REVIEWS OF BOOKS.

Alchemy and other Chemical Achievements of the Ancient Orient.—The Civilisation of Japan and China in Early Times as seen from the Chemical Point of View. By MASUMI CHIKASHIGE. (Tokyo : Rokakuho Uchida, 1936. Pp. vii + 102. Price 1.50 yen.)

The author, who is Emeritus Professor of Kyoto Imperial University, has based his work on a Japanese edition published six years ago. The translation, by Professor Sasaki, is in excellent English and the book is written in an attractive and scholarly style. It deals with ancient Chinese alchemy and its relation to alchemy in other lands, with bronze articles and the analyses of ancient Chinese bronzes, and with Japanese swords. The last section throws light on the metallurgical processes used by famous sword makers. The book is illustrated with several plates, one in colour, and is of considerable interest from the point of view of the history of Chemistry and Metallurgy.

J. R. P.

Alloys of Iron and Copper. By J. L. GREGG and B. N. DANILOFF. (Pp. xii and 454. 30s. net.) **The Metal, Iron.** By H. E. CLEAVES and J. G. THOMPSON. (Pp. xii and 574. 36s. net.) McGraw-Hill Publishing Co. Ltd, London, 1935.

These two publications continue the series of monographs on Alloys of Iron which are being prepared by the Iron Alloys Committee of the Engineering Foundation under the able chairmanship of Dr. G. B. Waterhouse. They present critical summaries of published data bearing on the various alloy systems examined.

The effects produced by the addition of copper to iron or to steel have been commented on many times in the past, some of the statements made being misleading, to say the least. At one time, the presence of even small amounts of copper in steel was held to be highly detrimental, particularly to hot working properties. Nowadays, large tonnages of copper-bearing steels are regularly forged and rolled with perfect satisfaction.

The iron-copper alloys are interesting in many ways. The two metals alloy in all proportions by direct fusion, but at still higher temperatures, there is a miscibility gap which widens with increasing temperature. In the solid state, the metals form limited series of solid solutions. The extent of the liquid miscibility gap appears to be affected noticeably by impurities in the metal, particularly carbon, and the question has been raised as to whether, if absolutely pure metals were used, a miscibility gap would be formed.

Structural steels containing small amounts of copper are now being increasingly used on account of their greater resistance, as compared with ordinary carbon steels, to atmospheric corrosion, particularly in industrial areas. Copper is also useful in combination with small amounts of other alloys—chromium, molybdenum, manganese—in raising the tensile strength of certain structural steels without adversely affecting their ductility or workability to any notable extent. Such steels may contain up to about 0·5 per cent. copper.; when larger amounts are added,

e.g., 1·0/1·5 per cent., interesting precipitation hardening effects may be produced, though it is doubtful at present whether they have any economic value. An account of all these materials, and also of the effects of copper additions on the properties of cast irons and corrosion-resisting steels are given by the authors, with that completeness of detail which is a feature of this series of monographs.

The other volume deals with the attempts which have been made to produce iron as free as possible from all impurities, and with the properties of these high purified metals. As the authors state, perfectly pure iron has never been prepared, at least in useful quantities; consequently its properties, which should be the basis of investigations on the effects of alloys on iron, have never been determined. Iron of a very high degree of purity has, however, been produced in appreciable quantities, and the authors summarise very clearly the changes in properties which occur as the content of impurity is reduced. Perhaps the most interesting effects are produced on magnetic properties, but here the subject is complicated by the fact that much depends on the type of impurity as well as the amount. Thus, it has been shown that hydrogen-treated ingot iron may have magnetic properties far superior to those of annealed electrolytic iron of greater purity.

Much has been said in the past regarding the effect of impurities on the corrodibility of iron, and it has been frequently considered that pure iron would be relatively resistant to corrosion. It seems likely, however, that the effect of purity, as between very pure irons and commercial products, is usually less important than that of environment. Iron, even when pure, is not inherently resistant to corrosion; real resistance is only obtained by incorporating substantial amounts of other elements, *e.g.*, silicon, chromium, nickel, which modify appreciably the characteristics of the oxide film which, as Evans has shown, is produced on the surface of iron by contact with the atmosphere.

The authors give a very complete account of the various methods used in preparing iron of high purity and of the properties of the materials so produced; their book is a veritable storehouse of all the relevant information on these important subjects.

Metallurgists owe a debt of gratitude to the Engineering Foundation for financing the production of these very useful volumes, and to the Committee, who are responsible for their preparation, for the great care they take to ensure that the accounts given of each alloy system are as complete and accurate as the wit of man can devise. The series of volumes should be in every metallurgist's library.

The Organic Chemistry of Nitrogen. By N. V. Sidgwick. New Edition revised and rewritten by T. W. J. Taylor and W. Baker. Oxford: Clarendon Press, and London: Humphrey Milford, 1937. Pp. xix + 590. Price 25s. net.

The first edition of this book, published in 1910, has long been out of print and scarce, and the appearance of a new and completely revised edition is an event which will be greeted with satisfaction. The original edition was characterised by certain special and very attractive features, and these are again prominent in the new edition. Although written from

the point of view of organic chemists, and with satisfactory emphasis on the methods of preparation and reactions of the substances concerned, the book achieves a successful relation of descriptive material to fields of general theory and with the physico-chemical aspects of the whole subject.

The field of materials covered is really very extensive, although the purine derivatives and simple alkaloids have been omitted from this edition. The treatment is clear and closely related to experiment, so that the reader does not feel that he is lost in the complexities of the subject. It is obviously impossible to give an adequate account of the contents of the eighteen chapters of the book, but it may perhaps be mentioned that some of them contain material of great interest to biochemists, whilst the accounts of the diazo-compounds, azoxy-and azo-compounds, and the five- and six-membered rings will probably be of special interest to organic chemists. The printing and paper are excellent and the price is very moderate.

Thorpe's Dictionary of Applied Chemistry. Fourth Edition (vol. I., A–Bi). By J. F. THORPE and M. A. WHITELEY. (London: Longmans, Green & Co. Pp. xxvii and 703.) Price 3 guineas net.

Thorpe has been one of the most used books in the reviewer's library for many years. Less than two years ago the last volume of the Supplement to the third edition appeared, and it was scarcely to be hoped that, so soon, the editors would recommence their herculean task. The fourth edition is, however, under way and greatly will it be welcomed. Thorpe continues to grow; the new volume occupies forty more pages than were devoted to similar entries in the last edition with its supplement, the article on "Analysis" being presumably rechristened "Chemical Analysis" and left for a later volume.

The compilers have taken the wise step of building anew. This volume is rewritten almost in its entirety; in a few cases only, *viz.* the introductions to some of the articles, is the text taken from earlier editions. The general plan of the last edition is followed, however, and each entry consists of a monograph written by an acknowledged expert. Every year we may expect a new volume, until the task is completed; in order that the earlier volumes may be kept up-to-date, appropriate cross references in later volumes will be utilised to introduce the later acquired knowledge. This is admirable—as far as it goes—and is probably the only way in which such a series of volumes can be kept reasonably up to date, but it has the obvious weakness that only a few entries in vols. I. to IV. or so can hope to find relevant cross-entry under W, X, Y, Z. We may perhaps be permitted to wish the editors and their colleagues more power to their elbows and may all their years be little ones!

A detailed review of such a work is obviously impossible. Suffice it to say that the reviewer has spent many more hours than he intended in reading it and that he looks forward eagerly to the appearance of the next volume. If there be any who do not know Thorpe, it may be said that the word "Applied" in the title is of historical rather than real present significance. The fact that seven and a half pages are devoted to an article on "atomic structure" is sufficient indication that the monographs are very far from being confined to subjects only of industrial interest; where,

however, a subject involves industrial considerations, that interest is adequately dealt with. We have here, in fact, an alphabetically arranged series of monographs which will, as a rule, be readily understandable by any ordinarily cultured reader.

Applied Radiochemistry. By O. Hahn. (New York: Ithaca. Pp. xi and 278. Oxford University Press. Price 11s. 6d. 1936.)

This volume contains the substance of lectures delivered by the author as Non-Resident Lecturer at Cornell in 1933. Their field is wider than the title suggests: actually only part III and IV deal with "applied" radiochemistry in the usual sense, and more than the first half of the book is devoted to attempts at a theoretical systematisation of the chemical behaviour of the radioelements. But in so far as the rules found for them must hold good also for other elements present only in imponderable amounts, their study may be rightly said to be "applied" radioactivity. The book mainly embraces researches carried out under the author's guidance in the Kaiser Wilhelm Institute for Chemistry in Berlin-Dahlem; both their high value and their somewhat intricate nature will certainly make the collection very welcome to all chemists interested in radioactivity.

No less than 100 pages of part II are occupied by a discussion of the "Separation of Minute Amounts of Material when Macroscopic Precipitates are formed" and of the "Deposition of Minimal Amounts of Material upon Preformed Precipitates"; or, in other words, they deal with "Hahn's Precipitation and Adsorption Law." The author invariably calls the rules formulated by him "laws," while these postulated by earlier investigators are named "rules"; but this is only a terminological peculiarity without any deeper claim, as he himself points out that his "laws" have not the general applicability originally expected of them; and he further discusses fully the exceptions so far established. No analytical chemist will be astonished to hear that there are too many relevant factors (the solubilities of the two substances in question; the presence, or absence, of isomorphism, or isodimorphism; the area, and the electric charge, of the surface of the precipitate) to allow of the formulation of a strict law expressed in a short sentence; but all will agree that the extensive researches of the author and his co-workers have helped greatly to the clarification of these theoretically and practically important questions.

The contents of the later parts of the book are likewise too rich for more than a few indications to be given here. One of the most useful practical results of the author's studies on the emanating power of various gels containing radium salts is certainly the development of a device for obtaining highly concentrated radon from "dry preparations." If, as usual, the aqueous solution of a radium salt is used as a source, the purification of the radon from H_2, O_2, H_2O and CO_2 is rather a troublesome process; but if, on the other hand, one of Hahn's "dry preparations" (*e.g.*, Fe $(OH)_3$, containing $RaCO_3$, and freed from water by means of ethyl alcohol and ether) serves as a radon source, a very simple apparatus (containing, besides a few valves and a storage vessel, only an annexe filled with calcium filings and a spiral dipped in liquid air) makes it possible to obtain up to 85 per cent. of the equilibrium amount of radon in great purity.

There are many other interesting chapters in the book. Its author

has devoted more time than anyone else now living to the study of radiochemical problems. To possess some of his recent researches in such a well printed and excellently illustrated volume will be an inspiration to all others working in similar fields.

F. A. P.

Atomic Structure of Minerals. By W. L. BRAGG. (London : Humphrey Milford, Oxford University Press, 1937. Pp. xiii and 292. Price 18s. net.)

The George Fisher Baker Non-resident Lectureship at Cornell has been the means of publishing a number of books on various branches of chemistry. The present volume is a little removed from the ordinary in that it does not correspond to the author's course, but has been written as a contribution to the literature of that branch of crystallography which Professor W. L. Bragg has made particularly his own—the structure of inorganic substances.

The book falls into two distinct portions, the necessary parts of structural analysis, and a detailed account of mineral structures. It is most valuable to have so complete a discussion of the labours of the Manchester School and a conspectus of work all the world over in such a readable form. Full recognition is given to the difficulty of becoming proficient at " thinking in three dimensions " ; nevertheless, the diagrams reproduced are sufficiently numerous, as well as excellent, to help a great deal in acquiring the necessary skill. The reader is urged to prepare models for himself. This is a fascinating occupation, and one in which students can now indulge at a comparatively early stage in their career. It is interesting to notice how great is the debt which these modern developments owe to the methods of classical crystallography. Continuity has not been lost in passing from external form to internal arrangement.

A few points may be selected to show how wide, and yet at the same time how detailed a view these pages provide. The usual classification of forces (ionic, homopolar, metallic, van der Waals) is accepted as convenient, but having in itself no profound significance : the systems of nuclei and electrons are subject ultimately to minimal energy conditions alone, and thus " class distinctions " disappear. In this connection, it is salutary to recollect that the rigid expression for the heat of formation of rocksalt from separated sodium and chlorine atoms has not yet been obtained ; a useful caution against overlooking the limitations of simplified concepts.

A word or two must be added about the photomicrographs of orientated crystals upon mica (Plate VIII.). The subtlety and delicacy of this phenomenon are entrancing, as well as the analogous effect when an anisotropic melt is introduced between a couple of mica cleavage plates. This causes the optic axes of the melt to swing round, and demonstrates the presence of a glide plane, as opposed to a symmetry plane, in such a crystal.

Professor Bragg has brought system and order into what is otherwise a bewildering array of substances, and in the course of so doing has produced a book which many will desire to possess.

F. I. G. R.

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