preparation of plastics, resins, etc., suitable for molding and coating.

Detailed description of the procedure and of the mostly new starch derivatives so prepared will be published later.

FRICK CHEMICAL LABORATORY
PRINCETON UNIVERSITY EUGENE PACSU
PRINCETON, NEW JERSEY JAMES W. MULLEN, 2ND

RECEIVED APRIL 17, 1941

ABSORPTION OF OXYGEN BY GLUTATHIONE IN ALKALINE SOLUTIONS

Sir:

In a recent communication, Xan, Wilson, Roberts and Horton[1] have called attention to the fact that certain mercaptans in alkaline solution absorb more oxygen than should be required to oxidize them to the corresponding disulfides. These authors report that the amount of oxygen absorbed per mole of mercaptan increases with increasing hydroxide ion concentration with the formation of an unknown end-product of oxidation.

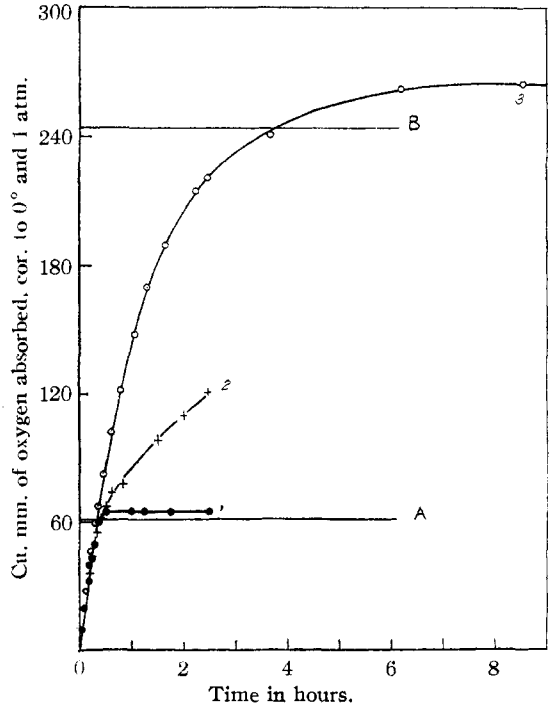

Fig. 1.—Absorption of oxygen at 37° and 1 atm. pressure by glutathione in alkaline solutions.

In an investigation under way in this Laboratory, the oxidation by oxygen of a mercaptan, glutathione, in alkaline solution with small amounts of copper sulfate as catalyst has been studied over a considerable range of hydroxide ion concentration. In this case also the amount of oxygen absorbed per mole of glutathione increases as the hydroxide ion increases and the end product, as indicated by the volume of oxygen absorbed, is predominantly the salt of the sulfinic acid. Figure 1 shows the results of three experiments in which approximately equal amounts of glutathione, 5 cc. of 0.00220, 0.00217 and 0.00218 molar solution, respectively, were oxidized by oxygen in the well-known Warburg apparatus at 37°. The concentrations of copper ion, assuming no reaction with either glutathione or hydroxide ion, were 4.70×10^{-6}, 4.63×10^{-6} and 3.70×10^{-6} molar, respectively. In Expt. 1, the initial *p*H of the solution is about 9.0. Although the volume of oxygen absorbed is somewhat higher than the calculated volume (represented by the straight line A) required to change the mercaptan to the disulfide, there is no indication of a further reaction involving the formation of a higher oxidation product. In Expt. 2, the hydroxide ion concentration is 0.0431 and there is definite evidence of a follow reaction after the formation of the disulfide. In Expt. 3, the hydroxide ion is 0.171. The straight line B indicates the calculated volume of oxygen absorbed to change the mercaptan to the sulfinic acid. Again the actual value is somewhat high and yet the type of curve and the apparent completion of the reaction indicate that the principal product formed is the salt of the sulfinic acid.

The rates of the above reactions increase with increase in copper sulfate concentration and oxygen pressure and, in general, the slower (but still complete) the reactions the nearer do the total oxygen absorptions approach the theoretical values for disulfide and sulfinic acid formation. The kinetics involved in the above reactions are now under consideration and further details will be given in a later publication.

DIVISIONS OF ANIMAL HUSBANDRY AND CHEMISTRY
COLLEGE OF AGRICULTURE M. B. YOUNG
UNIVERSITY OF CALIFORNIA H. A. YOUNG
DAVIS, CALIFORNIA MAX KLEIBER

RECEIVED APRIL 19, 1941

A COLOR TEST FOR *p*-AMINOBENZOIC ACID, THE CHROMOTRICHIA FACTOR

Sir:

The following is a very delicate and simple test for the newest member of the vitamin B complex,

(1) Xan, Wilson, Roberts and Horton, THIS JOURNAL, **63** 1139 (1941).

the chromotrichia factor, *p*-aminobenzoic acid[1]: To five micrograms of *p*-aminobenzoic acid in one cc. of glacial acetic acid one cc. of a 1% solution of *p*-dimethylaminobenzaldehyde in glacial acetic acid is added. In a second test-tube to 1 cc. of glacial acetic, 1 cc. of the *p*-dimethylaminobenzaldehyde solution is added (control). After five minutes of standing at room temperature a deep yellow color develops in the test-tube containing the amino acid. On the addition of 5 cc. of glacial acetic acid the solutions may be studied colorimetrically.

The colored compound is probably a Schiff base. This test is not given by aliphatic amino acids, nor by their aromatic derivatives such as tyrosine and phenylalanine. Nor is it given by glutathione, urea, pantothenic acid, nicotinic acid, nicotinic acid amide, or by thiamine. Thiamine[2] and some other compounds with primary or secondary amino groups give this reaction only on prolonged boiling or complete evaporation of the glacial acetic acid. The isomers of *p*-aminobenzoic acid (*o*- and *m*-benzoic acid) and their alkyl esters, as well as aniline and its derivatives, such as *p*-toluidine, also give the test. The latter compounds, however, are not normally found in biological material.

We are grateful to the International Vitamin Corporation for a supply of C. P. *p*-aminobenzoic acid.

(1) S. Ansbacher, *Science*, **93**, 164 (1941); G. J. Warner and S. Ansbacher, *J. Biol. Chem.*, **138**, 441 (1941).

(2) H. Tauber, *Science*, **86**, 594 (1937).

RESEARCH DEPARTMENT
SCHWARZ LABORATORIES, INC. HENRY TAUBER
NEW YORK, N. Y. STEPHEN LAUFER

RECEIVED APRIL 22, 1941

NEW BOOKS

A College Course of Inorganic Chemistry. By J. R. PARTINGTON, M.B.E., D.Sc., Professor of Chemistry in the University of London, Queen Mary College. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1939. x + 650 pp. 243 figs. 14.5 × 22 cm. Price, $2.50.

This text lies somewhere midway between the extremes of elementary book and comprehensive treatise, being written for students with a good grounding in the subject. Of the first twenty chapters, half deal with theories and laws, and the others with the descriptive chemistry of many of the non-metals and their typical compounds. The remaining fifteen chapters deal primarily with the metals (but including chapters on carbon, the nitrogen family, sulfur, and the inert gases). The method of treatment and literary style are those of the experienced teacher, typical of Professor Partington's many text contributions, the subjects being covered thoroughly with ample factual and illustrative material.

In the absence of major flaws, a reviewer has left only minor matters of style and subject choice for critical comment, such as: the unattractive typographical set-up of double salt formulas, the frequent use of old trivial names for compounds, the overdetailed consideration of certain items (for example, mixtures, compounds, the composition of water, acids, bases and salts), the extensive discussion of various nearly obsolete industrial processes and the omission of some modern ones, the use of the old explanation that on electrolytic liberation ions such as Na^- and $SO_4^=$ react with water to produce hydrogen and oxygen (the correct explanation is given later on), and the (perhaps justified) extensive use of the old Mendelejeff periodic table, even though the newer long form of the table is much clearer and more intelligible to students taking up modern atomic theory.

The careful reading of such an excellent "Inorganic Chemistry" textbook cannot but give a teacher a feeling of regret that the requirements of present-day American science curricula render its use impossible in any regular course, thus contributing to the unfortunate situation that most students majoring in chemistry complete their schedules and receive degrees without ever handling or even seeing any compounds of more than half the elements in the Periodic Table.

ALLEN D. BLISS

Ausführung quantitativer Analysen (Carrying out Quantitative Analyses). By HEINRICH BILTZ and WILHELM BILTZ. Third Edition. Verlag von S. Hirzel, Königstrasse 2, Leipzig, Germany, 1940. vi + 414 pp. 49 figs. 17.5 × 25 cm. Price, RM. 19.00.

The first edition of this book was copyrighted in 1930; it evidently met with a friendly reception in Germany. It consists of an Introduction and ten chapters. In the Introduction (49 pages) laboratory equipment, chemical manipulation, reagents and the planning of analytical work are discussed. Little, if any, adverse criticism could be raised against anything that is said in this introduction. It is full of timely advice and is written so clearly and interestingly that the teacher can read it without being bored and most of us will get valuable hints and will be pleased at the precautions that are emphasized. The student, on the other hand, will find something worth