

as learned. His six chapters range from elementary arithmetic to differential equations, and touch upon such things as friendly numbers, magic squares, the transcendency of π , Tartaglia's rhymed rule for solving a cubic, and so on. Altogether, the book is written in a light and elegant style, reminding us of Lucas; it is neither so technical, nor so critical, as its title might suggest.

Sometimes we are inclined to think that the author is poking fun; for instance (p. 50), he suggests that 0 (zero) is the initial letter of *οὐδέν*! It is scarcely necessary to say that the Greeks adopted the decimal notation, including zero and the nine other digits, after it had been invented by Eastern (probably Indian) mathematicians; and that our zero is almost certainly an enlargement of the dot which is still used by Oriental printers (unless the dot is a contraction for an older circle).

"Bernouilli," instead of Bernoulli, occurs so often that it can scarcely be condoned as a misprint; "Neper" we let pass, as a traditional misspelling; otherwise the names of authors seem to be correct. This is a small matter; a much more important fact is that the author, besides being interested in the discoveries of the ancients, is fully awake to the merits of the moderns. For instance, we have the modern definition of "function"; references to the modern theories of irrational numbers, of functional equations, and the like.

It is interesting to see from the preface that this book is intended to be a "repertorium" for "débutants en mathématiques." As a repertorium it is certainly not one of formulæ; so it must be judged as one of ideas, and since it begins with a quotation from Plato's "Republic," we may suppose that this is what the author means.

From this point of view, the author may be congratulated, because the ideas which he suggests are eternal, though the forms under which he presents them are merely those which seem for the present the most convenient and suitable. One great advantage of the historical treatment of the subject is that it shows how what we may call the machinery of the subject has been improved and simplified.

Prof. Boutroux promises us another volume dealing mainly with analytical geometry, mathematical logic, and infinitesimal calculus; it will also deal with complex quantities and series. Teachers will note that the range of the whole work approximately covers the course of general mathematics in the science faculties of the higher educational bodies in France.

G. B. M.

ANALYTICAL AND SYNTHETICAL CHEMISTRY.

- (1) *Industrial Organic Analysis: for the Use of Technical and Analytical Chemists and Students.* By Paul S. Arup. With a foreword by Prof. J. C. Irvine. Pp. xii+340. (London: J. and A. Churchill, 1913.) Price 7s. 6d. net.
- (2) *A Text-book of Quantitative Chemical Analysis.* By Dr. A. C. Cumming and Dr. S. A. Kay. Pp. xi+382. (London: Gurney and Jackson; Edinburgh: Oliver and Boyd, 1913.) Price 7s. 6d. net.
- (3) *The Sugars and their Simple Derivatives.* By Dr. J. E. Mackenzie. Pp. xvi+242. (London: Gurney and Jackson; Edinburgh: Oliver and Boyd, 1913.) Price 7s. 6d. net.
- (4) *The Silicates in Chemistry and Commerce: including the Exposition of a Hexite and Pentite Theory and of a Stereo-chemical Theory of General Application.* By Dr. W. Asch and Dr. D. Asch. Translated, with critical notes and some additions, by Alfred B. Searle. Pp. xx+456. (London: Constable and Co., Ltd., 1913.) Price 21s. net.
- (5) *Die Elemente der siebenten Gruppe des periodischen Systems: aus Abegg's der anorganischen Chemie.* Vierter Band. Zweite Abteilung. Herausgegeben von Dr. Fr. Auerbach. Pp. x+904. (Leipzig: S. Hirzel, 1913.) Price 26 marks.

(1) **T**HIS volume is intended for the use of students who, having received a grounding in theoretical and practical chemistry, are desirous of gaining an insight into the methods of industrial organic analysis. Eight typical series of commercial organic products have been selected, and detailed instructions are given of the analytical processes employed in determining the industrial value of the materials under consideration. The subjects chosen include coal and coke, coal tar and its distillation products, the petroleums, the fatty oils and fats, soap, milk, butter, starch and its degradation products, flour, barley, malt, and the preservatives and colouring matters introduced into foods. One very valuable feature of the book is the references to the larger manuals and special monographs given at the end of each chapter.

In the foreword Prof. Irvine deals with the controversial topic of the college training of industrial chemists. The subject was not new thirty years ago, and although the discussion is unending there is really no general problem to be faced; still less is there any general solution to be provided. Experts differ, and the weighty opinions of Prof. Martin (*sic*) Bogert, President

of the Society of Chemical Industry, should be balanced against those of Dr. Messel, his predecessor in this office. The workings of the latter's mind in this connection are adumbrated in the recent creation of two additional Chairs of "pure" chemistry in the Imperial College of Science and Technology. However, if some degree of technical proficiency is insisted on, the student cannot do better than to work through a selection of Mr. Arup's thoroughly practical exercises in industrial analysis.

(2) The authors have arranged this manual so that some knowledge of the principles of quantitative analysis may be acquired by a practical study of the three introductory sections, which include general principles, volumetric analysis, and gravimetric analysis, including electrolytic methods. Owing to its educative value, a thorough training in volumetric analysis is recommended when time permits of little or no gravimetric work. The exercises included in the volumetric section form a very instructive and comprehensive series, involving the use of all the ordinary standard solutions. In view of the great importance attached by the authors to this side of analysis, it is perhaps allowable to suggest that a short description of the chemical nature of the organic indicators (methyl-orange, methyl-red, phenolphthalein) would have made the volumetric section more self-contained. The preliminary chapters are followed by sections devoted to colorimetric methods, systematic quantitative analysis, and the analysis of simple ores and alloys. Modern methods have been selected, among which may be indicated the estimation of potassium as perchlorate and the separation of iron from allied metals in acid solution by the use of "cupferron," the ammonium salt of nitrosophenylhydroxylamine. The appendix contains details of the preparation of this useful organic reagent. The section on gas analysis refers to the use of the simpler forms of apparatus, such as the Lunge nitrometer and the apparatus devised by Hempel and by Orsat. Water analysis is included as an introduction to the estimation of substances present only in traces. The short section on ultimate organic analysis would have been rendered more complete by a brief reference to the Carius method for the halogens and sulphur. The determination of molecular weights includes details of the vapour density, cryoscopic and ebullioscopic methods.

(3) This treatise is a very readable monograph on the sugars and their immediate derivatives, based on a course of lectures given at the Birkbeck College and in the University of Edinburgh. Rightly on account of their intrinsic importance

three chapters each are devoted to cane sugar and glucose, these sections being a mine of information in regard to these well-studied sugars. Among the many researches summarised may be mentioned those on the methyl glucoses, the methyl glucosides, and their acetyl derivatives. One very interesting chapter is that relating to the configuration of the sugars, in which the stereochemical relationships of these compounds are fully discussed. Succeeding chapters deal with dioses, trioses, tetroses, pentoses, together with the naturally occurring mannose, *d*-fructose (lævulose), and raffinose. The less important synthetic sugars are also reviewed. A synopsis is furnished of the glucosides found in plants, and the concluding sections deal with fermentation and with the metabolic changes attending the use of sugars and allied carbohydrates as foodstuffs. References are given throughout to original sources of information, and the work is provided with complete author and subject indexes.

(4) It is impossible within the space available to discuss in detail the hexite-pentite theory devised by the authors, in the first instance, to explain the constitution of the naturally occurring aluminosilicates, and subsequently employed to elucidate the chemical structure of clays, ultramarines, glasses, glazes, porcelains, dental cements, hydraulic cements, and especially Portland cements. It is assumed that five or six molecules of hydrated silica, $\text{Si}(\text{OH})_4$, unite with partial elimination of water to form cyclic systems containing five or six silica residues, these complexes being termed respectively silicon pentite and hexite. Aluminium pentite and hexite arise in a similar way by the condensation of five and six molecules of hydrated alumina, $\text{Al}(\text{OH})_3$. The mineral aluminosilicates are regarded either as complex acids composed essentially of combinations of these silicon and aluminium pentite and hexite rings, or as salts of these acids when the hydroxylic hydrogens are more or less replaced by metallic elements. The felspars, micas, scapolites, etc., need no longer be regarded as molecular compounds belonging to different mineral groups; they can all be represented as unitary atomic compounds of the same class with definite structural formulæ. A similar hexite-pentite hypothesis is employed to explain the constitution of vanadic, molybdic, and tungstic complexes.

The translator, who has added several instructive and critical notes, doubts whether the authors are justified in extending their views to explain the plasticity of clays. The authors' theory has already been criticised by several writers, and

the present volume contains many polemical replies, notably in connection with the constitution and hardening of Portland cements. These hydraulic cements are considered to be basic lime salts of complex aluminosilicic acids containing coalesced hexite and pentite rings with calcium oxide side-chains replacing the hydroxyls of the hydrated silicon complexes, and occasionally containing alkali metals similarly attached to the aluminium hexite rings.

It is highly probable that the refractory oxides, silica, alumina, and their allies exist in highly complex molecules, and since among both inorganic and organic compounds there exists a certain tendency for the formation of five- and six-membered rings, it would probably be accepted by most chemists as a working hypothesis that such cyclic systems occur in the natural and artificial aluminosilicates and their derivatives, but it is open to doubt whether the authors do not greatly prejudice their case by attempting to extend this hypothesis to the explanation of the facts of coordination, radioactivity, and the constitution of organic substances, such as benzene, the artificial colouring matters, and the proteins.

(5) The appearance of this volume is a welcome indication that this monumental treatise on inorganic chemistry will be brought to completion in spite of the untimely death of its originator, the late Prof. Richard Abegg. There still remain for consideration, however, several important groups of elements, and the remaining volumes of the work are eagerly awaited by all interested in the systematic study of the chemical elements. A praiseworthy feature of the treatise so far as it has yet appeared is the thoroughness with which the compilers have accepted the periodic classification of the elements; this insures uniformity of arrangement, and renders the task of reference a very easy one. It is rarely necessary to turn to the indexes. The present volume is devoted to the halogens and manganese, the elements of the seventh periodic group. In the case of each element the opening section deals with the determination of its atomic weight. The descriptions of the physical and chemical properties of the elements and their compounds are very complete, and include, in addition, the mathematical treatment of many important examples of chemical equilibria, such as the Deacon's chlorine process, the variations in the vapour density of the halogens and their partition coefficients in various solvents. Special sections deal with the colloidal chemistry of the halogens and manganese.

The bibliography is remarkably full, there being more than fifteen hundred references for iodine

and its derivatives alone. Manganese varies considerably in its habit of combination, and its compounds are arranged whenever possible under the headings of the various valencies of the metal, but reference is also made to its alloys, and to compounds in which the valency of the metal is undetermined.

G. T. M.

TEXTILES.

Textiles: a Handbook for the Student and the Consumer. By Mary S. Woolman and Ellen B. McGowan. Pp. xi+428. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 8s. 6d. net.

THIS book strikes a new note from an educational point of view, and represents a serious attempt to present a course of instruction to students who intend to make some branch of textile work their future business, or who are, or will be, the buyers of textiles for personal or household purposes. Whilst its strongest appeal is to students of the type mentioned, the matter is so arranged that it offers a mass of information to a wide range of readers who are out of touch with technical methods, and yet are seriously concerned and interested about the character of the textile materials they sell, purchase, or use. It fills the wide gap at present existing in the domestic economy course of instruction in our colleges and schools, and as it deals with practically all kinds of fibres and the textiles into which they are made, it presents in a most interesting manner a remarkably concise and exact description of the methods and machinery used for producing the various materials.

Unusually full details are given for distinguishing the constituents of any textile material, to detect frauds and to estimate value. The character of the various types of dyes and their use, together with notes on finishing and laundry work, add materially to the value of the book. The last three chapters deal with the hygiene of clothing, economic and social aspects, and a series of clothing budgets, these latter being unusually complete and valuable as guides in the laying out of money the clothing of families and individuals of various degrees of economic status.

The book represents a well-defined arrangement of accurate information gathered from a multitude of sources, chiefly of a highly technical nature, and rewritten in a simple and interesting manner with a very clear view to their utilisation by those who are, after all, the consumers of all that is produced by the vast number of our textile factories and workshops, and on whom these in-