

or by the action of bromine and phosphorus on caproic acid and subsequent hydrolysis of the acid bromide,<sup>1</sup> but neither of these methods is as easy as the one just described.

**$\alpha$ -Aminocaproic Acid.**—Several experiments were carried out to produce  $\alpha$ -aminocaproic acid from  $\alpha$ -bromocaproic acid. The exact method of Abderhalden<sup>2</sup> was used, 140 g. of the bromo acid being employed in each run. The yield of pure product amounted to about 61 g. The first crop of crystals was about 45 g. and the second crop obtained by concentration of the mother liquors to crystallization and addition of an equal volume of alcohol gave 16 g. Further treatment of the mother liquors as described by Abderhalden did not increase the yield appreciably. The material, after washing with alcohol, is practically pure; if small amounts of colored products are present, they are easily removed by crystallization from water.

*Discussion of Reaction.*—This preparation has already been described in several communications and has been made by the action of ammonia on  $\alpha$ -bromocaproic acid,<sup>3</sup> the details being given in the paper by Abderhalden.<sup>4</sup> This investigator claims 100% yields but in the experiments carried out in this laboratory following his directions, only 65% yields of pure product were obtained.

#### Summary.

1. It has been pointed out that the commercially available *n*-butyl alcohol is a valuable material for the preparation of (A) *n*-amyl derivatives, and (B) *n*-caproic acid and its derivatives.

2. Detailed directions are given for the production of *n*-butyl cyanide, *n*-valeric acid, ethyl *n*-valerate, *n*-amyl amine, *n*-amyl alcohol, *n*-caproic acid,  $\alpha$ -bromo-*n*-caproic acid and  $\alpha$ -amino-*n*-caproic acid.

URBANA, ILL.

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#### NEW BOOKS.

**Notes on Qualitative Analysis.** By LOUIS AGASSIZ TEST AND H. M. McLAUGHLIN. Ginn and Company, 1919. iv + 92 pp. 13.5 × 19.5 cm. Price, \$0.80.

The book contains 24 pages given to the development of the theory of solutions and the law of mass action, followed by directions for experiments on the reactions of the common metallic and non-metallic radicals and tables for use in systematic analysis. A list of 162 questions for students is appended, based upon the practice and theory of qualitative analysis. The periodic table of the elements and a table of atomic weights conclude the volume.

<sup>1</sup> *Z. physiol. Chem.*, **16**, 454 (1913).

<sup>2</sup> *Ibid.*, **86**, 454 (1913).

<sup>3</sup> *J. prakt. Chem.*, [2] **1**, 6 (1870); *Ber.*, **33**, 2370 (1900); *Z. physiol. Chem.*, **86**, 454 (1913).

<sup>4</sup> *Z. physiol. Chem.*, **86**, 454 (1913).

The authors have prepared the book to be used by their students at Iowa State College, in a one-term course of 6 hours per week, taken before the study of general chemistry has been completed. This calls for an abbreviated treatment of the subject, and the authors are to be highly commended for having kept this limitation honestly in mind in writing their text. The subject matter included is such as can be presented to a class in a term's work and assimilated by them—a qualification possessed by but few texts on qualitative analysis that have been written with that end professedly in view. Those who have searched the market for a suitable laboratory guide for a course of one term know how rare it is to find a "brief" text on qualitative analysis in which the brevity is analytically detectable; and these will thank Messrs. Test and McLaughlin for adding one to the short list of such books.

The experiments on the reactions of the metals are well selected and the methods for systematic analysis are generally simple and workable. The treatment of basic theories in the book is excellent in its scope and stimulating to a beginning class in analysis, but open to much improvement in method and form. There are occasional misstatements and many inaccuracies, all of which should disappear from later editions. There is also improvement possible in the general composition, which suffers from crowding more kinds of material into a paragraph than the best usage permits.

The following statements seem to the reviewer to be errors which the authors will wish to correct in their revision of the work. It is not well to speak of the "direction of a reversible reaction" (p. 9), nor to recommend to students the use of the word "strength" instead of concentration (p. 3), at any rate in a text written from the standpoint of the dissociation theory. In deference to the same theory, the solubility of barium chromate in strong acids should be explained as due to the formation of relatively weak chromic or dichromic acid and not to the formation of the  $\text{Cr}_2\text{O}_7$  ion (p. 34); and the failure of calcium sulfate solution to produce precipitation in solutions of other calcium salts can hardly be because "the sulfate ions are already in combination with calcium ions." (p. 35). The peculiar behavior of nickel and cobalt sulfides upon treatment with acids is due to their low rate of solution, and not to their insolubility (p. 52). Since hydrogen peroxide does not oxidize chromic hydroxide, it would be better (p. 53) to substitute sodium peroxide for it in the equation, as is actually done in the laboratory directions. These and other statements will need to be doctored somewhat heroically before the authors can be safe from the critical undergraduate who is looking for inconsistencies in his teacher's doctrine.

The book is good enough so that it is to be hoped that the authors will make it better at another trial. It is suggested that a table be inserted

giving the concentrations of reagents used in the work of the course; it would be helpful to students and to teachers who adopt the book for their classes.

ARTHUR E. HILL.

**An Introductory Course in Quantitative Analysis, with Explanatory Notes, Stoichiometrical Problems, and Questions.** By GEORGE MCPHAIL SMITH, Associate Professor of Chemistry in the University of Illinois. The Macmillan Company, New York. 1919. x + 206 pp. 3 ill. 13 × 19 cm. Price, \$1.75.

This book is divided into 5 parts: Part I, 52 p., dealing with general discussion of the theories and practice of quantitative analytical operations; Part II, 46 p., consisting of typical gravimetric procedures; Part III, 62 p., consisting of typical volumetric procedures; Part IV, 19 p., dealing with methods of solving problems, together with 100 problems for solution by the student; Part V, 15 p., consisting of a series of questions concerning the procedures.

In subject matter and in method of treatment the book does not differ greatly from the well-known text by Talbot on the same subject, the chief differences being a much more complete general discussion, a somewhat greater number of experimental procedures (especially in volumetric methods), and the questions concerning the experiments.

The general discussion (Part I) is unusually detailed for an introductory manual; much of it is obviously meant to be assimilated gradually by the student as he becomes more familiar with the subject. For the most part the material is well selected and clearly written, although in a few places (*e. g.*, p. 31 and p. 33) description of a process and experimental direction are somewhat confused. The reviewer would suggest that where the subject of "weighing" is to be discussed in such detail (14 p.), a reference to Richards' "The Calibration of a Set of Weights,"<sup>1</sup> and also a specimen table showing the arrangement of data might well be included.

The analytical procedures are very well chosen, and the directions given conform to good analytical practice, being "sufficiently detailed to offer (the student) little opportunity for going astray, and thus to enable him to work successfully without an undue amount of personal supervision." Each procedure is followed by notes designed to explain and emphasize the importance of the different steps. The notes following the electrolytic determination of copper are especially thorough in their treatment.

The reviewer is pleased with the length at which the subject of volumetric analysis is treated, and with the detailed discussion of volumetric technique; he would point out, however, that while most sources of error are minutely treated, there are no directions for the correction of the volume of standard solution for the amount necessary to produce the desired "end-point."

<sup>1</sup> THIS JOURNAL, 22, 144 (1900).

The problems in Part IV serve a useful purpose, and the questions in Part V will be instructive and suggestive to both student and instructor.

Typographical errors are few for a first edition, and the appearance of the book is very satisfactory, although something might be gained at the expense of a few additional pages by placing the separate "Determinations" at the top of the page. There are a few instances of carelessness; thus in the section on "crucibles" only porcelain, quartz, alundum, and platinum are treated, while later "palau (also called rhotanium)" and again "palladium-gold" crucibles are used or referred to without explanation. Also the reviewer takes slight exception to the direction to "fume off the sulfuric acid" (p. 82), but after all these are very minor criticisms.

Altogether, Professor Smith has written a text which will undoubtedly prove a very valuable addition to the present list of texts on Quantitative Analysis, and one which will be found especially suited for use with large classes which are to be given a rather thorough introductory course.

GRAHAM EDGAR.

**Recent Discoveries in Inorganic Chemistry.** By J. HART-SMITH. Cambridge University Press, Cambridge, England. 1919. 88 pp. 15 × 23 cm. Price, \$1.40.

The author states in his preface that his object has been to give some account of the more important discoveries in inorganic chemistry within the last 15 years, so far as they concern the subject as usually taught in schools. In this he has been successful, for this small volume will certainly furnish a stimulating supply of new material to the teacher of inorganic chemistry, dependent on the somewhat shop-worn information offered by the standard text books on this subject.

The title of the book is, however, unfortunate, unless the adjective "recent" be interpreted from a very philosophical and almost geological point of view. Most of the subject matter is 10 years old, much is 15, and hardly any of it, perhaps naturally enough, is less than 5 years old.

The treatment too is sketchy and incomplete when compared with the similar work by Stewart, or even with the chapters on inorganic chemistry in the annual reports published by the London Chemical Society. In spite of this qualification we have run across many interesting things in this book which we did not know before, and very likely other people will have the same experience.

ARTHUR B. LAMB.

**The Chemistry and Manufacture of Hydrogen.** First Edition. By P. LITHERLAND TREED, A.R.S.M. (Mining and Metallurgy), A.I.M.M., Major, R. A. F. Longmans, Green and Co., New York (Edward Arnold, London). 1919. vii + 152 pp. 22 fig. 22.5 × 14 cm. \$3.40 net.

This book was written for English reading as indicated in the preface. It is a general review of what has previously been published and seems to the reviewer to contain nothing new.

The binding is not so good, but the type is clear and the general setup

is fair, although it could have been greatly improved if the composition were better balanced by the heavier type for the titled subjects treated. The majority of the figures in the illustrations are old and should have been replaced by later designs.

Chapter I states that hydrogen is used for war purposes, for inflating balloons, in the conversion of olein and other unsaturated fats and their corresponding acids into sterin or stearic acid; and in the production of synthetic ammonia. No mention is made of its use in the cutting and welding of metals or in the production of synthetic stones and other minor uses. Chapter II treats the chemical properties of hydrogen as outlined in chemical text books. However, the omission in this chapter of the properties of hydrogen as a *deodorizing* and purifying agent for fish and vegetable oils is unfortunate. Chapter III relates to the manufacture of hydrogen by chemical methods. The silicon process is treated in this chapter in such detail as to indicate that the author has been in personal touch with the subject. Chapter IV a continuation of the discussion of the manufacture of hydrogen by chemico-physical methods, relates only to the Linde-Frank-Caro process. Chapter V (final) treats of hydrogen production by electrolysis. Four types of electrolyzers (cells) are described, although two of these types are not now manufactured, having been replaced by improved types, the remaining types were in use in the early stages of development of electrolytic cells and now are seldom in demand. This chapter closes with a brief description of the Castner-Keller cell for the production of caustic soda and chlorine, and hydrogen as a by-product. The appendix contains tables and physical constants relating to hydrogen.

Those who desire general information on the subject of hydrogen will find the book interesting reading.

H. L. BARNITZ.

**Die Wirkungsweise der Rektifizier- und Destillier-Apparate; mit Hilfe einfacher mathemat. Betrachtungen.** By E. HAUSBRAND. 25 figs. 3rd Edition. 1916. Julius Springer, Berlin. 14 Mk.

This third edition is a complete revision of the earlier editions. It contains all the material of the other editions and takes into account recent work along this line. In the author's words, "Recent work has clarified much that was obscure, and formulas have been derived for the building of distillation apparatus, that for easy derivation and simplicity leave little to be desired." By their application the specifications for apparatus for the separation of two completely miscible liquids by distillation can be determined. The necessary physical data for application to specific substances have been collected from widely distributed sources and this author has added data for a number of liquids which he has determined.

The book is divided into 3 parts. The first deals with the theory of distillation apparatus and describes in detail the characteristics of distilling

apparatus and condensers for periodic and continuous operation. The second part considers the handling and practical application of the apparatus in the separation of a number of mixtures. The number is limited to typical examples and includes ethyl alcohol and water, methyl alcohol and water, acetone and water, acetone and methyl alcohol, acetic acid and water, formic acid and water, ammonia and water and the fractional separation of liquid air. The third part is made up of tables giving data for various mixtures and physical constants for liquids and vapors.

Apparatus for the separation of only two substances is considered as the information on mixtures of more than two liquids is very meagre; and, as the theoretical considerations of all possible combinations would lead to endless complications, the more practical applications have been considered.

R. O. E. DAVIS.

**Handbuch der Physikalisch-Chemischen-Technik.** By PROF. DR. KURT ARNDT, Privatdozent an der K. Techn. Hochschule zu Berlin. 833 pp. 644 figs. 17 × 24 cm. Ferdinand Enke, Stuttgart. 1915. 37.20 Mk.

The author has presented in this book a surprisingly large amount of information on physical-chemical apparatus and technique. The subject matter has been collected from a very large number of scientific journals and publications but particularly from the *Zeitschrift für physikalische Chemie* and *Zeitschrift für Elektrochemie*, references being given to the original articles in all cases.

The scope of the book is, perhaps, best described by referring to the principal points discussed, there being a chapter on each of the following subjects: general laboratory technique, electric ovens, pumps, thermostats, stirring devices, pressure regulation devices, analytical balances, and measurements of length, surface and volume, gas pressure, partial pressure, osmotic pressure, solubility, time, temperature, melting point, boiling point, heat, specific heat, viscosity, surface tension, diffusion, electrical resistance, dielectric constant, transference number, electric current, voltage, and optical constants. Each subject is discussed at some length and well illustrated by figures. Thus in the chapter on measurement of heat quantities, the best forms of apparatus so far developed and the technique for measuring reactions in solutions, the water equivalent of a calorimeter, heats of combustion, heats of evaporation, very small quantities of heat, together with calorimeters for high temperatures are well described and are illustrated by 36 figures.

In the manner of presentation the author has been very successful, an easily readable style having been retained in spite of the great condensation of material that was necessary. The general principles underlying the subject matter of a given chapter are first presented very briefly, yet clearly in a few paragraphs, after which the subtopics are discussed and illustrated. Purely theoretical discussions have been avoided in the book

as far as was consistent with the proper presentation of the subjects. The book contains a very detailed table of contents as well as an author and subject index.

This manual should prove to be especially useful to the less experienced investigators in physical chemistry, for in no other book is the field so thoroughly covered and so well illustrated. It should also be of assistance to those already familiar with the field, by furnishing valuable suggestions in the matter of technique and apparatus to meet special requirements.

JOSEPH M. BRAHAM.

**Die Katalyse.** Die Rolle der Katalyse in der Analytischen Chemie. By DR. GERTRUD WOKER, Privatdoz. University of Bern. Vol. II, Part I, Inorganic Catalysts.  $25 \times 16\frac{1}{2}$  cm. 803 pp. 13 illustrations. Ferdinand Enke, Stuttgart. 1915. 28 Mk.

Many will recall the first volume of this work by Dr. Woker, dealing with the general principles of catalysis as applied in particular to analytical chemistry, which appeared in 1910 as Volumes 11 and 12 of the excellent series of monographs entitled, "Die Chemische Analyse," edited by Margosches. While that volume was bewildering in its effect upon the reader, nevertheless, it presented in collected form a great amount of material dealing with the theory of catalysis, and displayed an amazing amount of erudition on the part of its author.

The present volume, (Nos. 21 and 22 of the same series) with its nearly 800 pages of text and its innumerable footnotes and references, surpasses even the first volume in the profuseness and completeness of the assembled material. The subject matter has been arranged under the heads of the various catalysts involved; thus, the chapters are entitled, "Catalysis by Water; Hydroxyl Ion; Hydrogen Ion; Iodide Ion; Neutral Salts; Heavy Metals; Oxides and Salts; Gases and Vapors; Light, and Agents of Unknown Origin."

The authoress points out in her introduction that in this field we must still heed the warning of von Lippmann, uttered long ago, that, "Catalysis today is revered almost as a fetish; that people seem to consider phenomena as adequately explained merely by calling them *catalytic*, when really all that has been done is to substitute for the unknown quantity  $x$  another equally unknown quantity  $y$ . As Berzelius, the discoverer of catalysis said in 1836 to Wöhler: 'God forbid that we trust too much to catalytic force.'" But to anyone who reads these volumes by Miss Woker, there can be no question of the fertility of the idea of catalysis, nor of the light which a study of this phenomenon and of reaction velocity has and still can shed upon the field of chemical analysis and of inorganic chemistry.

The publishers promise a second part of Volume II nearly as large as the first, to be devoted to biological chemistry (The Ferments).

ARTHUR B. LAMB.