Chemie in Natur und Wirtschaft. (A Short Treatise on Chemistry in Nature and Human Affairs.) Band I. **Allgemeine Chemie.** (Vol. I. **General Chemistry.**) By PROF. JOHANN MATULA; **Anorganische Chemie.** (Inorganic Chemistry.) Band II. **Organische Chemie.** (Vol. II. **Organic Chemistry.**) By PROF. CARL OPPENHEIMER. Second revised edition. Georg Thieme, Antonstrasse 15-19, Leipzig C 1, Germany, 1928. xvi + 566 pp. 65 figs. xiv + 471 pp. 7 figs. 17 × 24.5 cm. Price, Vol. I, unbound, M. 23; bound, M. 26; Vol. II, unbound, M. 19; bound, M. 22.

In the introduction to the first edition Professor Oppenheimer stated that this book arose from a desire to prepare a readable treatise of moderate length which should present the leading ideas on which chemistry has been developed into an unusually attractive and well ordered science, and which should also show the innumerable interrelations between chemistry and the work of the biologist and technologist. To this end the treatise was to contain everything that would serve to give a clear and adequate picture of the science, but in the choice of illustrative material preference was always to be given to matters that were important in nature, in the biological sciences or in industry. No substance was to appear in it unless it represented a type, was a natural product, had biological significance or technological interest. In the main, the authors have consistently followed this prescription.

Approximately half of the first volume is devoted to "general chemistry." This part, which was prepared by Professor Matula of Vienna, necessarily deals with many subjects that are usually treated in texts on physical chemistry, but the matter is presented as a necessary introduction to inorganic and organic chemistry—not as an independent discipline. Subjects like catalysis, complex formation, constitutional formulas, isomerism, tautomerism and polymerism, therefore, receive far more attention than they commonly do in books on physical chemistry. Professor Matula has a rare ability to present and apply physico-chemical principles without an elaborate use of mathematics, hence this section is exceptionally interesting and instructive for readers not primarily interested in physical chemistry.

In the remainder of the volume the senior author presents descriptive

inorganic chemistry, interspersed with brief historical notes, discussions and practical applications. The descriptive material differs but little from that contained in other texts on the subject except in its very extensive use of structural formulas. These are written without evidence and with a finality that frequently is unwarranted. The historical notes and theoretical discussions also present little that is novel in content or treatment. But the author writes with real enthusiasm when he is dealing with topics of biochemical interest—the mechanism of biological oxidations, the fixation of nitrogen, the pharmacology of carbon monoxide, the role of iron compounds in living organisms and similar topics.

As will be seen from the foregoing description this treatise is in no sense a "popular" presentation; it presupposes at least as much knowledge as could be obtained in good fundamental courses in organic and inorganic chemistry. It should appeal especially to the biologist and the medical practitioner but it also contains much that is stimulating and extremely interesting to the chemist.

E. P. KOHLER

Atlas der letzten Linien der wichtigsten Elemente. (*Atlas of the Persistent Lines of the Most Important Elements.*) By DR. FRITZ LÖWE. Theodor Steinkopff, Residenzstrasse 32, Dresden-Blasewitz, Germany, 1928. iii + 44 pp. 13 plates. 15 × 22.5 cm. Price, bound, R. M. 12.

The chief value of this atlas for the spectrum analyst lies in the reproductions of spectra and the tables which it contains.

For 42 of the elements (chiefly metallic) reproductions of spectrograms with a wave-length scale are accompanied by lists of the wave lengths of the most important lines with their relative intensities in spark and arc. The spectra in each case cover the particular region of the ultraviolet where the most important lines occur. Condensed spark spectra with self-induction on lamp graphite are used. For each element the four spectra result from moistening the electrode with solutions of 1.0, 0.1, 0.01 and 0.001 normal concentration.

Following the plates is a wave-length table of persistent lines (656), according to de Gramont, and Pollok and Leonard, for 64 elements, with relative intensities in arc and spark, ionization state and wave length of the strong line of next longer wave length as given by Kayser. The range 1863–6708 Å. is covered.

References to more important literature are given.

G. P. BAXTER

Atomstruktur und Atombindung. (*Valence and Atomic Structure.*) By DR. J. STARK. Polytechnische Buchhandlung, A. Seydel, Königgrätzerstrasse 31, Berlin, S. W. 11, Germany, 1928. xx + 198 pp. 15 figs. 14.5 × 22.5 cm. Price, R. M. 9.

In this book the author presents at considerable length a theory of atomic and molecular structure which differs widely in many respects

from other more generally accepted theories. Starting with the assumptions that atoms, and also the protons ("archions") and electrons in atoms, possess axes and equatorial planes and with known facts regarding magnetic moments, ionizing potentials, valence, etc., he deduces electron distributions for the different kinds of elements. To enable electrons to have fixed equilibrium positions outside the nucleus, "innerkinetic" forces are assumed, these balancing the Coulomb forces at small distances. Although in the main the distributions of electrons in layers conform to previously proposed distributions, there are many differences in detail.

The nucleus is assumed to be composed of "helions"—units consisting of two protons and one electron—equal in number and identical in arrangement with the electrons outside. To account for isotopes and radioactivity, "neutrons," each consisting of one proton and one electron, are supposed to be in random motion in the space between the nucleus and the innermost layer of extra-nuclear electrons.

According to the author, atoms are usually held together in non-polar compounds by means of two coaxially placed valence electrons. Because of the peculiarities of the atomic structures assumed, many of the molecular structures proposed are quite different from all others which have previously been proposed for the same compounds, but the reviewer could not see that they fit the experimental facts better than the more common structures.

To one who is already familiar with the experimental facts and with other current theories on the subject, this book is interesting and suggestive in that it shows how many phenomena can be related or explained in quite unorthodox fashion. To others, however, this book can hardly be recommended, for throughout the work the author presents his theory without giving the reader much basis for comparison with other theories. The reviewer, for one, found many of the arguments which were given quite unconvincing.

MAURICE L. HUGGINS

Über Lösungs- und Verdünnungswärmen einiger starker Elektrolyte. (The Heats of Solution and Dilution of Some Strong Electrolytes.) By DR. ERICH LANGE, Lecturer at the University of Munich. Gebrüder Borntraeger, W 35 Schöneberger Ufer 12a, Berlin, Germany, 1928. ii + 83 pp. 10 figs. 16.5 × 25.5 cm. Price, M. 6.40.

In this monograph the author outlines the thermo-chemistry of dilute solutions in a comprehensive manner. With copious references to a wide range of original articles, he reviews the theories of heats of solution and dilution of electrolytes and the experimental methods by which these theories can be tested.

The first section of the book is devoted to definitions, thermodynamic relationships and theoretical development. Here Dr. Lange shows how

the heat of solution of an electrolyte has been calculated, by the methods of mathematical physics, from the lattice energy of the salt and the energy of solvation of the resulting ions. He briefly summarizes the "inter-ionic attraction" theory of Debye and Hückel and gives their equations for heats of dilution, pointing out the difficulties in extending these calculations above the extremely dilute "limiting range."

The second section, devoted to calorimetric methods, starts with a discussion of units of heat (the calorie and joule). Here the author unfortunately confuses with the joule the mayer (= 1 joule/degree) suggested by T. W. Richards to designate *heat capacity* in the c. g. s. system.

Dr. Lange rightly emphasizes the error in the usual method of calculating heats of solution of "insoluble" salts from the heats of precipitation without knowing the corresponding heats of dilution. These are by no means negligible. He shows that in the case of silver chloride this error amounts to a hundred calories and that it would be even greater with higher valent salts.

A good review of calorimetric principles and precautions and thermometry is followed by a brief description of his own adiabatic calorimeter (for measuring large heat changes) and his adiabatic differential calorimeter for very small heat changes. The latter is indeed remarkable as much for its fundamental simplicity and compactness (a two-liter vacuum flask divided in half by a sheet of hard rubber) as for the sensitivity of $\frac{1}{2}$ millionth of a degree attained by an iron-constantan thermel of 1000 junctions. To insure corresponding accuracy required meticulous attention to details—complete and rapid mixing, carefully controlled heat of stirring and a consideration of such possible disturbing factors as the adsorption of the solute ions on the walls of the calorimeter.

Curves of the integral and differential heats of dilution of most of the alkali halides are shown in three figures. The basic numerical values of the integral heats of dilution of these electrolytes are given in a table which includes also results for nine other salts of higher valence types. These results are found to agree essentially with those of Nernst, Orthmann and Naudé, in the few instances where comparison is at all possible.

Dr. Lange's results qualitatively check the predictions of the Debye-Hückel theory. Below 0.01 *M* the heats of dilution of all five uni-univalent salts investigated are positive, although the slopes of the actual curves are not exactly that of the theoretical "limiting law." There is, however, considerable uncertainty in the value of the dielectric constant of water and especially its temperature coefficient, from which the theoretical constant is derived. A conclusive test of the Debye-Hückel theory must await a more exact determination of this constant.

Dr. Lange's book will prove stimulating and useful to the thermochemist interested in the latest developments in extremely sensitive calori-

metry. Whatever his specialty, the reader will find it a good summary of the increasingly large amount of theoretical work which has appeared, within the past few years, in the field of electrolytic solutions.

FRANK T. GUCKER, JR.

Soluble Silicates in Industry. By JAMES G. VAIL. American Chemical Society Monograph Series. The Chemical Catalog Company, Inc., New York, 1928. 443 pp. 185 figs. 16 × 23.5 cm. Price, \$9.50.

In this book Mr. Vail has given a thorough, systematic and authoritative discussion of the history, constitution, properties, preparation and industrial utilization of the soluble silicates and their solutions. The thirteen hundred references attest a detailed study of the literature and a desire to give credit to other chemists for their investigations and ideas and yet the book is not a systematic and complete collation of the literature, good, bad and indifferent, of the Germanic type. The book gives the impression that it is written primarily out of the author's own experience and knowledge. Facts are stated with a clearness and positiveness derived from first-hand acquaintanceship; a corroborative reference is cited if available but it seems to make no real difference if corroboration of the author's views is not available. Here there is no hedging between the conflicting views of other authorities so characteristic of the mere compiler. Moreover, the facts are marshaled in accordance with a logical plan which greatly facilitates the use of the book.

The number and variety of uses of water glass which are discussed in detail will astonish most readers. In the discussion of uses, few receipts are given, but the function of each ingredient in the complex mixtures is clearly analyzed in a manner to aid the reader in adapting the composition to his own special requirements. This book is a valuable addition to the Monograph Series of the American Chemical Society.

GRINNELL JONES

Gesammelte Abhandlungen. (Collected Works.) Volume V. By Dr. F. KEHRMANN, Professor at the University of Lausanne. Georg Thieme, Leipzig, Germany, 1928. 321 pp. 53 figs. 17 × 25 cm. Price, unbound, M. 30.

The fifth volume of Kehrman's collected papers contains reprints on a great variety of subjects. The first section presents, besides some early papers on complex acids which for one reason or another were not included in the first volume, Kehrman's most recent work on the "basic properties of carbon" and on "oxonium compounds." The second section deals with recent investigations on quinonimide, fluorindine and carbazine dyes. The third, which is entitled "Miscellaneous," contains early and historically interesting papers on such topics as the structure of benzoquinone and the action of ammonium sulfide on halogen nitro compounds, as well as recent work on the blue oxidation product of diphenylamine.

On a concluding page Kehrman presents the relation of his work to the three fundamental facts which in his opinion have contributed greatly to the present aspect of organic chemistry: the discovery of steric hindrance, oxonium salts and salts in which complexes of carbon and hydrogen can act as positive ions.

E. P. KOHLER

Elementary Organic Chemistry. BY HOMER ADKINS, Ph.D., AND S. M. McELVAIN, Ph.D., Department of Chemistry, University of Wisconsin. First edition. McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York, 1928. xi + 183 pp. 14.5 × 21 cm. Price, \$2.25.

In this brief book of twenty chapters, the writers aim to present "organic chemistry in a one semester course," and "have laid emphasis upon the characteristic reactions of the important functional groups." The arrangement of the earlier chapters is essentially that so successfully used by the late Professor Ira Remsen. Sections of the text are designated by numbers and cross references are frequently indicated. The make-up of the book indicates a continuance of the high standard of the International Chemical Series. There are occasional misspellings and some slight errors in English, which it is hoped subsequent printings will rectify. The term "deracemize" has not the opposite meaning of racemize as the term is generally used, and has little to commend it. The type is good and the arrangement makes for particularly easy reading.

In the introductory part, at least by inference, the complete non-existence of inorganic isomers might be assumed. This is unfortunate. At least twice where hydrogen is indicated in an equation, it is written in atomic form, which is certainly not to be advocated when the product evolved is the gas as it is in the cases cited. The reviewer is particularly glad to note that in dealing with the action of phosphorus trichloride on acetic acid, an explanation is given for the observed evolution of hydrogen chloride. The standard equation usually given for the preparation of acetyl chloride does not account for the production of this material. Many of the difficulties which elementary students in organic chemistry experience are due to an insufficient acquaintance with inorganic chemistry. It is to be regretted that the fact that tertiary amines do not react with acid chlorides is not specifically stated. Primary and secondary amines are dealt with and the student is apparently expected to infer that when there is no hydrogen on the nitrogen, the reaction does not proceed. In designating one of the amyl alcohols, the term "active" is used with no explanation whatsoever. Apparently the authors do not care to discuss optical activity at this point, but the better student, the one who is really alive to the subject, will certainly call for an explanation from his instructor, and if the explanation were very briefly given in the text, it would be

helpful to all concerned. On at least two occasions, namely, in the preparation of iodoform and in the preparation of phenylhydrazine, the reduction is indicated simply by "2H." This is a particularly unhappy method of expression, since it tells very little, and the student interested in the subject will raise the question "How is this hydrogen obtained?" and the one not quite so concerned will assume that the reaction proceeds merely by supplying hydrogen gas. In most cases in this text the particular reagent for accomplishing a particular end is indicated. This is as it should be, and if sodium arsenite and stannous chloride were indicated in the cases just mentioned, these two instances would not stand out as they now do. The objection to the rigid Kekulé formula for benzene (*i. e.*, with fixed alternate double and single bonds), namely, that such a substance should be readily oxidizable, is not as pertinent as the fact that such a structure would lead theoretically to a greater number of disubstitution products than have been found in the case of benzene derivatives. It would seem advisable to suggest this at any rate. Under azo dyes a somewhat complicated formula is given and the preparation of this compound is described in detail. There seems to be no good reason why the fact that it is known as Congo Red and that this is an important direct dye for cotton should not be brought to the student's attention.

The criticisms indicated are the more noticeable because, as a whole, the book is accurate and shows careful preparation. The authors are to be commended on the restraint shown by them in keeping the text elementary and concise. This volume should be decidedly useful in the teaching of so-called "short courses" in organic chemistry.

G. ALBERT HILL