identified as gallium by its melting point (30°) and by conversion into gallium trichloride (m. p. 75°). For each mole of trimethylgallium taken, 3.1 moles of methylated diboranes (calculated as monomethyldiborane), 1.53 moles of hydrogen, and 1.02 moles of gallium were obtained. The over-all reaction can thus be represented by the equation

$$Ga(CH_3)_3 + 3B_2H_6 = Ga + 3CH_3B_2H_5 + 3/2H_2$$

In other experiments the appearance of the film and the formation of hydrogen was not observed over a period of time as long as twenty-four hours. It seems probable that gallium borohydride is first formed in the course of the reaction but it then undergoes a rapid autocatalytic decomposition. The equations for these reactions may be written as

$$2(CH_3)_3Ga + 9B_2H_6 = 2Ga(BH_4)_3 + 6CH_3B_2H_5$$

and

$$2Ga(BH_4)_3 = 2Ga + 3B_2H_6 + 3H_2$$

The reaction between trimethylgallium and diborane at −45° resulted in the formation of practically pure dimethylgallium borohydride. Trimethylgallium, 13.1 cc., was treated with several portions of diborane until no further reaction was apparent. The quantity of diborane reacting was 18.7 cc.; monomethyldiborane, 12.2 cc., was obtained. These data lead to the empirical formula $(CH_3)_{2.06}GaB_{0.99}H_{3.91}$, for the product. The homogeneity of the product was demonstrated by fractionation into several parts, all of which showed the same vapor tension. The product thus obtained is a volatile crystalline solid which melts into a clear colorless liquid at +1.5°. It is stable at −80° but undergoes slow decomposition at room temperature. The vapor density confirms the monomeric formula (molecular weight found, 115; calculated, 114.5). It can be concluded that the reaction between diborane and trimethylgallium proceeds according to the equation

$$2(CH_3)_3Ga + 3B_2H_6 = 2(CH_3)_2GaBH_4 + 2CH_3B_2H_5$$

The new compound exhibits a vapor tension of 14 mm. at 0° and 51 mm. at 24°; the extrapolated boiling point is 92°; Trouton's constant is 23.5 cal./mole-deg.

The reactions of dimethylgallium borohydride are being studied in detail, and the volatile intermediates in the room temperature reaction between diborane and trimethylgallium are being further investigated.

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NEW BOOKS

Chemistry and Methods of Enzymes. By JAMES B. SUMNER, Professor of Biochemistry, and G. FRED SOMERS, Instructor in Biochemistry, Cornell University. Academic Press, Inc., Publishers, 125 East 23rd Street, New York, N. Y., 1943. xi + 365 pp. 15.5 × 23.5 cm. Price, $5.00.

Here, surprisingly enough, is the first work in the English language which presents a general survey of all classes of enzymes. Several works have appeared heretofore dealing with either the oxidative or the proteolytic enzymes but none has attempted to cover the whole field. This present survey is not, however, an exhaustive one of the type to be found in the German literature. As the authors state in their preface, they have attempted to give the research worker and advanced student a general survey of enzyme chemistry without presenting too much detail on any one subject. They appear to have accomplished this aim in a highly satisfactory manner.

The book is divided into four parts. The first part consists of a chapter on the general properties of enzymes. Part two deals with the hydrolytic enzymes and contains six chapters with the following titles: Esterases, Carbohydrases, Enzymes of Carbohydrate Metabolism, Nucleases, Amidases, Proteolytic Enzymes. The third part is composed of nine chapters treating the oxidative enzymes. These chapters are entitled: Oxidizing Enzymes, The Iron Enzymes, The Copper Enzymes, Dehydrogenases Containing Coenzymes 1 and 2, Oxidases which Transfer Hydrogen to Cytochrome, The Yellow Enzymes, Nuclein Desaminases, Miscellaneous Oxidases, Desmolases. Part four consists of two chapters—one on hydrases and mutases, the other on carbohydrate metabolism. In all, some 165 enzymes are thus covered. In most cases, the history, occurrence, action, specificity, method of activity measurement, properties, and the method of preparation of the enzyme are outlined briefly. Ample references are given to the more important original articles in the literature.

Twenty-two of the enzymes discussed are listed as having been obtained in crystalline form. The methods for crystallization of some of these sound so simple that the novice could well gain the impression that one might well isolate and crystallize a new enzyme over the weekend. If he

looks closer, however, he should be impressed by the fact that there is no common procedure for the isolation and crystallization of enzymes. Each enzyme is a special case that requires the application of the long and tedious method of trial and error in order to isolate it.

There are a few statements in the book concerning some of the oxidative enzymes with which the reviewer would take exception. For example, on page 187, it is stated without reference that "cytochrome c can be oxidized by leucoflavin." Leucoflavin presumably could *reduce* cytochrome c. Another case is the statement made on page 192 that "Cytochrome oxidase acts only on cytochrome c." There is no adequate proof for this statement. The authors quoted in support of the statement hazard the conclusion that the oxidase *appears* to be specific for the oxidation of cytochrome c. Also Chapter XII is given the title, "Oxidases which Transfer Hydrogen to Cytochrome." The chapter deals with cytochrome linked dehydrogenase systems which very likely only transfer *electrons* to the cytochrome system. Finally, the reviewer was surprised to learn on page 253 that "in purification (of xanthine oxidase) by Ball the xanthine oxidase properties have become destroyed." These are undoubtedly minor slips by the authors and are to be excused in their first edition in view of their general excellent handling of the intricacies of the oxidative enzyme field.

The printing and general appearance of the book is good. Subject and author indexes permit ready reference to the subject matter. The book should undoubtedly serve both the research worker and the advanced student as a valuable key to unlock the ramifications of enzyme chemistry.

ERIC G. BALL

The Chemistry of Powder and Explosives. Volume II. By TENNEY L. DAVIS. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1943. 267 pp. Price, $3.00.

As stated in the preface, this second volume preserves the point of view of the first volume and fulfils the plan which was outlined in its preface.

The text is divided into five chapters: Nitric Esters, Smokeless Powder; Dynamite and Other High Explosives; Nitroamines and Related Substances; Primary Explosives, Detonators and Primers.

Nitric Esters are discussed quite fully in 95 pages of Chapter V, under some 37 topics. Of these, 23 pages are devoted to the Nitroglycerines and 37 pages to the Nitrated Carbohydrates, including 10 interesting pages of their early history.

The other four chapters deal more particularly with the technology of Smokeless Powders, Dynamite and Other High Explosives such as TNT and Ammonium Nitrate mixtures, as well as Primary Explosives, Detonators and Primers.

The text is suitably supplied with well-chosen illustrations from modern technical practice.

Both volumes, taken together, give an adequate basis upon which a chemist commencing work in an explosives laboratory or in the explosives industry may build up a further and more specialized knowledge.

W. L. JENNINGS

Manual of Explosives, Military Pyrotechnics and Chemical Warfare Agents. Composition, Properties, Uses. By JULES BEBIE, PH.D., Consulting Chemical Engineer, Professor of Chemical Technology, Washington University. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1943. xiii + 171 pp. 14.5 × 22 cm. Price, $2.50.

This book is a "ready reference," written primarily for that group of chemists (very large at the present time) who have not had long and extensive experience in the field of explosives. Since, in the trade, many of the compounds and mixtures employed are known by a common or trade name (in some cases by several different names or terms, American and foreign) the chemist entering this field will be mystified. For instance trimethylene trinitramine is known commonly as cyclonite but also as cyclotrimethylenetrinitramine and hexogon. This fact is at once apparent when the reader refers to any one of these terms in the manual.

The arrangement is in alphabetical order and the product, if a definite compound, is listed by its correct chemical name and all other terms are listed. Trade names, chemical synonyms or service symbols are given as cross references. A few important explosives are given by their common names: *i. e.*, nitroglycerine, nitrocellulose, etc. Compositions, properties and uses are listed. A short bibliography of books, bulletins and manuals, trade catalogs, journal articles, and patents is appended. Although the author makes no claim to completeness, this book should prove useful especially to the newcomers in the field.

G. B. L. SMITH

BOOKS RECEIVED

July 10, 1943–August 10, 1943

R. E. BURK AND OLIVER GRUMMITT, Editors. "The Chemical Background for Engine Research (Frontiers in Chemistry—Volume II)." Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y. 297 pp. $3.50.

J. M. DALLAVALLE. "Micromeritics." Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y. 428 pp. $8.50.

ED. F. DEGERING. "An Outline of the Chemistry of the Carbohydrates." John S. Swift Company, Inc., Planographers, 5 East 3rd Street, Cincinnati, Ohio. 474 pp. $6.00.

HAROLD A. FALES AND FREDERIC KENNY. "Inorganic Qualitative Analysis. Semi-Micro Technique." D. Appleton-Century Company, 35 West 32nd Street, New York, N. Y. 237 pp. $2.65.

FRANK J. MUNOZ AND HARRY A. CHARIPPER. "The Microscope and its Use." Chemical Publishing Company, Inc., Brooklyn, N. Y. 334 pp. $2.50.

HENRY C. SHERMAN. "The Science of Nutrition." Columbia University Press, Morningside Heights, New York, N. Y. 253 pp. $2.75.