including those of Schlenk and his co-workers [Schlenk and Weickel, *Ber.*, **44**, 1182 (1911); Schlenk and Thal, *ibid.*, **46**, 2840 (1913)] are now being critically studied.

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NEW BOOKS

An Introduction to Chemistry. A Pandemic Text. By JOHN ARREND TIMM, Assistant Professor of Chemistry, Yale University. With a Foreword by John Johnston. McGraw-Hill Book Company, 370 Seventh Avenue, New York, 1930. xviii + 561 pp. 161 figs. 14.5 × 21 cm. Price, $3.50.

Those who are seeking something different in the way of presenting first-year chemistry will be interested in this book. It is an outgrowth of a course given at Yale for those students who desire to broaden their educational horizon by the acquisition not only of some of the pertinent facts of science but an understanding of some of the modern theories of chemistry and physics. It is not intended for those students who plan to take further training in the subject. The author has well stated in his Introduction that "A well-balanced life results from the cultivation of all of its moods. The risks of living too exclusively in any one of them are too great for any but the genius to take. In education none of these moods should be neglected. The student who studies literature and the humanities exclusively, is as ill-cultured as he who cares for science alone." And, further (from the Foreword by John Johnston), "This course endeavors, not to give the student a contemporary command of assorted facts relating to restricted classes of substances, but to correlate, and to explain in simpler terms, some of the chemical and physical phenomena which he encounters every day."

To those orthodox teachers who have always regarded chemistry essentially as a laboratory science, the idea of giving a year's course in introductory chemistry without laboratory work, without the practice of writing equations ("a cruel waste of time"), and without the working of problems, will come somewhat as a jolt. The author is certainly to be commended for his boldness in breaking away from all tradition. In choice of material, its arrangement and method of presentation, the author has thrown aside all that is conventional and, it must be admitted, has produced a book that is both informative and interesting.

The reviewer believes that if the lower seventy-five per cent. of the class of students who will desire to take a "pandemic" course in chemistry could be eliminated this would be a most excellent text. It is difficult for

him to believe that, in the hands of the average teacher, this book will be suitable for the "mine run" of students—students who are not primarily interested in chemistry and who, in general, are likely to have aptitudes for science which are below the norm for chemistry students. It may be that in the hands of the author and with a selected group of students this text with its relatively large amount of advanced material can be used with success, but the reviewer feels that for the average college freshman this text will prove to be a very heavy diet. Upper class students who have had an introductory course in chemistry in the high school followed by a course in physics in college could undoubtedly assimilate the material under the guidance of an inspirational teacher. The reviewer believes that the giving of such courses to selected groups should be encouraged. The larger universities are in a position to do this effectively. It is unfortunate that most of our curricula are devised for the *average* student and that the superior student is not encouraged to put forth his best effort. The book is one which every teacher of introductory chemistry should own—and use, for in it he will find much that is helpful.

J. H. MATHEWS

Physics of the Earth. IV. The Age of the Earth. By the Subsidiary Committee on the Age of the Earth. Division of Physical Sciences with the Coöperation of the Division of Geology and Geography and American Geophysical Union, National Research Council. Bulletin of the National Research Council, June, 1931, Number 80. Published by the National Research Council of the National Academy of Sciences, Washington, D. C., 1931. v + 487 pp. 17 × 25 cm. Price, paper, $4.50; cloth, $5.00.

In this book there have been brought together in one volume for the first time the essential data upon which are based the various methods for estimating the age of the earth's crystal rocks. It is much more than a mere compilation, however. The book consists of five parts, each the work of an outstanding specialist who alone has been responsible for his particular part. The contributing authors have evidently devoted much time and labor to the production of admirably comprehensive and critical reviews of the present status of their special subjects. Copious abstracts, references and bibliographies are given, rendering the book invaluable as a reference work.

Part I on "The Age of the Earth on the Basis of Sediments and Life" has been written by Charles Schuchert, who has made a most exhaustive examination and revision of the data bearing on the thickness of sediments and their rate of deposition with the result that the new age figures for this classic geological method are now more in harmony with those derived from the radioactive method. Professor Schuchert concurs with the general opinion as to the uselessness of the biological or palaeonto-

logical method based on estimates of the length of time supposedly required for the evolution of various living organisms.

Part II on "The Age of the Ocean" by Adolph Knopf shows conclusively that the method based on sodium accumulation in the ocean cannot be expected to yield reliable results.

In Part III on the "Age of Minerals from Radioactivity" Alois F. Kovarik presents a very complete and valuable new mathematical treatment of the problem of calculating the age of radioactive minerals and a "Critique of the Values of the Disintegration Constants."

Part IV, "Radioactivity and Geological Time," by Arthur Holmes, constitutes the largest and most important part of the book as a consequence of the preëminence of this method and the immense related literature already in existence. Professor Holmes, evidently at the cost of tremendous labor, has produced what must be generally admitted to be the most comprehensive, stimulating and useful work on the subject to date.

Part V, "The Age of the Earth from Astronomical Data," by Ernest W. Brown, deals with the astronomical data which have a bearing on the age of the earth.

A six-page summary by Professor Knopf of the main conclusions arrived at throughout the book is a valuable feature which will be of general interest.

The book has been written, it is stated, "to give to the reader, presumably a scientist, but not a specialist in the subject, an idea of its present status together with a forward-looking summary of its outstanding problems." This purpose has been more than fulfilled. The book will be indispensable to workers in this field.

H. V. ELLSWORTH

Gmelins Handbuch der anorganischen Chemie. (Gmelin's Handbook of Inorganic Chemistry.) Edited by R. J. MEYER. Eighth edition. **Strontium.** System—number 29. Issued by the Deutsche Chemische Gesellschaft. Verlag Chemie G. m. b. H., Corneliusstrasse 3, Berlin W 10, Germany, 1931. xxx + 239 pp. 26 figs. 17 × 25 cm. Price, to subscribers, Mk. 36; singly, Mk. 41.

This volume follows the lines of the earlier instalments of this invaluable handbook. Since strontium is number 29 in the numerical system of presentation here followed, this volume covers the element itself and its compounds with all the non-metals and many of the metals, in other words, practically all of the chemistry of strontium.

The only subject that I noticed to be missing was statistics as to the production, consumption and uses of strontium and its compounds.

The book is the joint achievement of some seven collaborators and the literature has been covered up to August 1, 1931.

ARTHUR B. LAMB

An Introduction to the Principles of Physical Chemistry. By O. MAASS, Professor of Physical Chemistry, and E. W. R. STEACIE, Assistant Professor of Chemistry, McGill University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, 1931. vii + 269 pp. 62 figs. 15.5 × 23.5 cm. Price, $2.75.

This book is intended for students who have had elementary courses in chemistry, physics and mathematics but who have not had calculus. It embodies material given in a course of about fifty lectures at McGill University for students intending to make chemistry their profession, chemical engineers as well as pre-medical and biology students. Whether it is wise to follow a thorough freshman chemistry course by a course in physical chemistry not using any calculus at all is an open question, although the authors feel that "This makes possible a better appreciation of more advanced and detailed courses in physical chemistry, since the student thus has several years in which to assimilate the fundamental ideas."

If one grants the authors' contention that a course of this type is desirable, one must be prepared to admit that the book is exceedingly well adapted to its purpose. The real difficulty lies in the fact that the complete avoidance of even the simplest differentials and integrals necessarily leads to a highly qualitative treatment of certain matters which could be given easily in a rigorous fashion and to the introduction of formulas for which the student cannot hope to understand the origin. Thus the connection between simple reaction rate equations and their integrated forms must remain obscure to the student who knows nothing of integration. Other examples could be cited. It is perfectly true, however, that all elementary courses in physical chemistry must encounter this difficulty to a greater or less extent whether or not calculus is required as a prerequisite.

The introductory chapter contains an excellent discussion of the objects and limitations of science, the scientific method, half truths and inexact laws, the empirical and mechanistic points of view, etc. This chapter is well worth reading and many of the statements made in it are all too little appreciated by the average scientific worker.

The remaining chapters treat most of the subjects which are ordinarily included in an elementary course in physical chemistry.

Even if it is granted that there is some tendency to neglect the so-called old fashioned physical chemistry and introduce too much discussion of new developments, one feels that the present book might well have contained more reference to new points of view. For example, one finds only a brief reference to current views concerning strong electrolytes, but their degrees of dissociation as determined by conductivity and freezing point methods are used in most of the discussion. The student might get the impression that the simple ideas advanced in the early days of the ionic theory are perfectly all right for dilute solutions. Later when the aberra-

tions from Ostwald's Dilution Law are discussed one would begin to realize that something is wrong somewhere. It would seem that even without any mathematics one could introduce more of the point of view of modern physical chemistry in this respect. The entire treatment of the origin of the electromotive force at metal–solution interfaces seems to be based on the idea that one can determine the difference in charge between a single electrode and a solution. A more rigorous treatment of the subject of cells might have been given.

The phase rule is not mentioned as such and the discussion of heterogeneous equilibrium is very brief. The chapter on velocity of chemical reactions is very brief and lacks in rigor in certain places.

No mention is made at any place of such things as atomic structure, radioactivity, photochemistry and isotopes. Such omissions are probably not serious in the type of course for which the book was written.

In spite of the absence of mathematics and the consequent introduction of some things which the student will have to unlearn at a later date, the book is, on the whole, very clearly and precisely written. The general style is good and the elementary student will be sure to acquire a vivid appreciation of the reasoning which underlies the general subject. The authors have succeeded admirably in attaining the aims which prompted them to write the book.

W. ALBERT NOYES, JR.

The Structure of Line Spectra. By LINUS PAULING, Ph.D., and SAMUEL GOUDSMIT, Ph.D. McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York, 1930. x + 263 pp. 14.5 × 23 cm. Price, $3.50.

Although written primarily as a text for spectroscopists, this book should find a much wider field of application, since a detailed knowledge of energy levels and spectroscopic term values is becoming of increasing importance to chemists. After a brief introductory treatment of atomic theories, the authors proceed to a detailed development of the theory of line spectra, which occupies the greater part of the book. The Periodic System is discussed from the spectroscopic viewpoint and the concluding chapters deal briefly with x-ray spectra, nuclear moments and the theoretical work on the paramagnetism of ions.

The treatment is thorough throughout and as such will be more useful to those wishing a working knowledge of the subject rather than to the general reader. Experimental results are included only to illustrate the theory, no attempt having been made to give a complete summary of available data. The value of the book is best shown by the fact that it has already become the standard text on its subject.

HUGH M. SMALLWOOD