

NEW BOOKS

Photochemistry. By S. E. Sheppard. 14 × 19 cm; pp. vii + 461. New York: Longmans, Green & Co., 1914. Price: \$3.50 net.—In the preface the author says:

"In the following pages I have endeavored to present a connected, and, in a measure, continuous account of the subject of photochemistry in its modern development. Unification of the scattered elements of this subject is no easy task, in view of the almost inevitable contingency of actino-chemical changes with other thereby recognized and characterized alterations of material systems.

"There has resulted a delay, not without danger, in the attainment of independent status by photo-chemistry, having been for so long ancillary, to her elder sisters, thermo- and electro-chemistry, so that only by a masquerade, momentous both for theory and practice, as the science of radio-activity has this Cinderella of the sciences been accorded its due recognition.

"There exists, and is likely to continue, some difference of opinion as to the desirability of incorporating a discussion of photo-physical and radiation phenomena and laws in a work on photo-chemistry. But neglect of this aspect of the question and too narrow a circumscription of its domain can only lead to further delay in the discrimination of a definite body of laws for this science. For this reason the plan has been followed in the present work of discussing at some length certain intensive studies on cardinal points in photochemical change rather than that of enumerating and recording every example of photo-chemical reaction or light-sensitive substance. The aim has been to aid students with examples of working hypotheses helpful in the completer investigation of the economy of any given photo-chemical reaction.

"As such a working hypothesis, the conception that in photo-chemical change singular intermediate complex ions, or, specifically speaking, veritable latent light-images, are formed, appears the most promising. The *singularity* involves concordance of the reaction order or kinetics of their growth and decay with the optical conditions of absorption and emission, the *intermediacy* or metastability of their constitution implies imperfect coincidence of photo-chemical equilibrium with the thermo-dynamically stable equilibria possible to the independent chemical components present.

"Every photo-chemical change is in consequence virtually photographic, the equilibrium to which it tends implies, so to say, a radiation proto-type of a colloid, a characteristic organization radiating from a centre, as the *unit* effect possible. So long as the action is in agreement with the principle of virtual velocities, the change is reversible, the partial chemical transformations tautomeric in type. But any acceleration of the temps of the change involves a loosening of residual affinities in the group which may readily lead to an irreversible transfer of an electron to a depolarizer and consequently to a *per saltum* mutation of the total energy such as the quantum theory of Planck demands. Hence the maximum work developable is as much contingent on the accommodation in space and time of a mutable depolarizer as on the nature of the system insulated, a point emphasized by Grotthuss and recently reiterated by Prof.

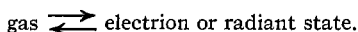
Bancroft. On this view the primary or direct photo-chemical change may well be termed catastrophic, and it is only by its coupling with a depolarizer and development as an indirect action that the discontinuous nature of the change is masked by a slow evolutionary process."

The headings of the chapters are: historical; the measurement of light quantities; the energetics of radiation; economic and energetic relations of actual light-sources; the absorption of light; statics and kinetics of photo-chemical change, dynamics of photo-chemical change; special photo-chemistry; radiant matter and photo-chemical change; the genesis of light in chemical change; organic photosynthesis.

The book is a disappointment to the reviewer perhaps because he had expected too much of it. There seems to be no distinct point of view and the author has the unfortunate habit of writing page after page in an involved style without saying anything definite. Typical instances of this will be found on pp. 155-157, 227-230, 245-252, 262-263, 266-267, 319-323, 350-352, 391-392.

As an illustration of this, I quote a rather mild passage, p. 391, from the chapter on the genesis of light in chemical change.

"The extensive technique of the culture and control of flames in detail lies outside the purview of this work. But the word 'culture' is used deliberately to signify that this technique of the study of flames must be necessarily of the same order as that of bacteriological and enzyme chemistry. Flames are not simple chemical species, but physicochemical entities of almost biological standing in the characteristic indetermination of their nature. That is to say, they are very sensitive mobile equilibria of continuously interacting chemical species, in which the act of metathesis is not subordinate to attainment of a static equilibrium, is not monotropic (in essence, exception being made of extrinsic factors which condition practical boundaries or limitations), but is the central and permanent self-reversing condition of their existence. Physically considered, flames are analogous, as singularly constituted transition or intermediate stationary motions of matter between two different states, apparently heterogeneous with each other, but really continuous in the duration of the critical intermediate medium, to 'gels,' which present intermediate, variably permanent transitions of matter between the solid and liquid end-states, and 'vapours,' which present similar permanent becomings or transitions between the liquid and gaseous end-states of matter. In flames, the enduring transition of dominant photo-chemical interest is that representable by the scheme



And so well does the ensemble counterfeit immobility that we are likely to misapprehend the fact that the *mobility* of the transition schematized, is the essence of the fact. If we term the pulsation, the to-and-fro movement of an element of matter between two alternative, dynamically incompatible phases (such as gaseous state \rightleftharpoons liquid state), a 'physis' or growing, we have in 'gels,' 'vapours,' and 'flames' virtually finite groups of such physes which may be termed 'symphyses,' expressing the fact of a multiplicity of such items growing together syntonically. And as we speak of the *maturation* of a gel, the *saturation* of a vapour, so we might speak of the *naturation* of flames."

Through a curious slip the author considers the color adaptation of the chameleon, p. 335, as a case of Wiener's color adaptation, though the latter applies to substances which tend to assume the color of the incident light, whereas the chameleon assumes the color of the ground which he is on.

Wilder D. Bancroft

Chemistry in America. By Edgar Fahs Smith. 14 × 21 cm; pp. vii + 356. New York: D. Appleton & Co., 1914. Price: \$2.50 net.—The first chapter opens as follows:

"A review of the contributions of Americans to the Science of Chemistry would be incomplete without a consideration of the publications made in the earliest days in which scientific matters began to interest the people of our country. Before the United States became a republic, interest in such matters was manifested. The members of the venerable American Philosophical Society were most anxious to foster investigations along all lines of scientific endeavor. This is evidenced in a preface to the first volume of the Transactions of that Society, published in 1789, in which the aims of the Society were set forth—to seek the best methods of promoting the fertility of land and of protecting trees and plants from worms and insects, to improve useful animals, to preserve timber, and to ascertain the virtues and use of many plants; and, further, the Society expressly states that it will not confine its efforts wholly to these things, nor will it exclude other useful subjects such as Physics and Chemistry."

Papers by de Normandie, J. Madison, and M'Causlin are cited as illustrating the earliest contributions of Americans to chemistry. After this come two chapters on the Chemical Society of Philadelphia, followed by chapters on Woodhouse, Priestley, Cooper, Maclean, and Robert Hare. A chapter is devoted to the Columbian Chemical Society founded in 1811. The tenth chapter deals with leading chemists as mineralogists, while the eleventh is taken up with sketches of James C. Booth, T. Sterry Hunt, J. Lawrence Smith, and F. A. Genth. The last chapter comes down to the present time with sketches of Wolcott Gibbs, Prescott, Johnson, Mallet, Carey Lea, Cooke, and Willard Gibbs.

The book closes with the following paragraphs:

"The preceding pages contain the most significant efforts of American chemists, extending over a period of a little more than one hundred years. The results compare favorably with those of a like period in the early history of our science in any other country. The earliest contributions represented beginnings. They were carried out when the republic was young. Years of preparation and adjustment followed for the new nation, and then years of internal strife; it is exceedingly gratifying and encouraging to observe that the scientists of the country, including the noble guild of chemists, contributed much to bring the national resources into prominence and usefulness, as well as to guide the educational development of the States.

"To the *Journal of Science*, founded by Silliman, were added *The American Chemist* (1870-, by Charles F. Chandler), the *American Chemical Journal* (1879-, by Ira Remsen), the *Journal of Analytical and Applied Chemistry* (1887, by Edward Hart), the *Journal of Physical Chemistry* (1896, by Wilder D. Bancroft), the *Chemical Engineer* (1904, by R. K. Meade), the Transactions of the American Electro-Chemical Society, the Transactions of the Institute of Chemical Engineers

and the most potent factor in chemical affairs—the American Chemical Society, with its admirable journals. All these have fostered the growth and development of chemistry in this country.

“The maintenance of well equipped laboratories in the colleges, as well as the very palatial structures connected with some of the older universities and with the larger state universities, are further evidence of our development along chemical lines.

“It is not the writer's purpose to discuss the investigations which have come from the many working centers of the United States during recent years, that story awaits another narrator; but, if only a desire, on the part of Americans to learn more concerning the place which American chemists occupy in the world's history of chemistry, is awakened, this compilation of facts will not only have been a pleasure but it will have served a worthy purpose.”

This is an interesting and valuable book, written in the delightful spirit so characteristic of the author.

Wilder D. Bancroft

Intermetallic Compounds. By C. H. Desch. 15 × 22 cm; pp. v + 116. New York: Longmans, Green & Co., 1914. Price: 90 cents net.—In the introduction the author says: “In the following sections the occurrence of intermetallic compounds as indicated on the equilibrium diagram and determined by the method of thermal analysis is first discussed. This is followed by a short note on the microscopical control of the thermal indications. An account is given of the methods which have been adopted with the object of isolating intermetallic compounds in a pure condition, and of their assumed occurrence as native minerals. So little success has been met with in this direction, however, that our knowledge of the properties of such compounds is mainly derived from a study of the alloys in which they occur. The succeeding sections are therefore devoted to a consideration of the influence which the presence of intermetallic compounds exerts on some of the more important physical properties of alloys. It is also shown that the systematic investigation of certain properties, especially the electrical conductivity and the thermo-electric power, affords the most delicate means in a large number of cases of determining whether chemical combination takes place in a given series or not. An account is then given of the scanty data which we possess as to the crystallographic characters of intermetallic compounds, and of the evidence for the existence of compounds in liquid alloys, and the concluding section reviews the theoretical aspect of the subject.”

The book is an interesting one and the only serious criticism to be made is on the paragraph, in which the author assumes definite compounds as occurring in a series of solid solutions. The author says, p. 17, that “the two opposing views refer only to the molecular condition of the solid solutions concerned. On the one view the metals are present at least in a large part in the form of compound molecules, on the other, they are free.” This is quite wrong. The reviewer has never stated that the six series of solid solutions in the copper-zinc alloys are due to copper and zinc alone. He has taken the ground that we have no general way of telling what are the constituents of any given series of solutions and that it is more profitable to admit our ignorance than to postulate the existence of arbitrarily selected compounds.

Wilder D. Bancroft

The Theory of Heat Radiation. By Max Planck. Translated by Morton Masius. 15 × 21 cm; pp. v + 225. Philadelphia: P. Balkistson's Son & Co., 1914. Price: \$2.00 net.—This is a translation of the second German edition. In the preface the author says:

"The main fault of the original treatment was that it began with the classical electrodynamical laws of emission and absorption whereas later on it became evident that, in order to meet the demand of experimental measurements, the assumption of finite energy elements must be introduced, an assumption which is in direct contradiction to the fundamental idea of classical electrodynamics. It is true that this inconsistency is greatly reduced by the fact that, in reality, only mean values of energy are taken from classical electrodynamics, while, for the statistical calculation, the real values are used; nevertheless the treatment must, on the whole, have left the reader with the unsatisfactory feeling that it was not clearly to be seen, which of the assumptions made in the beginning could, and which could not, be finally retained.

"In contrast thereto, I have now attempted to treat the subject from the very outset in such a way that none of the laws stated need, later on, be restricted or modified. This presents the advantage that the theory, so far as it is treated here, shows no contradiction in itself, though certainly I do not mean that it does not seem to call for improvements in many respects, as regards both its internal structure and its external form. To treat of the numerous applications, many of them very important, which the hypothesis of quanta has already found in other parts of physics, I have not regarded as part of my task, still less to discuss all differing opinions."

The five sections of the little volume are entitled: fundamental facts and definitions; deductions from electrodynamics and thermodynamics; entropy and probability; a system of oscillators in a stationary field of radiation; irreversible radiation processes.

Wilder D. Bancroft

The Viscosity of Liquids. By A. E. Dunstan and F. B. Thole. 15 × 22 cm; pp. v + 89. Longmans, Green & Co., 1914. Price: 90 cents net.—The subject is treated under the headings: the development of a working formula; the measurement of viscosity; the measurement of the viscosity of pure liquids prior to 1895; the measurement of the viscosity of pure liquids subsequent to 1895; the viscosity of liquid mixtures; viscosity of electrolytic solutions; the viscosity of colloids; the relation between viscosity and chemical constitution; some applications of viscosity.

One reason for making a distinction between measurements of viscosity before and after 1895 is that the later experiments were subsequent to those of Thorpe and Rodger. The chapter on the viscosity of colloids is interesting both for what it does and does not contain. There is no discussion at all of what would happen if the more viscous phase were the external one and yet this is a very important matter in the case of true emulsions. On the other hand, the chapter does contain a discussion of the work of Wolfgang Ostwald and of Hatschek, as well as paragraphs on the properties of colloidal solutions of soap, nitrocellulose, and rubber.

In the chapter entitled "Some Applications of Viscosity," the authors say:

"The value of a physical property in the eyes of the average chemist depends on its applicability to problems which arise in the various branches of chemistry and which sometimes cannot be definitely solved by purely chemical methods. Mention need only be made of the application of refractivity and absorption spectra to the classical controversies concerning the constitutions of ethyl acetate and of isatin and of the work of Patterson, Lowry, and others on the connection between rotatory power and velocity of chemical reaction. Since viscosity is so highly a constitutive property, it may and has been applied to a number of problems arising in physical, inorganic, and organic chemistry, and has proved particularly useful in certain cases such as determining the constitution of the acetaldehyde phenylhydrazones where chemical evidence is not available."

Wilder D. Bancroft

The Sugars and Their Simple Derivatives. By John E. Mackenzie. 16 × 23 cm; pp. vii + 242. Philadelphia: J. B. Lippincott Co., 1914. Price: \$2.25 net. —In the preface the author says:

"The carbohydrates are among the most important of all chemical compounds, from several points of view. They form the main portion of the diet of most animals. They are the raw material for many industries. Yet comparatively little is known concerning the more complicated carbohydrates, though much study has been devoted to them. On the other hand, the simple carbohydrates, the sugars, have been investigated to such effect that the chemical configuration of the majority of them has been elucidated.

"The following pages are based on a course of lectures first given at Birkbeck College, London, in 1903, and subsequently at the University of Edinburgh. In addition to students of pure chemistry, others interested in medicine, brewing and distilling, sugar manufacture, etc., attended these lectures. On this account more attention has been devoted to such subjects as metabolism, fermentation, and the manufacture of sugars than would have been the case otherwise. It is hoped that the book may serve as a companion to works on physiological chemistry and to technological works on brewing, distilling, sugar manufacture and sugar analysis."

The author discusses the preparation and properties of sucrose, maltose, lactose, glucose, and glucosamine. He then takes up the dioses, trioses, tetroses, pentoses, methylpentoses, aldohexoses, and ketohexoses; after which come twenty pages devoted to disaccharides, trisaccharides, tetrasaccharides, and glucosides. The last two chapters are entitled fermentation and metabolism.

The book seems to be a careful compilation of data, with relatively few errors. On p. 27 the author says that "the heat of solution of sugar in water is positive for all concentrations at temperatures between 15° and 25°, but becomes negative above 50°. As early as 1680, Boyle observed that a freezing mixture could be made by mixing sugar and snow." There is no necessary relation between these two sentences and it is a pity that a false impression should be conveyed. It is also unfortunate not to distinguish between heat of solution and heat of dilution. The work of Fischer and of Nef is given in considerable detail and Hudson's work on milk sugar has not been overlooked.

Wilder D. Bancroft