

the chromotrichia factor, *p*-aminobenzoic acid<sup>1</sup>: 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,

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

urea, pantothenic acid, nicotinic acid, nicotinic acid amide, or by thiamine. Thiamine<sup>2</sup> 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.

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

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NEW YORK, N. Y.

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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<sup>+</sup> and SO<sub>4</sub><sup>2-</sup> 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

remembering on every page. It is interesting to note that porcelain crucibles are used except in a few cases and that the beakers are lipless. For rough weighing the hand balance is still used and a 10-gram porcelain weighing scoop is recommended for non-hygroscopic substances after the student has learned to weigh out samples from glass-stoppered weighing tubes. Emphasis is placed on contamination of reagents by glassware and for preparing ammonia solutions ammonia gas under pressure in steel bombs is recommended. Küster's hydrogen sulfide outfit is shown with twenty outlets for sixty students in quantitative analysis and ninety in qualitative analysis. Weighing is described as "easy to learn but hard to describe." The student is warned never to interfere with the adjustment of the balance and is referred to textbooks on Physics for information concerning the testing of weights and to the instructor for information concerning the balance.

Chapter I (54 pages) covers typical procedures in gravimetric analysis. Solubility relations are discussed and the solubility product is explained. Slight reference to the common ion effect and formation of complex ions is made but in the next breath the student is told that 0.15 mg. of silver chloride dissolves in 100 cc. of pure water, 0.02 mg. in the same volume of 1% hydrochloric acid, 0.35 mg. in 5% hydrochloric acid and 5 mg. in 10% hydrochloric acid. Then, probably to warn the student against too much faith in chemical theory, he is told that considerable alkali chloride often prevents complete precipitation of the copper group by hydrogen sulfide. The computation of analytical results is not discussed but the student is referred to the logarithm tables of Küster and Thiel for such information. He is advised not to use characteristics in logarithmic calculations but to find the position of the decimal point by rough arithmetic.

The order of treatment is unique and is said to be based upon the relative importance of each method. The first procedure is the determination of iron and this is followed by aluminum and then chloride. It is pointed out that the silver chloride precipitate can be used for the determination of silver and that silver bromide or iodide is like the chloride. Then, on the sixth page of laboratory directions, the determination of the atomic weight of silver is discussed as carried out by Richards and Mueller in 1907. The work of Britton on the  $pH$  values for the precipitation of hydroxides is mentioned but in the list of texts neither Britton's book nor that of any other Englishman is mentioned. The U. S. A. fares rather better in this respect for of the ten authorities who are quoted ten or more times in about 450 references Hillebrand is mentioned 20 times, Kolthoff 14, Lundell 12 and J. Lawrence Smith 10. No authority is quoted more than Hillebrand and several procedures are taken from the text by Kolthoff-Sandell published in 1936. These numbers refer to the entire book. Under copper, which is the fifth element considered, the determination as cuprous sulfide and cupric oxide is placed before the electrolytic procedure. In this chapter on Gravimetric Analysis there are 15 sections which end with a discussion of precipitations with cupferron, dimethylglyoxime, nitron, 8-hydroxyquinoline, anthranilic acid, pyridine,  $\alpha$ -nitroso- $\beta$ -naphthol, dicyandiamidine and benzidine. For all these analyses, accurately measured solutions are dispensed

by the laboratory assistant and a convenient device for making the measurements is shown in the Introduction.

Chapter II deals with volumetric analysis; neutralization, oxidation with permanganate, bromate, ceric sulfate and potassium dichromate, iodometry, reduction with titanium trichloride, precipitation methods and electro-metric titrations are discussed in the order named. No attention is paid to calculations but it is stated that concentrations expressed with reference to normal solutions are simplest. Eight pages are devoted to acidimetry and alkalimetry. The sodium carbonate method of standardizing an acid is explained but no other method is recommended for the direct standardization of either acid or base. Ionization constants are not mentioned nor is the  $pH$  at the end-point emphasized sufficiently. Under oxidation methods a table of six normal potentials is shown but the Nernst rule is not given and the section on electro-metric titrations is weakened because of the avoidance of mathematics.

The remaining eight chapters are concerned with the analysis of minerals, ores, fertilizers, alloys, metallurgical products and silicates. The methods chosen are invariably good and always with the aim to provide the student with suitable methods for practice covering the different types of procedure which include fusion with alkali carbonate, alkali bisulfate, caustic alkali, sodium carbonate and sulfur, etc. It is not intended that the book should be a reference book for the practised analyst.

The book is an excellent text. It is well written from a scholarly standpoint but with emphasis on practical results rather than education in chemical theory. One of the authors worked under W. F. Hillebrand and under C. I. Winkler. The influence of these men is plainly shown. The methods selected have been chosen largely as a result of experiences at the Universities of Göttingen, Kiel and Breslau, the *Bergakademie* at Clausthal, the technical school at Hannover, and various technical plants. It is seldom that a book reflects so well both scientific and technical work. The omission of mathematical theory seems to be the greatest fault. Sometimes the methods chosen are not the best, as is illustrated by the fact that the only method given for the determination of carbon in iron or steel is the wet combustion method of Corleis which our steel plants have found less useful than direct combustion in an electric furnace.

The book, reflecting as it does current German practice, explains why so many of the young men who have left the German schools to study in other countries are often unusually well prepared with respect to analytical procedures but ill prepared with respect to theory and chemical calculations. Every teacher of analytical chemistry will profit by reading and studying the book. If translated into English as a college text, it would not find many adoptions.

WILLIAM T. HALL

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**Theoretical Electrochemistry.** By N. A. MCKENNA, B.A. (Oxon). D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1940. xiii + 469 pp. 109 figs. 14.5 × 22 cm. Price, \$5.50.

The title "Theoretical Electrochemistry" is descriptive of the contents of the book. It is primarily a discussion of

the theories with emphasis on the modern Debye theory of interionic attraction. McKenna has included some description of the experimental apparatus and technique, but these digressions from the theoretical treatment are relatively brief. An extreme example of this under-emphasis of the experimental side of the subject is that the allusion to the glass electrode is limited to five lines of text and four references to the literature in a footnote.

McKenna seems to be prone to omit definitions of important words or concepts when they are first used or to be vague or inexact in their definitions. Thus, for example, the first definition of the  $pH$  which the reviewer has been able to find is in the heading of a table on page 432, after the symbol has been used many times. The concept of "activity" and the related "activity coefficient" cause difficulty in the minds of students because of the abstract character of the concept and of the choice of the standard state and the influence of the units used. In this book there is an additional and needless source of confusion because the author does not clearly distinguish between the "activity coefficient" and the "osmotic coefficient." His first definition on page 24 would equally well cover both and in many places he says "activity coefficient" for "osmotic coefficient" although later he defines each correctly.

Another concept that is troublesome for students is the "time of relaxation" of the Debye theory. On page 51 he says "Now, if an ion is removed to infinite distance from its surrounding electrolyte, its ion atmosphere will disappear. The time interval required for the ions to return to a random distribution is called the time of relaxation,  $\tau$ , of the ion atmosphere. It is equal to the time required to build the ion atmosphere up again when the ion is returned in the absence of any external field." This is followed within a few lines by the correct algebraic expression for the time of relaxation. But there is no hint to the student that since the ion atmosphere approaches its final statistical condition asymptotically with respect to the time, a useful definition of the time of relaxation must cut off the time at some convenient fraction of the total transformation. The time of relaxation should be defined as the time required for the potential due to the ionic atmosphere to fall to  $1/e$  part of its original value after the removal of the central ion. The analogy with the definition of the "half life" of the radioactive elements might be helpful to the student.

His discussion of the measurement of the conductance of solutions of electrolytes by the alternating current technique abounds in blunders. His analysis is based on the premise that the reactances to be dealt with in the bridge are primarily inductive reactances, although a capacitive reactance is correctly ascribed to the cell. If the only resistance coils available were wound as a helix on a metal tube as support this might be true but modern commercially available resistance coils are wound in such a way that they are substantially pure resistances. The inductance can be made so small that at audio frequencies the very small unavoidable reactance is capacitive rather than inductive. His discussion is, therefore, quite inconsistent with the practical realities of the proper modern technique. He says "Capacity errors in the bridge itself are avoided by earthing the bridge and introducing inductances on both sides, one variable on the same side as the cell and one fixed on the opposite side." As a matter of

mathematical theory the unavoidable capacitive reactance of the cell can be compensated by introducing a variable inductor in series with the cell and in the same arm of the bridge; but this is from a practical point of view a very poor way to do it. He does not describe the commonly used and much better method of compensating for the capacitive reactance of the cell due to incomplete reversibility of the electrode processes by the use of a variable air condenser in parallel with an adjacent arm of the bridge.

His statement, "The resistance to be measured depends on the frequency" is misleading and inaccurate. The fact is that errors due to polarization, or to capacitive shunts, or to improper grounding are functions of the frequency; but if these errors are eliminated by proper design the true resistance of the electrolyte is independent of the frequency within the audio range.

His mathematical analysis of the conditions of the bridge balance contains gross errors. The fundamental premise of his derivation (his equation 42) is wrong, apparently due to a misunderstanding of the modifications which it is necessary to incorporate into the conventional form of Ohm's law in order to make it applicable to circuits containing inductance and capacity and variable or alternating power sources.

He says (page 63) "For the general case of an alternating potential difference of frequency  $p$  the e. m. f. at time  $t$  is given by

$$i. e., \quad \begin{aligned} E &= E_0 e^{ipt} \\ \frac{\partial E}{\partial t} &= jpE_0 e^{ipt} \end{aligned} \quad (43)$$

where  $j = \sqrt{-1}$ . The operator  $\partial/\partial t$  may therefore be replaced by  $jp$ ." Then he proceeds to use the relationship  $\partial q/\partial t = jpq$  where  $q$  is the charge on the electrodes, and a different function of the time than the assumed function which he uses in his alleged proof. In these few lines there are three blunders. First, wherever the frequency appears in the equations of the alternating current theory it should be multiplied by  $2\pi$ , so that the frequency is expressed not in cycles per second but as an angular velocity in radians per second. Second, if he prefers to replace the usual expression for variation of voltage with time,  $E = E_m \sin 2\pi pt = E_m \sin \omega t$  by its equivalent exponential form, he should use the correct relationship, namely,  $\sin x = (e^{ix} - e^{-ix})/2j$ ; rather than the incorrect relationship  $\sin x = e^{ix}$  which he uses. Third, his conclusion from his differentiation of one erroneous function that he can write  $\partial q/\partial t = jpq$  is a mathematical absurdity.

The lines quoted above are followed by more than a page of complicated mathematics leading to what purports to be the condition of balance of a bridge (his equation 52). In this equation the resistance and inductance of one ( $R_3$  and  $L_3$  in his notation) of the four arms of the bridge do not appear at all. This obviously absurd result cannot be obtained from the previous equation without at least one more mathematical blunder or a misprint.

The book is modern in the sense that the subject is discussed primarily from the point of view of the Debye Theory of Interionic Attraction rather than the classical Arrhenius Theory. It is more factual and less difficult mathematically than Falkenhagen's "Electrolytes." Students who have difficulty in reading Falkenhagen may find this work a helpful introduction.

Some professors delight in setting examination papers containing a large number of statements—some correct, some obviously wrong, and some wrong in a subtle or inconspicuous detail—and then requiring the student to mark them "correct" or "wrong." An advanced student might obtain good practice for this type of examination by a critical reading of this book.

GRINNELL JONES

**Fermentos.** (Enzymes.) By JOSE GIRAL PEREIRA, Professor extraordinary at the Polytechnic Institute (Mexico). Former Professor of Biological Chemistry at the University of Madrid. Casa de España, Mexico, D.F., printed and made in Mexico by Fondo de Cultura Económica, Avenida Madero 32, 1940. 239 pp. 16.5 × 22.5 cm.

This book is an extensive and thorough compilation of the complex subject of ferments and enzymes. It is divided into three parts, the first dealing with general theory, methods of preparations and some industrial applications, the second with systematic description of some fifty enzymes and the last with special cases such as alcoholic fermentation, muscular enzymes, the cancer cell and muscular contraction in its biochemical aspect. The author intends it for the use of physicians, pharmacists, biologists, chemists and manufacturers (*industrialistas*). The reviewer doubts, however, that many, outside the field of enzyme specialists, could follow the complicated and highly specialized chemistry of the subject matter. To these, however, particularly if removed from library facilities, the book will be a help.

The book is well printed but the proof reading of organic structural formulas leaves much to be desired. Many pentavalent carbon atoms are to be found (*e. g.* pp. 80, 124, 129, 217); a trivalent one (p. 79) and a divalent hydrogen (p. 31) in the formula for  $\alpha$ -glucose were noted by the reviewer. The formula for  $\beta$ -glucose on page 31 is not correct, as the only difference between  $\beta$ - and  $\alpha$ -glucose should be in the position of the OH and hydrogen in the first carbon atom. It is not clear what the author means by the pyrrole formulas in the condensation reaction on page 113. An index would have been a very helpful addition.

Considering the numerous structural formulas in the text, the percentage of errors is small and on the whole the book is conscientiously and ably written. It is gratifying to welcome such an addition to chemical literature in the Spanish language.

J. ENRIQUE ZANETTI

## BOOKS RECEIVED

March 10, 1941–April 10, 1941

EUGEN BAMANN and KARL MYRBÄCK. "Die Methoden der Fermentforschung." Lieferung 6. Georg Thieme Verlag, Rosspatz 12, Leipzig C1, Germany. 335 pp. RM. 25.20.

NICHOLAS D. CHERONIS. "Organic Chemistry. An Introduction to the Carbon Compounds." Thomas Y. Crowell Co., 393 Fourth Avenue, New York, N. Y. 728 pp. \$4.00.

WILHELM EITEL. "Physikalische Chemie der Silikate." Second edition. Johann Ambrosius Barth Verlag, Salomonstrasse 18B, Leipzig C1, Germany. 826 pp. RM. 54, bound RM. 56.70.

F. STANLEY KIPPING and F. BARRY KIPPING. "Perkin and Kipping's Organic Chemistry." Parts I, II and III. Third edition. Thomas Y. Crowell Co., 393 Fourth Avenue, New York, N. Y. 1027 pp. \$6.00.

E. K. MARSHALL, JR., JOHN S. LOCKWOOD and RENÉ J. DUBOS. "Chemotherapy." University of Pennsylvania Press, Philadelphia, Penna. 42 pp. \$0.50.

L. S. McCLUNG and ELIZABETH MCCOY. "The Anaerobic Bacteria and their Activities in Nature and Disease. A Subject Bibliography." Supplement 1, Literature for 1938 and 1939. University of California Press, Berkeley, California. 244 pp.

E. B. MILLARD. "Physical Chemistry for Colleges." Fifth edition. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 600 pp. \$3.75.

F. F. NORD and C. H. WERKMAN. "Advances in Enzymology and Related Subjects." Volume I. Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y. 433 pp. \$5.50.

F. F. NORD and R. WEIDENHAGEN. "Handbuch der Enzymologie." Vols. I and II. Akademische Verlagsgesellschaft, Becker and Erler Kom.-Ges., Leipzig, Germany. In the U. S. A., Buchhandlung Gustav Fock, 145 West 44th St., New York, N. Y. 1545 pp. \$38.50.

FRANCIS EARL RAY. "Organic Chemistry." J. B. Lippincott Co., 333 West Lake St., Chicago, Illinois. 706 pp. \$4.00.

MANFRED RICHTER. "Grundriss der Farbenlehre der Gegenwart." Band 51 der "Wissenschaftliche Forschungsberichte." Verlag von Theodor Steinkopff, Dresden-B1., Residenzstrasse 32, Germany. 226 pp. RM. 11.25, bound RM. 12.38.

THOMAS M. RIVERS, *et al.* "Problems and Trends in Virus Research." University of Pennsylvania Press, Philadelphia, Penna. 75 pp. \$0.75.

MILTON SILVERMAN. "Magic in a Bottle." The Macmillan Co., 60 Fifth Avenue, New York, N. Y. 332 pp. \$2.50.

LYNN THORNDIKE. "A History of Magic and Experimental Science." Volumes V and VI. "The Sixteenth Century." Columbia University Press, Morningside Heights, New York, N. Y. 695 and 766 pp. \$10.00.