NEW BOOKS

The Emission of Electricity from Hot Bodies. By O. W. RICHARDSON, F.R.S., Wheatstone Professor of Physics, King's College, London. Second edition. (Monographs on Physics, edited by Sir J. J. Thomson, O.M., F.R.S., Master of Trinity College, Cambridge, and Frank Horton, Sc.D., Professor of Physics in the University of London.) Longmans, Green and Co., 39 Paternoster Row, London; Fourth Avenue and 30th Street, New York; Bombay, Calcutta, and Madras. 1921. viii + 320 pp. 35 figs. 15 × 23 cm. Price $5.25 net.

The second edition of this excellent treatise will be welcomed by all those interested in thermionics, especially as the author's own contributions enable him to handle in the most authoritative manner a subject in the development of which he has been the recognized leader. The rapid advances in this field have justified a very considerable extension both experimental and theoretical beyond that of the first edition. The author confines himself to the strictly scientific phases, omitting the industrial applications. While this may be disappointing to some readers, it was rendered imperative by the wide applications of thermionics to amplifiers, rectifiers, detectors, etc., which makes their consideration impractical in a work dealing primarily with the physical and electrical properties of the thermal emission of ions and electrons. Following a general presentation of theory in the first two chapters, the succeeding ones deal with the temperature variation, the effect of gases on, and the energetics of, electron emission; with the emission of positive ions by hot metals, the effect of gases on such emission, and the emission of ions by heated salts. The final chapter treats the production of ions by chemical action. The converse subject of the possible chemical effects of ions is not discussed, nor are the electrical properties of flames.

S. C. LIND

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. By J. W. MELLOR, D.Sc. Vol. I. Longmans, Green and Company, Fourth Avenue and 30th Street, New York; 39 Paternoster Row, London; Bombay, Calcutta, and Madras; 1922. xv + 1065 pp. 274 figs. 16 × 25 cm. Price $20.00 net.

"This work aims at giving a complete description of all of the compounds known in Inorganic Chemistry, and where possible, these are discussed in the light of the so-called Physical Chemistry." The appearance of the first volume of the six or seven which are to make up this comprehensive work is a matter of considerable importance. Volume I is described by the author as "mainly introductory," treating the History of Chemistry, many general principles, together with hydrogen, oxygen and their compounds. It is, therefore, not altogether fair to judge the value of the complete work by the present volume and any criticisms which the reviewer has to make may not apply to the completed work. The key to the treatment given in the present volume is a statement by the author in the preface

that his "Modern Inorganic Chemistry" is an abridgment of the present work. This is borne out by the Table of Contents which follows that of the elementary text almost exactly with the exception of certain changes in the order. To the reviewer this constitutes a serious misconception of the different functions of a text-book and a reference book, and it is to this that most of the faults of the present volume may be attributed.

In an elementary text-book the subject must be treated in a certain logical sequence and since no previous knowledge of the subject is presupposed, each topic must be discussed only in the light of those principles which have been developed up to the particular point studied. It seems, however, to the reviewer that a comprehensive reference book should assume a fairly thorough general knowledge on the part of the reader and should endeavor to present complete and accurate discussion of each topic which may be treated. In the present volume general theory, frequently only partially treated, is interspersed in the chapters on particular topics, while much miscellaneous statistical information is included in chapters on general theory. Examples illustrating this question may be cited. (1) "Valency" is discussed in much detail in the chapter entitled "Combination by Volume" but the modern conception of its relation to atomic structure is not mentioned, as this subject is to be included in a later volume. (2) "Acids, bases, salts, and neutralization," are discussed in the chapter on oxygen, but as the theory of electrolytic dissociation is not brought in until 600 pages further on, the subject is not discussed from this standpoint. (3) In the chapter on hydrogen, "Chemical Affinity," "Opposing Reactions," "Guldberg and Waage's Law" are treated, but "Consecutive" and "Concurrent Reactions" appear in the chapter on oxygen, as does "Catalysis." (4) "The Preparation of Oxygen" occurs naturally in the chapter on oxygen, but after looking in vain for its preparation by air liquefaction, the reviewer finally found this discussed much later in the chapter entitled "The Kinetic Theory of Atoms and Molecules." The chapter entitled "Water" includes "The Boiling Points of Liquids," "The Phase Rule," "Supercooling, Supersaturation, and Metastability." Many other examples could be given of an arrangement of topics which seems to the reviewer to lessen considerably the usefulness of the volume for reference purposes.

The entire volume is written in the style associated with previous works by the same author. There is a liberal sprinkling of poetical and philosophical quotations together with a considerable amount of running philosophical comment reflecting the author's own views. Thus, after pointing out that insolubility is almost entirely a question of refinement of measurement, the author adds "in some cases the alleged solubility—*e. g.*, platinum in water—cannot be proved directly but requires involved reasoning which appears to be subtle sophistry of no substance or profit."

This makes the volume pleasantly readable but it occupies much space and it seems doubtful whether it adds materially to the value of the work for reference. Continued use of phrases in foreign languages, usually accompanied by the translation, seems to the reviewer somewhat unnecessary. Thus "the nascent state—*status nascens;*" "the break—*point de rebroussement*—in the solubility curve of sodium sulfate" may serve as illustrations.

The subject matter is treated in extreme detail in many cases and much more briefly in others; thus "the thermal expansion of water" covers 6 pages while "the uses of oxygen" is dismissed with half a page. In many cases the references include quite recent work; thus, the discussion of crystal structure includes references as late as 1920; on the other hand the measurement of freezing-point lowering includes no work later than that of Beckmann (1897).

The references, which are extremely numerous, are given at the end of each sub-section, and this makes them somewhat difficult to locate, especially since, as indicated above, the method of treatment involves dividing closely related subjects into different chapters. The references to early work seem to be much more complete than those to more recent investigations. An author index would have been a valuable addition.

In so large a volume it seems probable that a number of typographical or other errors will occur. The reviewer has not looked for these, but has happened upon such statements as the following. (1) P. 436: "A gas is an elastic fluid at a temperature above its critical temperature, and a vapor is an elastic fluid below its critical temperature, but in a liquid state." (2) P. 549: "The more concentrated solutions (of potassium iodide in water) will depress the mercury (of a barometer vacuum) most, the less concentrated solution will depress the mercury more than water alone, but less than the more concentrated solution." (3) The reviewer has been able to find no justification for the statement (p. 431) that the Clausius-Clapeyron equation represents the variation of vapor pressure with temperature more accurately than the Clapeyron equation at low temperatures.

A list of the chapters will give some idea of the subjects treated, although the sub-headings are not always to be inferred from the chapter heading. Thus in addition to examples cited above we find the "Diffusion of Gases" treated in Chapter VII rather than Chapter IV, "The Polar Theory of Chemical Combination" treated in Chapter VIII, the "Phase Rule" in Chapter IX.

Chapter Headings.— Chapter I, The Evolution and Methodology of Chemistry; II, Combination by Weight; III, Hydrogen and the Composition of Water; IV, The Physical Properties of Gases; V, Combination by Volume; VI, The Classification of the Elements; VII, Hydrogen; VIII, Oxygen; IX, Water; X, Solutions; XI, Crystals and Crystallization; XII, Thermodynamics and Thermochemistry; XIII, The Kinetic Theory

of Atoms and Molecules; XIV, Ozone and Hydrogen Peroxide; XV, Electrolysis and the Ionic Hypothesis; XVI, Electrical Energy.

Of these, the reviewer would select as more satisfactory the purely historical chapters, and those on "Crystals and Crystallization;" "Water;" and "Ozone and Hydrogen Peroxide." In the last named especially there is a large amount of very well arranged information, with a full reference list, and this gives promise that the succeeding volumes, which will presumably contain a larger proportion of descriptive matter, will be less subject to the criticisms given above.

GRAHAM EDGAR

The Physical Properties of Colloidal Solutions. Second edition. By E. F. BURTON, B.A. (Cantab.), Ph.D. (Toronto), Associate Professor of Physics, University of Toronto. Monographs on Physics, edited by Sir J. J. Thomson, O.M., F.R.S., Master of Trinity College, Cambridge, and Frank Horton, Sc.D., Professor of Physics in the University of London. Longmans, Green and Co., Fourth Avenue and 30th Street, New York, 1921. viii + 221 pp. 18 figs. 23 × 15 cm. Price $4.25.

This is the second edition of a well-known book originally published in 1916. Nearly all of the original text is reprinted with minor changes and with an addition of about 10% of new matter. The most important additions deal with a limitation of Perrin's law of the distribution of colloidal particles under the influence of gravity, and with the coagulation of colloids. The book is readable and can be commended to advanced students of chemistry.

GRINNELL JONES

Biochemistry: A Study of the Origin, Reactions, and Equilibria of Living Matter. By BENJAMIN MOORE,[1] M.A., D.Sc., F.R.S., Whitley Professor of Biochemistry, University of Oxford. Longmans, Green and Company, New York; Edward Arnold, London, 1921. vii + 340 pp. 6 figs. Price $7.50 net.

The late Professor Moore tells us in his preface that the book is not a general text-book, but that it attempts to "deal intensively with certain of the properties of living matter." As it is "intended for students of Honours Schools and researchers," one hopes for a truly stimulating book presenting clearly novel points of view. The author has, unfortunately, fallen short of his aims. In the first place, clarity is lost owing to a rather complex style and poor order of presentation; secondly, few of the views discussed are really new.

Devoting his first two chapters to an exposition of the idea that cells are energy transformers deriving their energy ultimately from the sun, he goes on to show that in them change is constantly occurring and that, owing to their colloidal make-up, equilibrium is always labile. Their phasic or rhythmic activity is, perhaps, over-emphasized; but the general treatment

[1] Deceased.

of the cycle of life is admirable. He next develops a theory which states that cellular energy is peculiar to itself,—"biotic energy" he terms it. Here little evidence is adduced to show that the usual laws of chemical equilibrium and thermodynamics are inapplicable to living matter. In fact, conceding their applicability, as he virtually does, it is difficult to see the necessity of introducing the concept of biotic energy. His hypothesis of the origin of life by the catalytic formation of organic compounds in photosynthetic processes occurring after the cooling of the earth is interesting and suggestive. In 7 succeeding chapters he throws some light on his theory and much on photosynthesis in cells. For the scope of the book, and compared with the chapters to follow, the experimental data are perhaps too detailed.

Later chapters are less convincing. The outline of energy transformations in living matter is in part contradictory to Professor Moore's hypothesis of the origin of life, partly opposed by experimental evidence of the type brought forward by Rhumbler, and lacking in force since the consequences of the Donnan equilibrium are not considered. The exposition of physico-chemical theory is neither clear nor thorough. Naturally enough, enzymes and catalysts are approached from a physico-chemical standpoint; and while the older literature is set forth clearly, more recent work emphasizing the influence of hydrogen-ion concentration on enzyme action and work which attempts to explain their action on the basis of adsorption is scarcely mentioned. The suggestion that the exanthemata, such as measles and scarlet fever, are due to autocatalytic action seems unjustified in a day when bacteriology is discovering the sub-microsopic organisms causing poly-omyelitis and typhus fever, and the causative organisms of yellow fever and hemorrhagic jaundice. The discussion of glandular mechanisms and the equilibria of colloid and crystalloid within the cell is a serious attempt to apply physical and chemical thinking to these phenomena. This, too, is marred by insufficient consideration of the peculiar properties of proteins, particularly as ampholytes, and the influence of hydrogen-ion concentration upon their combination with electrolytes. Furthermore, neglect of the phenemona involved by the Donnan equilibrium is unfortunate.

By the omission of such considerations Professor Moore missed an opportunity of giving a much clearer insight into intracellular processes and diminishes the usefulness of the book as a whole.

RONALD M. FERRY