

ing parallel with the crystallographic directions but nevertheless a molecule about $5 \times 5.5 \times 10.5$ Å. in size is indicated.

The equatorial "a" axis Weissenberg shows an interesting pseudo-halving of the $(0kl)$ reflections; *i. e.*, the $(0kl)$ reflections for k odd are generally weak. A possible explanation can be given in terms of a pseudo-symmetry of the biotin molecule. A molecule which in projection is approximately symmetrical to a plane normal to the "c" axis could result in such an intensity distribution.

Another interesting systematic pseudo-halving exists which was not noticed until a Patterson synthesis of the $(0kl)$ reflections was made. The two largest peaks (excluding of course the identity peak at 0,0) were found at $1/2, 0$ and $1/4, 1/2$. The first of these peaks is merely the expression of the first mentioned pseudo-halving. The peak at $1/4, 1/2$ can be traced to the second pseudo-halving; $(0kl)$ reflections, where k is even and $k/2 + l$ is odd, were generally weak. This suggests that the flattish molecules are packed approximately side by side, neighbors being-related to one another by

a two-fold screw axis. In the direction of their lengths the packing would be imbricated. The one sulfur atom per molecule of biotin should be fairly near the central bisecting pseudo-plane of symmetry.

It should be emphasized that much of the foregoing note is highly speculative; indeed only the great interest in biotin could warrant its publication in its present form. The actual X-ray cell determinations are probably accurate to within about 1%. The picture of the molecular size and shape, however, is merely a reasonably plausible explanation of some of the X-ray and optic data. A more complete study of the X-ray data is now under way.

Much of the experimental work was done while the writer was National Research Fellow in Protein Chemistry at the Massachusetts Institute of Technology.

ANDERSON INSTITUTE FOR BIOLOGICAL RESEARCH
RED WING, MINN., AND
DEPARTMENT OF PHYSIOLOGY, UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINN. I. FANKUCHEN

RECEIVED JUNE 3, 1942

NEW BOOKS

Anhydrous Aluminum Chloride in Organic Chemistry.

By CHARLES ALLEN THOMAS, Central Research Director, Monsanto Chemical Company, in collaboration with MARY BALUK MOSHIER, HERBERT E. MORRIS and ROSS W. MOSHIER, Thomas and Hochwalt Laboratories, Monsanto Chemical Company. (A. C. S. Monograph Series.) Reinhold Publishing Corporation, 330 West 42nd St., New York, N. Y., 1941. xiii + 972 pp. 15.5×23.5 cm. Price, \$15.00.

This is truly a monumental work, 878 pages of text, an author index of some 7000 names, a subject index of over 20,000 entries and a patent index with 594 U. S. patents and more from other countries.

The book opens with an historical sketch of Friedel and Crafts. This is followed by a chapter on the physical and chemical properties of aluminum chloride and its many combinations and one on the mechanisms of the reactions catalyzed by it. The manufacture, handling and storage of this material are also cared for. The main portion of the book, 656 pp., is a well-ordered, comprehensive and detailed presentation of the reactions of aromatics with alkyl halides, olefins, acyl halides, anhydrides and the like, with their numerous modifications. This is what every organic chemist knows, only a great deal more of it. Three chapters, 107 pages, are given to the new, tremendously important applications of aluminum chloride to

aliphatic compounds. This section with its thousand references, largely patents, covers among other things the isomerization of hydrocarbons and the addition of olefins to paraffins to make high octane gasoline, the production of ethyl chloride from ethylene and hydrogen chloride, the polymerization of olefins to lubricants, high molecular weight, semi-solid products and resins and the cracking and refining of petroleum products.

The enormous amount of information is concisely yet clearly presented and should be of great service to organic chemists whether interested in pure chemistry or in its applications.

E. EMMET REID

A Treatise on Physical Chemistry. Third Edition—In Five Volumes. Volume One. **Atomistics and Thermodynamics.** Edited by HUGH S. TAYLOR, David B. Jones Professor of Chemistry, Princeton University, and SAMUEL GLASSTONE, Professor of Chemistry, The University of Oklahoma. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1942. vii + 679 pp. Illustrated. 15.5×23.5 cm. Net price, \$7.50; \$6.50 on order for set.

If Mr. Gallup were to poll the country's middle-aged physical chemists for the book that had the greatest in-

fluence on their professional training the returns would very likely show Nernst's "Theoretical Chemistry" to be it, although the younger generation seems to be hardly better acquainted with this book than they are with the Bible! But beginning with the early 'twenties the rapidly expanding science demanded, and got, a whole set of working-textbook-reference books individually addressed by very competent authors to special fields, which in some cases involved a developing body of knowledge treated by Nernst in only a few pages or a few chapters, and which in other cases involved facts and approaches not even hinted at or dreamed of before 1920 by Nernst or anybody else.

The persistent and very proper demand for a summarizing story of how we stand in certain special fields as explained to us by a few persons who are gifted with the power to swallow a field whole, digest it, and come up with a clear, logical and interesting account of it, has brought to American chemists a really excellent review-service and colloquium-service, as well as our special-field book service.

Professor Hugh Taylor and the nineteen authorities who collaborated with him in writing the various summarizing chapters of "A Treatise on Physical Chemistry" (first edition—October, 1924, second edition—December 1930) did a great service to American chemistry. All who have used these two volumes are much interested to know what the third edition, now expanded to five volumes, will be like. The first volume is off the press, March, 1942. Professor Taylor and Professor Samuel Glasstone have combined forces as editors of the enlarged Treatise.

Volume I, labelled Atomistics and Thermodynamics, contains four chapters, an appendix (Values of Physical Constants) and a subject index.

Its Chapter I, The Atomic Concept of Matter, by Hugh S. Taylor, runs 1-117 pages as compared with 1-34 pages in the second edition. It carries extensive revisions and many additions of new material including more comprehensive treatments of radioactivity and the mass spectrograph and very helpful sections on separation of isotopes, nuclear structure, nuclear fission, nuclear processes, and a most useful table of induced radioactivities. In this chapter one can get a brief but excellent and well-balanced picture of how we stand at present with respect to the nucleus.

Chapter II, Quantum Theory of Atomic Spectra and Atomic Structure, is written by Saul Dushman in his incomparably fine manner of exposition. The chapter runs from page 119 to 436, as compared with 276 pages in the second edition. Dr. Dushman's treatment runs the whole gamut of the quantum effects of interest to chemists, including sections on: Quantum Phenomena, Photoelectric Effect, Inverse Photoelectric Effect, Compton Effect, Raman Effect, Quantum Theory of Radiation, Matter Waves, Corpuscles and Waves, The Bohr-Sommerfeld Theory of Electronic Orbits, The Wave Mechanics Treatment of the Hydrogen Atom, Inner Quantum Number and Electron Spin, Effect of Magnetic and Electrostatic Fields on Spectral Terms, Electron Configuration in Atoms and Periodic System of the Elements, Quantum Numbers for Inner Electrons, Multiplet Levels in Optical Spectra, Intensities of Spectral Lines, Magnetic Properties of Atoms and Ions in Relation to Spectral Type, Hyperfine Structure of Spectral Lines, Quantum Theory of Valence.

Chapter III, First and Second Laws of Thermodynamics, by Hugh S. Taylor, follows along for about one-half its length very much the same pattern of the chapter "The Energetics of Chemical Change" in the second edition, with some changes and additions, and then treats Partial Molal Quantities, The Activity Function, Thermodynamics and Statistics. The last section gives a very nice discussion of partition functions.

Chapter IV, The Third Law of Thermodynamics and Statistical Mechanics, is a beautifully written treatment by John G. Aston, a professor of *organic* chemistry (let it be noted) and a new addition to the staff of contributing authors. Seventy-five listed topics are organized under section headings as follows: The Third Law of Thermodynamics; Statistical Mechanics; Nuclear Spin Effects; Gases; The Third Law and Statistical Mechanics; Heat Content, Free Energy and Equilibrium Constants; Solids; Magnetic Cooling; and several valuable appendices. Throughout the chapter *entropy* is naturally Professor Aston's most absorbing theme.

Many chemists will be looking forward with freshly aroused interest to the other four volumes. The authors of the forthcoming chapters will indeed have to exert themselves to rival the excellent performance of their colleagues in this first volume. The publishers, too, have done a piece of first-class book manufacture.

EDWARD MACK, JR.

Advances in Enzymology and Related Subjects. Edited by F. F. NORD, Fordham University, New York, N. Y., and C. H. WERKMAN, Iowa State College, Ames, Iowa. Volume II. Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y., 1942. viii + 374 pp. 23 illustrations. 15.5 × 23.5 cm. Price, \$5.50.

The second volume of "Advances in Enzymology" is characterized by a breadth of interest far transcending its chosen field of enzyme chemistry or "Enzymology" as the editors have so unhappily chosen to express it. In accordance with this, we find a comprehensive report "Vitamin K, its Chemistry and Physiology," by Henrik Dam, once of Copenhagen, now of Rochester. A few years ago the inclusion of such vitamin chemistry in a treatise on enzymes would seem incongruous indeed. With the striking developments in biological oxidations where riboflavin, thiamin and nicotinic acid, once identified as vitamins, have now been shown to be the prosthetic groups of many important enzyme systems, vitamin K appears to "belong." Perhaps this foreshadows the development of a role for vitamin K among the enzymes of the body. Typical also of the all-inclusive nature of this volume are the reviews "The Adrenal Cortical Hormones" by J. J. Pfliffer and "Bacterial Viruses (Bacteriophages)" by Max Delbrück.

Dealing with the purely hydrolytic enzymes, there are three papers of very great value. The first of these, "The Kinetics of Hydrolytic Enzymes and Their Bearing on Methods for Measuring Enzyme Activity," by Donald D. Van Slyke, should be carefully studied by any investigator in this field. In it the author analyzes the kinetic behavior of simple hydrolyses of this type, develops the mathematical treatment of such reactions and then shows how the

experimental conditions should be chosen and interpreted so that valid and significant results may be obtained. Undoubtedly many false and misleading reports which now find publication could be transformed into valuable contributions by strict observance of the rules as Dr. Van Slyke has elaborated them. There are, then, two reviews of proteolytic enzymes, "A Classification of Proteolytic Enzymes," by Max Bergmann, and "The Enzymatic Properties of Peptidases," by M. J. Johnson and J. Berger. These are in many ways complementary. The latter authors, restricting their attention to the "peptidases," summarize the occurrence of these enzymes in nature, with emphasis on the varied nature of the same type of enzyme from different sources. For instance, there are really many different kinds of enzymes which split leucyl peptides; there is no justification to consider them all a single enzyme, "leucyl peptidase," and far less to label them "amino peptidase" or "peptidase" as some authors have a tendency to do. Dr. Bergmann's attention is focussed on the recent work from his Laboratory at the Rockefeller Institute. He presents a new working classification of the proteolytic enzymes, in which peptidases and proteinases, as groups, are discarded in favor of endopeptidases and exopeptidases. Again, emphasis is placed on the like and unlike characteristics of enzymes from different sources in nature. Thus, there are enzymes in beef spleen, beef kidney, swine kidney, cattle pancreas (trypsin), and the papaya which split benzoyl-L-arginine-amide and benzoyl-L-lysineamide at proportionate rates, but which differ strikingly in other properties such as their pH requirements and dependence upon activators. The accumulated evidence suggests that such proteolytic enzymes are composed of several determinant groupings of amino acid or other residues—one common to them all which controls the specificity of the family as a whole, and others peculiar to each member, which influence the pH and activation requirements. It is likely that when normal conditions return, striking advances will be made in this direction.

There is also a group of reports dealing more or less with carbohydrate metabolism, "Heterotrophic Assimilation of Carbon Dioxide" by C. H. Werkman and H. G. Wood, "Cellulose Decomposition by Microorganisms," by A. G. Norman and W. H. Fuller, and "A Unified Hypothesis of the Reciprocal Integration of Carbohydrate and Fat Catabolism" by E. J. Witzemann. "Diamin-Oxydase" by E. A. Zeller, "The Chemistry of Tea Fermentation," by E. A. Houghton Roberts and a paper on the respiration and metabolism of *Aspergillus*¹ by Hiroshi Tamiya complete the contents.

(1) "Atmung, Gärung und die sich daran beteiligenden Enzyme von *Aspergillus*,"

W. F. Ross

The Spectrochemical Analysis of Metals and Alloys. By F. TWYMAN, F.R.S., Managing Director, Adam Hilger, Ltd. Chemical Publishing Company, Inc., 234 King Street, Brooklyn, New York, 1941. vii + 355 pp. 61 figs. 14.5 × 22 cm. Price, \$8.50.

As managing director of Adam Hilger, Ltd., Mr. Twyman has had a great deal to do with the instrumental design

of spectrographs and accessory apparatus, and also with the general furtherance of spectrochemical analysis. He is thus in a position to write an authoritative book on the subject. In the preface the author states that he had three classes of readers in mind when writing the book, namely, "(1) teachers and students of metallurgy who wish to acquaint themselves with the scope and nature of spectrochemical analysis as carried out in industrial laboratories; (2) metallurgists already engaged in industry to whom it may fall to introduce the method for routine control or research; (3) those already engaged in this field of analysis." To these he might well have added directors of research or heads of analytical laboratories who may be considering the application of spectrochemical analysis to their own particular problems.

Chapter I, The History of the Development of Spectrochemical Analysis, is based on a similar chapter in Kayser's "Handbuch der Spektroskopie." Chapter II, The Elements of Atomic Spectrum Theory, is a revised version of the section of the same title that A. C. Candler contributed to "Spectrochemical Analysis in 1938." Chapter III deals with Spectrographs and Accessory Apparatus. In this chapter the author discusses both grating and prism types of instruments, with a distinct preference for the latter. It is interesting to note that two commercial grating instruments of American manufacture have been joined by the "Technal" grating spectrograph for metallurgical analysis, which was put on the market by Adam Hilger, Ltd., in 1940. Chapter IV, The Microphotometer, is one of the most readable yet concise discussions the reviewer has seen. It is a pity that the visual comparator type of instrument was not discussed in this chapter.

Part II opens with Chapter V, Methods of Exciting Emission Spectra. This is a comprehensive survey of the various methods and the apparatus required for each. Chapter VI deals with the Taking of Spectrograms, Measuring Wavelengths, and Identifying Elements: Books and Tables. Chapter VII covers the Techniques of Spectrochemical Analysis, which the author defines as the proper selection of apparatus, mode of excitation of the spectrum, and the evaluation of the photographic plate applied to a particular analytical problem. In this chapter the logarithmic sector, the step sector and the step diaphragm, etc., are discussed. Chapter VIII, Types of Problem to which Spectrochemical Analysis is Applicable, should be read by every research director who may not know either the advantages or disadvantages of this mode of analysis. From the purely practical standpoint, the practising spectrochemical analyst will probably get the most out of Chapter IX, dealing as it does with the Practice of Spectrochemical Analysis of Metals and Alloys. The commercial analysis of Aluminum and its Alloys, Cadmium, Gold, Iron, Steel and Ferrous Alloys, Lead and its Alloys, Magnesium and its Alloys, the Platinum Metals, Silver, Tin, Zinc and Zinc-base Alloys, are all discussed. Chapter X, The Analysis of Substances not in Metallic Form including Gases, concludes the text. This is followed by two appendices, the first on Units and Definitions, and the second Additional Notes on methods.

The style of the book is very simple and readable. References are to paragraph numbers throughout the book, and literature references are made by the authors' names

followed by the year in which the paper appeared. These are all listed at the end of the book under the heading Bibliography and Author Index. Without a doubt this book is the best exposition of the principles and practice of emission spectrum analysis that has appeared in English. It is a "must own" book for the library of every analyst who has anything to do with spectrochemical analysis.

Since the American edition was undoubtedly printed from the British plates (or perhaps the printed forms were imported into the United States) it is a pity that a better quality of paper was not used. The paper quality in the American edition is worse than that in the British. The American publisher did not even see fit to print the spectrum plates, such as the frontispiece, on glazed paper. In view of these things, it is strange that the American edition should be priced at \$8.50, which seems exorbitant in comparison to the British price of one guinea. After all, the cost of the plates would be absorbed in the British publisher's cost, and even allowing for an import duty, the American cost is exorbitant.

LOUIS WALDBAUER

BOOKS RECEIVED

May 10, 1942-June 10, 1942

- A. A. BENEDETTI-PICHLER. "Introduction to the Micro-technique of Inorganic Analysis." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 302 pp. \$3.50.
- PETER GABRIEL BERGMANN. "Introduction to the Theory of Relativity." Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y. 287 pp. \$4.50.
- J. C. COLBERT. "A Shorter Course in Organic Chemistry." Second edition. D. Appleton-Century Company, Inc., 35 West 32nd Street, New York, N. Y. 355 pp. \$3.75.
- LOUIS J. CURTMAN. "Introduction to Semimicro Qualitative Chemical Analysis." The Macmillan Company, 60 Fifth Avenue, New York, N. Y. 377 pp. \$2.75.
- ED. F. DEGERING AND COLLABORATORS. "An Outline of Organic Nitrogen Compounds." John S. Swift Co., 5 East Third Street, Cincinnati, Ohio. 381 pp. \$6.00.
- HORACE G. DEMING AND CLIFFORD HENDRICKS. "Introductory College Chemistry. A Course for Beginners." Second edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 521 pp. \$3.00.
- JOHN C. HOGG AND CHARLES L. BICKEL. "Laboratory Manual to Elementary General Chemistry." D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y. 283 pp. \$1.60.
- FOREST RAY MOULTON, Editor. "Liebig and after Liebig. A Century of Progress in Agricultural Chemistry." American Association for the Advancement of Science. Smithsonian Institution Building, Washington, D. C. 111 pp.
- LEON B. RICHARDSON AND ANDREW J. SCARLETT. "Brief College Chemistry." Henry Holt and Company, Inc., 257 Fourth Avenue, New York, N. Y. 385 pp. \$3.00.
- H. R. ROSENBERG. "Chemistry and Physiology of the Vitamins." Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y. 674 pp. \$12.00.
- PAUL VON STEIN. "Organic Reagents in Inorganic Analysis." Chemical Publishing Company, Inc., 234 King Street, Brooklyn, N. Y. 242 pp. \$4.50.
- J. D. STRANATHAN. "The 'Particles' of Modern Physics." The Blakiston Company, 1012 Walnut Street, Philadelphia, Pa. 371 pp. \$4.00.
- F. P. TREADWELL AND WILLIAM T. HALL. "Analytical Chemistry. Volume II. Quantitative Analysis." Ninth English Edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 806 pp. \$6.00.