

conjugated with the acid chloride of the acetylated hydroxy acid fragment followed by selective hydrolysis of the ester linkages. This method suffers from the instability of β -alanine ester, and from the need of 1 mole of the rather expensive ester merely to neutralize the hydrochloric acid formed in the reaction. In work on the isolation of the acid fragment from liver,³ the use of excess ester was justified by the rarity of the acid chloride. Since it has been shown⁴ that the acid fragment of pantothenic acid is a readily obtainable compound,⁵ it would be desirable to eliminate the use of β -alanine ester in the synthesis of this vitamin.

The sodium salt of β,β -dimethyl- α,γ -dihydroxybutyric acid⁵ was refluxed for thirty minutes with excess acetic anhydride, and the solution was concentrated under reduced pressure to dryness. The residue was dissolved in dilute hydrochloric acid and extracted with ether for six hours. The extract was dried and evaporated, and dissolved in a large excess of thionyl chloride. After one hour, excess thionyl chloride was removed under reduced pressure. The acid chloride may be used directly, or purified by distillation (b. p. 140–142° at 13 mm.) with equal success.

8.9 g. (0.1 mole) of β -alanine was dissolved in 50 cc. of 2 *N* sodium hydroxide and cooled in ice and salt. During the next thirty minutes 50 cc. of 2 *N* sodium hydroxide and 25 g. of the acid

(3) Woolley, *Science*, **91**, 245 (1940).

(4) Williams and Major, *ibid.*, **91**, 246 (1940).

(5) Kuhn and Neustadter, *Monatsh.*, **39**, 293 (1918).

chloride were added alternately in small portions. The reaction flask was shaken vigorously during these additions. The solution was adjusted to pH 7.0, concentrated under reduced pressure to dryness, and the residue extracted with ethanol. To the concentrated ethanol solution was added 9 g. of sodium hydroxide in 100 cc. of methanol. After one hour concentrated hydrochloric acid was added until the solution was acid to thymol blue. Sodium chloride was filtered off and the filtrate was concentrated under reduced pressure to a sirup. This was extracted thrice with ethyl acetate, and the extracts freed of solvent and dissolved in water. Sodium bicarbonate was added until pH 7.0 was reached, when the solution was extracted with ether for six hours and then evaporated under reduced pressure. The cake of sodium salt was dissolved in absolute ethanol and 6 volumes of ethyl acetate added. Sodium pantothenate was obtained as a white, hygroscopic powder; yield, 10–12 g. Calcd. for $C_9H_{16}NO_5Na$: Na, 9.5. Found: Na, 9.4. Half-maximum effect in promoting growth of *Lactobacillus casei* was obtained⁶ when 0.02 microgram per cc. was added. For analyses the barium salt was more convenient than the sodium salt because it was not hygroscopic. It was precipitated from alcohol solution by acetone or ether. Calcd.: Ba, 23.9. Found: Ba, 23.8.

(6) Snell, Strong and Peterson, *THIS JOURNAL*, **60**, 2825 (1938).

THE HOSPITAL OF THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH
NEW YORK, N. Y. D. W. WOOLLEY

RECEIVED JUNE 10, 1940

NEW BOOKS

Quantitative Analysis. By HAROLD SIMMONS BOOTH, Ph.D., Professor of Chemistry, and VIVIAN RICHARD DAMERELL, Ph.D., Assistant Professor of Chemistry, Western Reserve University. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, N. Y., 1940. xi + 246 pp. 48 figs. 15.5 × 23.5 cm. Price, \$2.25.

This book is designed for the usual college course in elementary quantitative chemical analysis. It appears to fulfill this purpose admirably.

A typical chapter in the book is devoted to the determination of some one radical or to a volumetric method. There is first a summary of the method, discussing the

principles involved, and sources of error in the results. Then follow detailed directions and finally a series of questions to test the students' knowledge. Theory and principles are introduced as they are needed in the course of the work. The very inadequate treatment of quantitative calculations, particularly in volumetric methods, is intentional as the authors believe this subject should be treated in a separate volume.

The book is perhaps a little over-extended on the subject of balances, weights and weighing (24 pages) and, on the other hand, the number of determinations does not allow the student or instructor a very wide choice. For instance, determination of silica in an insoluble silicate is given in

detail but there is no suggestion as to how alkalis could be determined either in such a silicate or even when present in soluble form. The limitations of a method are often not made clear. For instance, after precipitating calcium as oxalate in a dolomite, the student might easily assume that this method should also be used in a phosphate rock. The volumetric determination of copper should be modernized. There are perhaps a dozen recent articles on the subject. Finally, special directions to the student which might only apply in the author's own laboratory such as are given on pp. 6, 109, 119 and elsewhere are in general a nuisance rather than an advantage. These, however, are minor matters. The book in general is excellent.

H. W. FOOTE

An Introduction to Chemical Science. By W. H. HATCHER, Professor of Chemistry, McGill University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1940. viii + 423 pp. 66 figs. 14.5 × 22 cm. Price, \$3.00.

This book is written for the non-professional general arts student. The most noticeable difference from the usual beginning text is the lack of arithmetical problems and almost complete absence of numerical data. The book is divided into four main divisions under the titles of I, Inorganic Chemistry; II, Organic Chemistry; III, Food Chemistry; IV, Industrial Chemistry; the first of which occupies about half of the book.

Although unsatisfactory for students who have any real interest in science or need for the fundamentals of chemistry as prerequisite for other courses, the book will be useful in stimulating the interest of the non-scientific student who wishes to learn what chemistry is about. It seems to be best suited to a course given without laboratory work where experiments are given as lecture demonstrations.

CHARLES R. CONARD

Organic Syntheses. An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. XX. By CHARLES F. H. ALLEN, Editor-in-Chief, HOMER ADKINS, W. E. BACHMANN, N. L. DRAKE, R. L. SHRINER, LEE IRVIN SMITH and A. H. BLATT, Secretary. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1940. 113 pp. 15.5 × 23.5 cm. Price, \$1.75.

The volume XX of this, most serviceable, series is of the same excellent quality characteristic of the preceding volumes. The book, having appeared some while ago, has been on our reference shelf long enough to prove its great usefulness. Presumably the same has been the experience in many other laboratories. For the benefit of those who have not yet seen this volume, we append the list of the 39 preparations described: β -(3-acenaphthoyl)-propionic acid, acetylacetone, *o*-anthraldehyde, 2-ethoxy-1-naphthaldehyde, *d*-arabinose, 1,2,3-benzotriazole, 6-bromo-2-naphthol, *t*-butyl acetate, cysteic acid monohydrate, decamethylene bromide, dehydroacetic acid, *trans*-dibenzoyl ethylene, dibenzoylmethane, di- β -carboethoxyethylmethylamine, α,α -dichloroacetamide, dimethyl-ethynylcarbinol, 5,5-dimethylhydantoin, 2,2'-dinitrobi-

phenyl, diphenylketene, *n*-dodecyl *p*-toluenesulfonate, fumaryl chloride, furylacrylic acid, *o*-*n*-heptylphenol, 2-hydroxy-5-nitrobenzyl chloride, mandelamide, methyl β -bromopropionate, *N*-methylformanilide, methyl myristate and methyl palmitate, monoperphthalic acid, 5-nitroindazole, pentaacetyl *d*-glucononitrile, phenyl cinnamate, picolinic acid hydrochloride, *dl*-serine, sodium amide, terephthaldehyde, α -tetralone, 2,3,4,6-tetramethyl-*d*-glucose, *dl*-threonine, *dl*-valine.

M. GOMBERG

Why Smash Atoms? By ARTHUR K. SOLOMON, Research Associate in Physics and Chemistry, Harvard University. Harvard University Press, Cambridge, Massachusetts, 1940. xii + 174 pp. Illustrated. 15.5 × 24 cm. Price, \$2.50.

An excellent popular story of contemporary research in nuclear physics, this book may be warmly recommended to interested laymen and to workers in other fields who want an illuminating rather than a detailed account of the subject.

Voltage doublers, van de Graaff generators, and cyclotrons, as well as important auxiliary apparatus are intimately and informally described by a writer with first hand experience of many of them, and depicted in numerous excellent photographs.

The elementary outline of nuclear physics presented is suggestive and interesting, at least to a reader with a certain amount of previous acquaintance with the subjects discussed.

The sketches and line drawings are very numerous and generally well conceived, although one or two, such as those on pp. 36 and 47, are less satisfactory than the ones usually seen in elementary texts.

The author emphasizes the cooperative and engineering aspects of modern physical research, as well as the essential unpredictability of the direction of scientific advance. The make-up and typography of the book are very good.

NORRIS F. HALL

Fundamentals of Physical Chemistry. By EARL C. H. DAVIES, Ph.D., Professor of Physical Chemistry at the West Virginia University. Second edition. The Blakiston Company, 1012 Walnut Street, Philadelphia, Pennsylvania, 1940. vii + 447 pp. 78 figs. 15 × 22 cm. Price, \$3.50.

"Fundamentals of Physical Chemistry" in the new edition has the same sequence of topics as the first but with considerable new material and a dozen new figures. The volume is intended to serve as the basis for an introductory non-mathematical course in the subject.

In addition to the standard material on the properties of the three states of aggregation, solutions, equilibria, electrolytic phenomena, etc., a very readable account is given of many of the fields where physicochemical concepts have assisted to a better understanding and correlation of phenomena as in biology, the chemistry of proteins, of vitamins and organic catalysts necessary for the maintenance of the life cycle. The chapter on colloids for ex-

ample includes reference to applications in connection with soil erosion, surface films, rubber and foods.

A pleasing feature of the volume in addition to the clear style of writing and historical references is the considerable number of excellent reproductions from photographs of distinguished contributors to science. A very liberal citation of well selected references is also a valuable feature. The quality of the printing and the arrangement of the material and the figures are all that could be desired.

The author has evidently felt constrained, as many chemists do, to connect Boyle's law with the ubiquitous number 22.4. Thus Professor Davies writes, apropos of Boyle's law, "when the temperature remains unchanged, the volume (v) of one molecular weight of a gas is inversely proportional to the pressure (P)."
The reviewer's plaint is that by implication the student is led to associate Boyle's law with "one molecular weight of a gas." The author's next sentence however puts the matter exactly, "the temperature remaining constant, the volume occupied by a given mass of gas is inversely proportional to the pressure."

The reviewer deprecates the introduction of the term "absolute temperature" (page 4) without previous explanation on the ground that the concept is of very fundamental significance. Also the statement, "Joule-Thomson coefficient is negligible for monatomic gases such as helium." Incidentally, the negative sign of the effect (third column, Table 3) for hydrogen has been inadvertently omitted. The explanation of the nature of so-called "Raman spectra" might be more complete.

F. G. KEYES

BOOKS RECEIVED

June 10, 1940—July 10, 1940

- ERNEST J. BALDWIN. "Principles of Inorganic and Analytical Chemistry." D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, N. Y. 506 pp. \$3.25.
- EUGEN BAMANN and KARL MYRBÄCK. "Die Methoden der Fermentforschung." Lieferung 1. Georg Thieme Verlag, Rossplatz 12, Leipzig C 1, Germany. 172 pp. RM. 13.5.
- D. J. BELL. "Introduction to Carbohydrate Biochemistry." University Tutorial Press Ltd., Clifton House, Euston Road, London, N. W. 1, England. 112 pp. 3 s. 6 d.
- PAUL E. BOUCHER. "Fundamentals of Photography." D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, N. Y. 357 pp. \$3.00.
- E. F. BURTON, H. GRAYSON SMITH and J. O. WILHELM. "Phenomena at the Temperature of Liquid Helium." American Chemical Society Monograph. Reinhold Publishing Corporation, 330 West 42d St., New York, N. Y. 362 pp. \$6.00.
- J. A. V. BUTLER. "Electrocapillarity. The Chemistry and Physics of Electrodes and Other Charged Surfaces." The Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y. 208 pp. \$5.00.
- F. FEIGL and RALPH E. OESPER. "Specific and Special Reactions for Use in Qualitative Analysis with Particular Reference to Spot Test Analysis." Nordemann Publishing Co., Inc., 215 Fourth Avenue, New York, N. Y. 192 pp. \$3.50.
- T. R. HOGNESS and WARREN C. JOHNSON. "Qualitative Analysis and Chemical Equilibrium." Revised edition. Henry Holt and Co., 257 Fourth Avenue, New York, N. Y. 538 pp. \$2.90.
- C. L. MANTELL. "Industrial Electrochemistry." Second edition. McGraw-Hill Book Co., Inc., 330 West 42d St., New York, N. Y. 656 pp. \$5.50.
- HANS MEYER. "Lehrbuch der organisch-chemischen Methodik." Dritter Band. "Synthese der Kohlenstoffverbindungen." Zweiter Teil. "Heterocyclen." Verlag von Julius Springer, Schottengasse 4, Wien I, Germany. 1684 pp. RM. 177, bound RM. 182.
- N. F. MOTT and R. W. GURNEY. "Electronic Processes in Ionic Crystals." Oxford University Press, 114 Fifth Avenue, New York, N. Y. 275 pp. \$5.50.
- RALPH L. SHRINER and REYNOLD C. FUSON. "The Systematic Identification of Organic Compounds." Second edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 312 pp. \$2.75.
- HOBART H. WILLARD and N. HOWELL FURMAN. "Elementary Quantitative Analysis." Third edition. D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, N. Y. 531 pp. \$3.25.
- F. WITTKA. "Moderne fettchemische Technologie." Heft 2. "Gewinnung der höheren Fettsäuren durch Oxydation der Kohlenwasserstoffe." Johann Ambrosius Barth, Salomonstrasse 18 B, Leipzig C 1, Germany. 167 pp. RM. 13.80.
- "Gmelins Handbuch der anorganischen Chemie. Eisen- und Stahllegierungen. Patentsammlung." 2. Ergänzungsband, Teil 1. Verlag Chemie, G. m. b. H., Berlin W 35, Germany. 623 pp. RM. 47.25.
- "Handbuch der Lebensmittelchemie." Achter Band. "Wasser und Luft." Zweiter Teil. "Untersuchung und Beurteilung des Wassers I. Luft." Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany. 619 pp. RM. 84, bound RM. 87.60.
- "List of Inspected Electrical Equipment." The Underwriters Laboratories, Inc., 161 6th Avenue, New York, N. Y. 476 pp.