is an amine or, if a phenol, is not removed from its solution in ether by alkali solution.

We note with interest Professor Pyman's statement that psychotrine did yield a dye and that in aqueous alkaline solution it was similar to that given by cephaeline, although apparently he has not examined this psychotrine dye spectrophotometrically. No pure psychotrine was available to us and, as stated in our paper, the psychotrine obtained by us from ipecac fluid extract by the method of Hesse yielded a dye apparently identical with that from cephaeline. We, therefore, assumed that the "psychotrine" obtained by us was contaminated with cephaeline and that the dye yielded by psychotrine, if any, was completely masked by that produced from the contaminating cephaeline.

We regret our misstatement regarding Carr and Pyman's conclusion as to the constitution of emetamine.

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NEW BOOKS

The Structure of Matter. By J. A. CRANSTON, D.Sc., Lecturer in Physical Chemistry, Royal Technical College, Glasgow. D. Van Nostrand Company, 8 Warren Street, New York, 1925. xvi + 196 pp. 70 figs. 22.5 × 15 cm. Price $4.50.

This is in part an elementary account, for the benefit of somewhat advanced students of chemistry, of some of the most important recent work in radioactivity, crystal structure and X-rays. In addition, about half of the book is devoted to atomic structure theory. The overwhelming majority of this section is devoted to Langmuir's exposition and extension of Lewis' views, with the somewhat surprising result that the whole of optical spectroscopy is dismissed in two pages and the entire Bohr theory in fourteen, while the accounts of static models fill sixty pages. This policy is defended in the preface on the ground that whether "true" or not, the octet theory gives great aid to the chemist "in visualizing chemical combination and in giving in simple form the reason of chemical changes."

The order of subjects is well suited to the purpose of the book and the "scheme" which serves as frontispiece gives a good key to the whole. The reviewer, in presenting essentially the same material to university students, is accustomed to give less space, relatively, to the properties of free electrons and much more space to spectroscopy, but that is a matter of individual taste. Considering the amount of attention given to X-ray crystal analysis, some account of the ion-lattice theory of polar crystals might well be included in a subsequent edition. The "Wembley" chart

of the elements near the end of the book might be replaced by a more compact diagram without loss of interest.

On the whole, the book is probably the best available in its own particular line. The reviewer's students, during the semester just past, found it an excellent introduction to the study of systematic inorganic chemistry.

NORRIS F. HALL

A Treatise on Physical Chemistry. Edited by HUGH S. TAYLOR, D.Sc. (Liverpool), Professor of Physical Chemistry, Princeton University, Princeton, New Jersey. D. Van Nostrand Company, New York, 1925. Vol. I, xi + 644 pp. Illustrated. Vol. II, ix + 700 pp. Illustrated. 23 × 15 cm. Price $12.00.

This large text or small reference work is addressed, the Editor tells us, "primarily to the advanced student in physical chemistry, to the research student desirous of learning the background to his problem and to the research man in industry who requires the theoretical treatment of his practical investigations. Actually, however, the book may have a wider appeal. As divided into two volumes, the work appears to meet the demand for a graduated text in physical chemistry. The material of the first volume represents that portion of the subject of theoretical chemistry that can with advantage be addressed to the first-year student of physical chemistry who plans to continue his studies beyond that year. It contains the main features of the classical era of physicochemical development. The volume contains, it is true, a more detailed treatment of the subject than the average student will fully grasp in his first year of its study. It will not be amiss, however, for the serious student to find in his text somewhat more than will be discussed in his lectures and exercises. Stimulation to further effort may result. For all students who plan to take more than one year of work in physical chemistry, assimilation of the material of the first volume will represent a very solid accomplishment and a sound basis for approach to the more modern aspects of the subject which find their treatment in the second volume. In the latter, the student is taken to the borderland of the subject where active development is even now in progress."

The advantages of a coöperative text are clearly presented by the Editor: more authoritative treatment of all fields, freshness and variety of approach, greater up-to-dateness due to the shorter period of preparation necessary, the possibility of more frequent revision. Another of its characteristics, the frequent repetition of the treatment of certain themes and the occasional divergence of the views expressed may be either a defect or an advantage. The present reviewer inclines to the latter view. Certainly the book lacks a certain symmetry and elegance—perhaps misleading—which may be apparent when the whole material is presented by a single writer according to a carefully balanced (and often somewhat arti-

ficial) plan. These qualities are, however, usually confined to smaller books than this one, to "Outlines" and books of "Fundamentals" where no such wealth of experimental material is to be found as in these volumes. On the whole, the more leisurely, informal, experimental aspect of this book should make it more useful to the student than a treatment too rigidly pruned to the bare mathematical skeleton of the subject.

The first chapter, on The Atomic Concept of Matter, by the Editor, reviews the well-known historical development of the periodic system to the beginning of the present era of structure theory. The nucleus atom, positive rays and isotopes are very briefly but well presented. Ordinary printer's errors will not be discussed in this review; a list of minor corrections has been sent to the Editor. Nevertheless, the reference to the electron as a "discreet" unit of electricity on p. 12 seems worthy of immortality. On p. 23, the part played by Friedrich and Knipping in realizing von Laue's prediction should receive mention. On p. 25, there is little justification in general usage or in fact for applying the term "radio-lead" to Radium G. The symbols for the first members of the uranium series in Fig. 2 should read U_1, UX_1, UX_2, U_2 and not Ur, UrX_1, UrX_2, Ur_{II}. It is unfortunate to say (p. 26) that Goldstein called the positive rays "canal strahlen"—let us speak either German or English. The reviewer would like to see a more adequate discussion of nuclear stability and the relative abundance of elements and isotopes either in this chapter or in the one on Radioactivity.

The second chapter, The Energetics of Chemical Change, is also contributed by the Editor. Here are given the usual brief treatment of the first and second laws, heat capacity and heat of reaction, free energy, entropy and equilibrium. The whole is somewhat abbreviated in view of what is to follow, and seems to present no unusual features. One may, perhaps, quarrel with such forms of exposition as (p. 38): "Any such change in the internal energy of a system can only be achieved with a simultaneous change in the energy of surrounding systems, since the law of the conservation of energy *must* be obeyed."

Chapters III and IV on the gaseous and liquid states of aggregation by Professor Otto Maass of McGill University, together give a very clear and well-written account of the behavior of fluids. Pp. 107 and following, on the critical phenomena, seem especially vivid.

Chapter V on The Solid State of Aggregation by Professor Robert N. Pease of the University of Virginia presents in a very much abbreviated form the elements of crystallography and the results of X-ray analysis. The heat capacity relations of solids are also briefly given without theoretical treatment. An account of the lattice theory of polar crystals would have been appropriate at this point.

Chapter VI on Thermochemistry contains many more details of method

than any of the previous chapters. Numerous types of calorimeters are described, and such matters as thermal leakage are discussed in considerable detail. The calculation of the partial molal heat content for the solvent when that for a solute is known, heats of adsorption and wetting, heats of hydration of gas ions and the heat of evaporation of electrons are some of the subjects discussed by the author, Dr. A. L. Marshall, of Princeton.

Chapter VII, by Professor J. C. W. Frazer of Johns Hopkins University, deals with The Laws of Dilute Solutions. Although frequently marred by careless sentence structure, this chapter contains features of peculiar interest. Chief of these is the authoritative and thorough account of osmotic pressure and its measurement. Kinetic theories of the effect and speculations as to its mechanism receive a brief treatment. All the colligative properties are discussed from the experimental point of view and the chapter ends with an account of the Donnan theory of membrane equilibrium.

Homogeneous Equilibria in general form the subject of Chapter VIII by Dr. Graham Edgar of the Ethyl Gasoline Corporation.

Chapter IX, a long one on Heterogeneous Equilibrium, is contributed by Professor Arthur E. Hill of New York University. Here the Phase Law of Gibbs is introduced by a study of distribution and then applied to a great variety of important systems.

Chapter X by Professor G. A. Hulett of Princeton deals with The Measurement of Electrical Energy. In the discussion of the silver coulometer, the tests of Faraday's law at high pressure (p. 471) might be mentioned. The fact that all organic materials, such as filter paper, affect both the *weight* and the *purity* of the deposited silver, might be more clearly stated. The discussion of standard cells is very good and brief.

The chapter on Conductance, Ionization and Ionic Equilibria by Professor J. R. Partington of the University of London is exceedingly interesting, as much for the historical and critical aspects of the treatment as for any of the others. Especially copious references serve to show, among other things, how often a particular electrochemical discovery has been made and forgotten only to be rediscovered with fresh delight by some new investigator. The reviewer agrees that the thorough assimilation of the material in Volume I would constitute a very solid accomplishment indeed for any student beginning physical chemistry and hopes some day to have the pleasure of meeting one who could do it in an ordinary year's course.

With the second volume, dealing with more modern aspects of the subject, "the fun begins." An especially logical, clear, comprehensive and well written chapter by Professor Herbert S. Harned of Pennsylvania starts the book. The electrochemistry and thermodynamics of ionized solutions are here given perhaps the best balanced and most authoritative treatment

in print, although of course the author's debt to the classical treatise of Lewis and Randall is a heavy one. A less condensed exposition of Debye and Hückel's theory would be welcome, as well as a further discussion of its relation to Milner's and the extent to which the two theories appear to be borne out by the experimental results. Further, it seems to the reviewer that such (to chemists) unfamiliar symbols as ∇ (for the operator "nabla") might well receive a word of explanation in a work on chemistry.

To Professor N. Howell Furman of Princeton fell the task of breaking what is virtually new ground in a chapter (XIII) devoted to Electrometric Methods in Analytical Chemistry. As is fitting, in addition to electrometric methods, the use of indicators is lucidly discussed in this chapter. The reviewer was surprised to learn what a very extensive body of data has been accumulated concerning potentiometric and conductimetric titrations, especially through the labors of such investigators as I. Kolthoff, and Willard and Fenwick.

Professor F. O. Rice's Chapter XIV on Reaction Velocity in Homogeneous Systems, aside from presenting a variety of interesting material concerning catalysts, effectively demonstrates both the unsatisfactory character of the radiation theory and the lack of adequate alternatives. This subject is further elaborated by Dr. Saul Dushman of the General Electric Company in the chapter on quantum theory. Dr. Dushman quotes at length various arguments for and against the view that particular frequencies of thermal radiation are the immediate cause of activation and reactivity. His final conclusion is as follows: "The whole problem of unimolecular reaction velocities is still open. Perhaps some light will be thrown upon it by considerations based on Einstein's theory of *à priori* probabilities such as have been recently suggested by E. A. Milne and R. H. Fowler in their discussion of the mechanism of ionization." One hopes that the new form now being given the quantum theory by Heisenberg, Born, Dirac, Pauli and others will prove as fertile when applied to chemical reactions as it has in other directions. The main portion of Dr. Dushman's chapter is devoted to atomic structure. The Lewis-Langmuir theory is presented in rather surprising detail for a work on physical chemistry and this is followed by one of the best short elementary expositions of the Bohr theory in English, covering the literature well into the year 1924. The remaining chapters deal with The Third Law of Thermodynamics (Professor Worth H. Rodebush, Illinois); Photochemistry (Professor Taylor); Infra-red Radiation (Dr. H. Austin Taylor, Liverpool); Colloidal Chemistry (Professor Walter A. Patrick, Johns Hopkins) and Radioactivity (Dr. S. C. Lind). These all preserve the same high standard as the earlier chapters.

On the whole, the reviewer feels that the work is probably the most generally useful exposition of physical chemistry in print.

NORRIS F. HALL

A Graphic Table Combining Logarithms and Anti-Logarithms. By ADRIEN LACROIX and CHARLES L. RAGOT. The Macmillan Company, 64 Fifth Avenue, New York City, 1925. 40 pp. 25 × 17.5 cm. Price $1.40.

A table of logarithms is about the last place where one would expect to find novelty. Novelty is, nevertheless, achieved in this new volume.

A horizontal line runs repeatedly across each page like the lines of type in a printed book. On the upper side of this line is printed a numerical scale, and on the lower side a logarithmic scale. The first two digits of both numbers and logarithms are given on the left-hand margin of the page, the next two digits are placed opposite the graduations on the scales, while the fifth digit is obtained by counting off the ten smaller subdivisions of the scale. The whole scale occupies about forty pages.

So far as accuracy is concerned, this table is much superior to the ordinary five-place table. This latter may be in error by one unit in the fifth place, while the new table can be read and can be considered accurate to within one or two units in the sixth place. So far as speed is concerned, it also has the advantage over the old tables, since the fifth place can be read off more quickly from the subdivisions of the scale than by the use of the proportional parts required in the ordinary table. Finally, it should be pointed out that the new tables are just as convenient for use in the reverse as in the direct order; that is, it is just as convenient to find anti-logarithms as logarithms. This is a decided advantage over the old tables.

This volume also contains a six-page graphic table of the same kind, reading however directly to only four places. Its general utility lies somewhat between the ordinary five-place and four-place logarithm tables. It is almost as accurate as the five-place, and almost as rapid and convenient as the four-place table.

These tables certainly should be of great use to the chemist.

ARTHUR B. LAMB