mitted, however, in the hope that others will not continue to make the same error.

CONTRIBUTION FROM THE CHEMICAL LABORATORY OF NORTHWESTERN UNIVERSITY
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NEW BOOKS

A Condensed Collection of Thermodynamic Formulas. By P. W. BRIDGMAN, Professor of Physics in Harvard University. Harvard University Press, Cambridge, 1925. Humphrey Milford, Oxford University Press, London. 34 pp. 24 × 16 cm. Price $1.50.

The ten quantities commonly employed in thermodynamic argument, namely, p, t, v, s, dQ, dW, E, H, Z and Ψ (defined in Table I), give rise to 720 first derivatives of the type $[\partial x_1/\partial x_2]_{x_3}$, of which any three are independent, and among which more than ten billion relations exist. Any one of these relations could be obtained at once from a table giving each of the 720 derivatives in terms of the same set of three, but a much smaller table will suffice. The smallest would be one of eight entries, giving the total differentials of eight of the quantities with respect to two of them selected as independent variables, but its use would involve algebraic elimination of the ratio of the two independent differentials by means of the equation $dx_3 = 0$. Professor Bridgman's Table II (t and p independent) which is based on the relation $[\partial x_1/\partial x_2]_{x_3} \equiv [\partial x_1/\partial a_1]_{x_3}/[\partial x_2/\partial a_1]_{x_3}$, enables any one of the 720 to be written down at once; it contains 90 entries of which 45 are duplicates, double entry being employed to facilitate reference.

The 65,000 second derivatives can be obtained by purely formal differentiation from the 21 entries of Table III (t and p independent). Table IV gives the first derivatives for systems such as water in equilibrium with steam, where p is a function of t; v and t are here chosen as independent variables. Then come eight "examples of the use of the tables"—problems not at all of the conventional type; and finally a section on the extension of the tables to systems in which pressure is not the only mechanical variable, with examples involving sudden tension of steel, electromotive force and surface tension.

In the Introduction, the method of constructing the tables is made clear; the effect of the whole book on the student should be to convince him that the mathematical relations which take up so much space in conventional textbooks of thermodynamics can all be obtained "in an entirely routine way, without any tricks of manipulation," and that the real thermodynamic difficulties are those involved in clearly understanding what the problem is, and in expressing it in the language of the mathematical theory.

W. LASH MILLER

Structure et Activité chimiques. (**Structure and Chemical Activity.**) Vol. II. Reports and Discussions of the second Conseil de Chimie, held at Brussels, April 16–24, 1925, under the auspices of the Solvay International Institute of Chemistry. Gauthier-Villars and Company, 55, Quai des Grands-Augustins, Paris, 1926. xiv + 672 pp. Illustrated. 25.5 × 16.5 cm. Price, unbound, 96 francs and foreign postage 4 fr. 25.

This report of the papers presented at the second Conseil de Chimie, of the Solvay International Institute of Chemistry, held at Brussels, April 16–24, 1925, also contains a record of the discussion of these papers.

The papers were subdivided into four groups, as follows: I. Surface Tension: The Spreading of Liquids on Water and on Solids, by W. B. Hardy. II. Crystalline Structure and X-rays: Organic Crystals, by W. H. Bragg; The Analysis of Crystalline Structures by X-rays. Agreement with Chemical Constitution, by W. L. Bragg; Structure of Colloidal Matter in the Solid State, by J. Duclaux. III. Chemical Activity: The Mechanism of Chemical Transformation, by Thomas, Martin and Lowry; The Indirect Interatomic Relations in Organic Compounds, by Frédéric Swarts. IV. Reactivity of Molecules: The Influences Exerted by Atoms or Groups of Atoms on the Reactivity of Molecules and on the Rigidity of the Bonds within the Molecules, by Tiffeneau and Orékhoff; Light and Chemical Reactions, by Jean Perrin; The Intermediate Reactions of Catalysis, by M. A. Job; Developments Resulting from the Theory of Catalytic Phenomena in Heterogeneous Reactions, by Eric K. Rideal; Catalyses by Solid Surfaces, by E. F. Armstrong and P. Hilditch; Autoxidation and Catalytic Phenomena, by Moureu and Dufraisse; Catalysis and Oxidation, by H. E. Armstrong; Absorption in Relation to Catalysis and the Actions of Enzymes, by J. Duclaux; A Survey of the Role of Catalysis in Enzymatic Reactions, by Hans von Euler.

ARTHUR B. LAMB

Gerlands Beiträge zur Geophysik. (**Gerland's Contributions to Geophysics.**) Edited by VICTOR CONRAD. Akademische Verlagsgesellschaft m. b. H., Markgrafenstr. 4, Leipzig, 1926. Band XV, Heft 1. iii + 89 pp. 20 figs. 23.5 × 15 cm.

Geophysicists and geochemists will welcome the reappearance of this standard periodical. Founded by the late Georg Gerland at Strassburg in 1887, it has long been a recognized repository for geophysical data, particularly in seismology. After Gerland's death it was continued by Rudolph and Hecker, until difficulties due to the War and to the cession of Alsace to France forced its suspension in 1918, after the publication of 14 regular and 3 supplementary volumes.

In the succeeding interval several geophysical periodicals have sprung up: the *Zeitschrift für Geophysik* in 1924, publishing short articles only; the *Zeitschrift für angewandte Geophysik* in 1922, whose continuance, after

the completion of one volume, is said to be in doubt; and the *Geophysical Supplement to the Monthly Notices of the Royal Astronomical Society*, in 1922. Mention should also be made of the revival in 1925 of *Chemie der Erde*, which had completed one volume before the War.

The *Beiträge* now resumes publication with Volume 15 (1926), under the editorship of V. Conrad of Vienna. Its broadness of field is maintained by the inclusion, in this first number, of articles in meteorology, terrestrial magnetism, atmospheric electricity, geochemistry, seismology and oceanography. Its international character is continued through contributions from Sweden, England, Switzerland, Norway, Germany, Italy and Russia. Dr. Cottrell, Professor Noyes, and others whose hearts are in the revival of international good feeling, will be pleased to note not only the publication of articles in English, French and German, but also the addition of a supplement giving abstracts of all of them in Esperanto. As geophysics is the international science par excellence, it is fitting that a geophysical periodical should set this good example.

GEOPHYSICAL LABORATORY ROBERT B. SOSMAN
CARNEGIE INSTITUTION OF WASHINGTON

Crystalline Form and Chemical Constitution. By A. E. H. TUTTON, D.Sc. Macmillan and Co., Limited, St. Martin's Street, London, 1926. xii + 252 pp. 72 figs. 22.5 × 15 cm. Price $3.60.

This book is largely an account of the researches of Dr. A. E. H. Tutton on the variation of the crystallographic and physical properties in certain isomorphous series. Essaying to answer the question as to whether "isomorphism" signifies actual equality or only close approximation of corresponding interfacial angles, he studied in great detail and with a high degree of precision the properties of the members of two such series, the alkali sulfates and selenates, and the hexahydrated double sulfates and selenates of uni- and bivalent metals. The results established, beyond any further possibility of doubt, that the angles of isomorphous substances do differ systematically, and the quality of his work is deserving of high praise. The method of presentation seems, however, somewhat unfortunate, as the following quotation from pages 51–52 will illustrate.

"……Now no apparatus was available for preparing these plates and prisms, with truly plane surfaces exactly orientated with respect to the crystal symmetry. Hence the author caused an instrument to be constructed by Messrs. Troughton and Simms for the purpose, the 'Cutting and Grinding Goniometer,'……Prof. [Lt. Col.] F. E. Wright has recently described one in America which is practically on the lines of the author's instrument, but not so convenient. Less ambitious but useful pieces of apparatus, in many parts, for grinding surfaces on crystals, have also been devised by Wülfing and by Thomas, the last mentioned being much the more efficient, although, of course, not nearly so convenient or accurate as the author's Cutting and Grinding Goniometer."

Besides descriptions of the author's own work, the book contains brief chapters on the main facts of crystallography, parallel growths of crystals, polymorphism and similar phenomena, relations between crystal structure and optical activity, liquid crystals, and Fedorov's crystallochemical analysis. There is a bibliography, but as may be surmised from what has been stated above, it includes only articles by A. E. H. Tutton.

The author is very conservative in some respects, and seems unable to evaluate properly the significance of various modern advances in crystallography. Thus, he spends a page (229) deprecating the two-circle method of crystal measurement, holding it incapable of accuracy and difficult of application, whereas the consensus of opinion among present-day crystallographers is that the accuracy attainable by this method is quite equal to the constancy of angles usually encountered among different crystals of the same substance, and that the corresponding methods of calculation and interpretation of crystals are in every respect superior to those used in the one-circle method. On the other hand, he accepts certain inferences from x-ray studies of quartz, tartaric acid, etc., as demonstrating the atomic arrangement in these light-rotating crystals, whereas some other crystallographers see in the results presented thus far only plausible guesses.

It should not be inferred, however, that the reviewer is claiming the book to be of no interest to anyone outside the author's circle of friends or disciples. The average chemist finds most modern books on crystallography and crystal structure rather difficult reading, and so may welcome the elementary treatments of these subjects it contains.

EDGAR T. WHERRY

Einführung in die physikalische Chemie und Kolloidchemie, ins besondere für Biologen und Mediziner. (Introduction to Physical and Colloid Chemistry, Especially for Students of Biology and Medicine.) By Dr. H. R. KRUYT, Professor at the University of Utrecht. Translated into German from the second Dutch edition, by Dr. A. NOWAK, Ludwigshafen. Akademische Verlagsgesellschaft m. b. H., Leipzig, Markgrafenstr. 4, Germany, 1926. xiii + 208 pp. 67 figs. 22 × 15 cm. Price, unbound, M. 8.40; $2.00; bound, M. 10; $2.40.

The parts of physical chemistry of most direct application in biology and medicine are here presented in a very elementary but very clear and accurate way. The author relies mainly upon the simple kinetic theory to develop very distinct mental pictures of the phenomena he discusses. His expositions can scarcely fail to add greatly to the grasp of his non-chemical readers.

A few suggestions of possible improvement occur. For example, in the theory of lyophilic colloids the electrical effects are over-emphasized and those due to "solvation" in its various ramifications are not sufficiently discussed. In the chapter on electrical conductance the dependence of the

mobility of ions upon their concentration is not mentioned, and the anomaly of strong electrolytes is left a mystery. The use of the conception of solution pressures of ions (and particularly the calculation of these quantities from single potentials) mars the discussion of electromotive force. Perrin's chance check in the calculation of the heat of decomposition of ozone from absorption spectra should not be used in substantiation of the radiation theory of reaction rate. Finally, the discussion of the "glass electrode," p. 199, might be omitted without loss from any standpoint.

E. D. EASTMAN

Reports of the Imperial Industrial Research Institute, Osaka, Japan. Dispersoidological Investigations. IV. Dispergation and Aggregation, in General, and Particularly in their Application to Cellulose, by Professor Dr. P. P. VON WEIMARN. V. Quantitative Study on Cellulose Dispergation in Aqueous Solutions of Calcium Thiocyanate Saturated at Room Temperatures and at 50°, by Professor Dr. P. P. VON WEIMARN and Dr. S. OTSUKA. Imperial Industrial Research Institute, Department of Agriculture and Commerce, March, 1925. 208 pp. 58 figs. 26 × 19 cm.

The title does not do justice to Professor von Weimarn's interesting report which, in addition to containing a wealth of experimental data on the dispersion and swelling of cellulose and its ultramicroscopic examination, outlines his general views on aggregation and dispersion (or dispergation, as he calls it), as well as his method of producing colloids by grinding and an abstract of his patents on the treatment of cellulose. Incidentally he stresses the importance of adsorption of impurities at the surfaces of ultramicroscopic crystals, which may easily amount to 10% of the whole crystal mass, and shows how such contaminated crystals may, *if we only wait long enough*, purify themselves by extruding the impurity as one large crystal lattice is formed; for on aging, "contiguity" leads to "congresence." When lyophilic groups drag others into solution, he calls the process "dispersoidal parasitism;" and he sees no need of treating adsorption "as a process of formation of a *unimolecular* layer as, for example, accepted by I. Langmuir, but merely as 'solution' in a *very thin*, superficial layer," in which he agrees with Gouy, Hardy and others. Atoms once in combination, have altered their physicochemical properties to only a certain extent because of juxtaposition; and molecules must be regarded in this light. "The more completely and perfectly satisfaction has been granted to the tendency of matter to fill up space vectorially in a given formation, the more stable is the formation"..."Among contemporary dispersoidologists, the most give in their adherence to the view that the primary cause of the aggregative activity of electrolytes consists in their neutralizing the electric charge on the superficial layers of the dispersed particles. Contrary to that view, I maintain that the electric properties of the surfaces are the consequences of the chemical condition

of the superficial layer of the particles, that they are consequences of the atomic (in the wide sense of the term) processes that work themselves out in this superficial layer." We are cautioned against accepting the classical "chemical formulas" for cellulose, which is represented as containing ultramicroscopic crystals oriented into elongated strings (somewhat like the nematic substances of Friedel) but separated by adsorbed material. Viscose shows no evidence of orientation. Cellulose dispersed with the aid of calcium thiocyanate can yield a thread somewhat like viscose. An outline is given of future work planned.

The book shows vestiges of the fact that it was written (probably) in Russian and translated into English (possibly by a Japanese); but the language, though at times unusual, is comprehensible, despite Professor von Weimarn's adherence to a rather personal nomenclature.

JEROME ALEXANDER

Chemie der freien Radikale. Entwicklungsgang und gegenwärtiger Zustand der Lehre von den freien Radikalen. (Chemistry of Free Radicals. Development and Present Status of the Subject of Free Radicals.) By Dr. PAUL WALDEN, Professor at the University, Rostock. S. Hirzel, Leipzig, 1924. xiii + 351 pp. 21 figs. 22 × 14.5 cm.

Since the publication of Schmidlin's "Das Triphenylmethyl" twelve years ago, many new types of free radicals have been discovered. The discussion of all these extraordinarily interesting substances involves a consideration of widely different portions of organic chemistry, inorganic chemistry and physical chemistry. While the peculiar behavior of hexaphenylethane was thus appropriately enough the central theme of the first monograph on free radicals, the author of the present volume was confronted with a broader field and has taken full advantage of the widened horizon. Indeed, the book is written primarily in the spirit of one interested in those general theoretical problems which are for the most part still unsolved. A detailed presentation and discussion of many of the more strictly chemical aspects of the subject have been omitted and the emphasis has been placed on the physicochemical interpretation of the available data. The book is in this respect an excellent supplement to Schmidlin's volume and presents for the first time a critical survey of the limitations of the cryoscopic methods of determining the degree of dissociation of substances like hexaphenylethane.

The subject matter has been carefully brought up to date. The many tabulations with ample references to the literature will be of great value to all those who desire to have a complete bibliography of this field. In this way the monograph serves the investigator as well as giving to the more general reader an interesting and stimulating account of the broad outlines of the entire field.

JAMES B. CONANT

Handbuch der biologischen Arbeitsmethoden. Unter Mitarbeitung von über 600 bedeutenden Fachmännern. (Handbook of Biological Laboratory Methods; with the Collaboration of more than 600 Prominent Authorities.) Herausgegeben von Geh. Med.-Rat Prof. Dr. EMIL ABDERHALDEN. Abt. I, Chemische Methoden, Teil 1. xxiv + 926 pp. Urban und Schwartzenberg, Berlin und Wien, 1926.

This is the first part of the first division of the monumental work edited by Professor Abderhalden. The second part of the same division was reviewed in THIS JOURNAL, **48,** 539 (1926).

This part of the first division consists of four "Lieferungen," issued at considerable intervals, some of them, evidently, a number of years ago. Each is sold separately.

Lieferung 6, 148 pp., price M. 4.35, "Preparation of the Most Important Inorganic and Organic Reagents," by Krämer and Schrader, includes directions for the preparation of 88 inorganic and 107 organic substances. Very few references to the literature are given and one gets the impression from the fact that the latest given seems to be in 1911, that this portion of the book was written 15 years ago. The compilation will be found very useful and might be used by students in preparative laboratory work, but not all of the directions are carefully given. Under nitrosyl chloride the direction is given to prepare lead chamber crystals by passing nitric oxide(!) into 100% sulfuric acid, the nitric oxide to be prepared by the action of nitric acid on copper. The preparation will succeed if sufficiently strong nitric acid is used, but the concentration required is not given. Under anhydrous perchloric acid, to be prepared by vacuum distillation, no mention is made of the dangerously explosive character of the compound or of the fact that a hydrated acid distils more easily and safely.

Lieferung 30, 314 pp., price M. 7.80, contains: (a) "Testing the Most Common Solutions and Reagents," by Paul Hirsch. This gives tests for 113 substances and density tables for common bases and acids, ethyl alcohol, methyl alcohol, mixtures of alcohol and ether, formaldehyde and glycerol. (b) "Work with Optically Active Carbon Compounds," by Egon Eichwald. This gives a fairly comprehensive account of the various methods of resolving racemic compounds into their active constituents; also methods of asymmetric synthesis. (c) "Methods of Investigation in the Field of Tautomerism and Desmotropy," by Julius Schmidt. This is a very good and useful monograph on our knowledge of the subject up to about 1917. It does not contain an account of Kurt Meyer's latest and most accurate methods for the determination of enol forms—but that cannot be considered the author's fault.

Lieferung 37, 80 pp., price M. 2.25, "Methods of Demonstrating and Testing for Unsaturated Compounds," by H. Bauer. Double and triple unions between carbon atoms, unsaturated nitrogen compounds of the ammonia type and those with a double union between nitrogen atoms,

double unions between carbon and oxygen, double and triple unions between carbon and nitrogen and double unions between carbon and sulfur are considered, systematically, with the characteristic addition reactions of each.

Lieferung 178, xxiv + 384 pp., includes: (a) "Avoidance of Laboratory Accidents," by F. Flury, 50 pp. Directions for avoiding accidents of various kinds, for first aid and descriptions of safety devices. Something of this sort should be in the hands of all chemists and, in abbreviated form, it should be placed in the hands of students. (b) "Indicators," by E. Czapski, 30 pp. The preparation, properties, uses and hydrogen-ion concentrations at the color changes are given for 27 indicators. It would be an advantage if the author had given a brief summary of the indicators suitable for particular uses and a chart for hydrogen-ion concentrations, such as is found in Washburn's "Physical Chemistry." (c) "Characteristic Carbon-Nitrogen Condensations of Carbonyl Compounds," by Ernst Komm, 96 pp., includes condensations with hydroxylamine, hydrazine and its derivatives and derivatives of urea. (d) "Acylation," by F. Wrede, 56 pp., includes the preparation of acetyl, benzoyl and sulfonyl derivatives, acylation with isocyanates, with carbamyl chloride, chlorocarbonic ester and with a few other acid chlorides. (e) "Esterification of the Carboxyl Group," by Franz Bachér, 136 pp.; a very comprehensive and interesting description of the varied methods used for the preparation of esters.

In the book, throughout, the subjects have been treated in a very general manner and not with particular reference to biochemical uses. This, of course, very greatly increases the value for other readers and users. It contains a mine of welcome information for organic chemists. It is a useful supplement to the new edition of Beilstein, which does not contain material of this kind.

W. A. NOYES