BOOK REVIEWS

Physical Inorganic Chemistry. Edited by ROBERT A. PLANE and MICHELL J. SIENKO. W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1963. ix + 166 pp. 16 × 23.5 cm. Price, $3.95 paper, $7.00 cloth.

Professors Sienko and Plane have chosen to consider "five areas basic to inorganic chemistry" in their introductory volume to a new Benjamin series, "The Physical Inorganic Chemistry Series." Each of these areas, namely atomic structure, molecules, solid state, liquids and solutions, and chemical reactions, is "outlined in a separate chapter of this book." The authors suggest that succeeding monographs will expand these areas.

This book, which is intended by the authors to bridge inorganic chemistry and the disciplines of the calculus, elementary physics, and introductory physical chemistry, begins with an introductory four pages labeled "Concepts From Thermodynamics." This section (in which the Free Energy Function is not mentioned) acts as an outline review of the thermodynamic principles desirable to a study of inorganic chemistry. The book proceeds to discuss (superficially) the topics mentioned above in the order listed.

Chapter 1 begins with the one electron Schrödinger equation which is reproduced assuming the de Broglie condition and the general mathematical form of wave motion. (No attempt is made to justify the quantized solutions even though generalized associated Laguerre and Legendre polynomials are presented. The concept of normalization is only briefly mentioned while the term orthogonality is not used anywhere in describing the solutions.) The names Hartree-Fock and Slater are introduced as being associated with approximate methods for many electron atoms. Spectroscopic state formalism is presented. Magnetic properties of atoms are discussed. Electronic spectra, selection rules, band width, etc., are mentioned, and finally the chapter ends with discussions of ionization potential and electron affinity. (All this is in an 18-page package.) The remaining four chapters follow similarly, each introducing the reader to the topics considered of importance (by the authors) to the inorganic chemist.

This book, which appears to be relatively free from misprints (this reviewer notes no "dashed lines" on p. 11 and the replacement of B by b on p. 81; the numerical equation on p. 81 also is incorrect; states a, b, e, and t on p. 54 should be A, B, E, and T) is written in the same readable style common to another popular general work by the authors. It does not contain footnotes but does suggest, at the end of each chapter, some books which "should prove helpful" as supplementary reading.

The brevity with which topics are treated in this book, intended to be used along with several other monographs in the series as a text for an advanced inorganic chemistry course, is best displayed by a few examples. Chapter 2, "Molecules," has a section labeled Valence Bond in which the ionic form or description is not mentioned. (Ionic forms are briefly introduced in a section called Resonance.) Also in Chapter 2, symmetry LCAO molecular orbitals for an octahedral complex are presented without adequate description of their construction. In Chapter 3, "Solid State," fluorescence and phosphorescence are discussed in a less than 300-word treatment of luminescence. In Chapter 4 the Born and Sackur–Tetrode equations are presented without even qualitative justification of their validity. A result of such abbreviated descriptions is a book reading much like an encyclopedia with an arbitrary listing of physical quantities.

By implication, the authors of this text (and authors of several other recent inorganic texts) have condemned the teaching of physical chemistry in many of our colleges and universities. The traditional course which excludes (or only briefly discusses) such topics as atomic and molecular structure, chemical bonding, and molecular spectroscopy, does not become a suitable prerequisite for topics such as transition metal chemistry (which uses ligand field theory), boron hydride chemistry, mechanisms of chemical reactions, and discussions of the hydrogen bond. In an attempt to give the inorganic student a satisfactory background for these topics, glossed-over, semirigorous, and unfortunately rather uncritical treatments of theoretical chemistry are presented under the guise of physical (or theoretical) inorganic chemistry. Such treatments certainly are not desirable and (in the opinion of this reviewer) should be avoided if possible.

The authors of this book have not avoided the pitfalls that are likely to result when topics are introduced briefly, superficially, and uncritically. The following statements are some examples found particularly distressing to this reviewer:

"For the majority of compounds where d electrons are important . . . the atom with d electrons is located in a field of cubic symmetry," p. 12.

"In ligand field theory, orbitals of a central atom orient themselves spatially so as to give the most favorable interaction energy between the central atom and surrounding ligands," p. 34.

"This theorem (Jahn–Teller) states that if an electronic state is degenerate in a given symmetry then distortion will occur so as to remove degeneracy," p. 61.

"The dielectric constant is defined as the ratio of the effective field to the imposed field, or $1 + 4\pi(P/E)$," p. 69.

"An n-fold axis is a symmetry operation. . .," p. 76.

The cost of this book (paperback) will enable many chemists to purchase it. Hopefully these chemists will have built their own "bridge" between inorganic chemistry and the disciplines of the calculus, physics, and physical chemistry. Hence they will not have to depend on this "monograph" (a misnomer) to build the bridge as the footings used are rather poorly constructed.

Because of the rather interesting simile used (and its implications), it seems suitable that this review be concluded with a philosophical quotation from the introductory paragraph to the chapter on Chemical Reactions. ". . . . dynamic considerations (in inorganic chemistry) too often have been made subsidiary to structural studies. . . . It is hoped that further systematization of inorganic thermodynamic and kinetic information will lead to unifying concepts which will stimulate the field to the same extent that the tetrahedral carbon atom did to organic chemistry."

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Nouveau Traité de Chimie Minérale. Tome XX. Alliages Métalliques (Suite). Edited by PAUL PASCAL. Masson et Cie, Éditeurs, 120 Boulevard Saint-Germain, Paris (6e). 1963. pp. 773–1926. 17.5 × 26 cm. Price, broche 200 F, cartonne toile 212 F.

This is Part Two of Volume XX, on metallic alloys, of the Pascal treatise. Part One dealt with alloys of light metals (groups IA, IIA, magnesium, and aluminum) and with alloys of transition metals with metalloids. This second part contains three sections: alloys of copper and silver (370 pp.), alloys of refractory transition metals (580 pp.), and alloys of low melting heavy metals (200 pp.). Most of the book, about 650 pages, is written by M. Oswald, about 250 pages are by M. R. Collongues, and about 200 are by P. Pascal; a small section, on coins, is by P. Fauconnier and R. Lapassade.

The scheme is essentially that of the classical compilation on binary alloys by M. Hansen (1936). Although the general impression is that it is not as meticulously complete and exact as the well-known older Hansen, still the field has been brought up to date, serving a valuable purpose. The phase diagrams look more like schematic diagrams than like plots of actual experimental data, which we have in the Hansen book. They are for this reason, however, very clear and effective. Some of the data are presented in clear tabular form. Every section, moreover, as also almost every system of importance, is presented with some brief critical discussion or summary.

The bibliography, subdivided into a great number of sections, seems to be exhaustive, and is stated to have been taken through December, 1961, with a few sections closed as of January or June of 1961. At the same time most sections of the bibliography include references to 1962 papers. The bibliography is effectively presented, and every page of the book states where to find the pertinent references. The total number of references is immense, but many of them are repeated in various sections.

There is no index, but the arrangement is so systematic (alphabetic when necessary) that it is an easy matter to find any particular one of the thousand or more systems mentioned. The only guide to the book is a brief table of contents which, moreover, is unfortunately confused and incorrect in eight or nine entries, an inexcusable lapse in a book of such pretentions and cost. The table of contents calls for a section on "Alloys of Thorium," for pp. 1089–1141. There is no such section in the book, and those pages are taken up by part of a rather irrelevant article, of about 50 pp., on coins (denominations, compositions, etc.) entitled "Alliages Monétaires." This is a more or less historical account, in particular of French coins; it has no true scientific interest whatever, although it may be of value to mints, museums, and coin collectors.

Despite this inexplicable lapse, the presentation throughout the volume in general is orderly, systematic, and clear, accomplishing a valuable coverage not only of the possible systems but also of a significant variety of aspects of the important systems. The treatment is thorough and even to some extent critical. The style is of course essentially that of the preceding volumes. The quality of the whole effort is certainly to be praised.

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Colloidal Surfactants. Some Physicochemical Properties. By KOZO SHINODA, Department of Chemistry, Yokohama National University, Minamiku, Yokohama, Japan, TOSHIO NAKAGAWA, Research Laboratories, Shionogi Pharmaceutical Company, Imafuku, Amagasaki-shi, Japan, BUN-ICHI TAMAMUSHI, Tokyo Women's Christian College, Suginamiku, Tokyo, Japan, and TOSHIZO ISEMURA, Department of Biology, Osaka, University, Kitaku, Osaka, Japan. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. 1963. 310 pp. 15.5 × 23.5 cm. Price, $11.50.

Despite a number of shortcomings, this book is a necessary part of the library of anyone studying or using surfactant solutions. The four sections, written by different authors, but presumably under the general direction of Dr. Shinoda, differ very greatly and will be described separately in this review.

The first section, "Formation of Micelles," is the shortest and may well prove to be the most controversial and at the same time the most useful. It is useful because it contains an enormous amount of data in tabular form, together with references to the original sources so that the user can judge for himself with respect to the important characteristics of purity of materials and accuracy of measurement. Dr. Shinoda gives here a complete exposition of the point of view that micelles are to be regarded as a separate phase in the thermodynamic sense. This point of view has been shown by K. J. Mysels and others to be not strictly correct, and it is difficult to predict whether a "little" mistake in thermodynamic treatment will or will not be important.

The section is also extremely useful because it makes available a great deal of work published in Japanese, and thus not readily usable by most investigators outside Japanese-speaking areas. It is surprising that so little recognition has been accredited to the fact that the dye method of determining the CMC is known to give erroneous results and that tables showing the variation of the CMC with various structural properties are assembled with values using the dye method and other methods mixed indiscriminately.

The second section on nonionic surface active agents presents a very competent review of what is known of their physical–chemical properties and interpretation. One cannot help but be impressed by the fact that there is still a very great deal of work necessary to understand their behavior, particularly with reference to phase-rule diagrams. It is useful to have the necessity for working with chemically pure materials so strongly emphasized, but it is rather doubtful that some of the data quoted represent work on adequately pure substances.

The last two sections on adsorption and monomolecular layers, respectively, contain necessarily a certain amount of duplication. That by Dr. Tamamushi is particularly clearly written, but again, shows up the need for further work. It is useful to find clear emphasis on the fact that surfactant solutions with maxima in adsorption isotherms as functions of "concentration" must be systems containing three or more components, analogous to the case of surface tension minima. That by Dr. Isemura does not discuss sufficiently the problem, which exists when polymeric materials are adsorbed at surfaces, as to the extent to which loops project rather deeply into the bulk of the solution and as to whether or not this represents an equilibrium condition. A considerable amount of the work which has been done at the Weizmann Institute seems not to have been taken into consideration.

One of the most valuable aspects of the book as a whole is the enormous number of references to original papers from all parts of the world, even though it is far from complete. The commercial importance of surfactants has resulted in the publication of so large a volume of data that a book such as this would be of value just for its help in telling an investigator where to look for what. The reviews of the status of theoretical concepts in the various sections are not in any way intended by the reviewer to be overshadowed by this emphasis on the value of the extensive bibliography. Dr. Shinoda and his colleagues are to be congratulated on doing a good job on a very difficult subject to summarize.

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Isotopenaustausch und Substitution des Wasserstoffs in organischen Verbindungen. By A. I. SCHATENSTEIN. Veb Deutscher Verlag der Wissenschaften, Berlin W. 8, Niederwallstrasse 39, Germany. 1963. 365 pp. 17 × 24 cm. Price, $67.60.

The present volume, number 8 in the series "Physikalisch-chemische Trenn- und Messmethoden," is a German translation of Schatenstein's book which was published by the Academy of Sciences in Moscow in 1960. Some new material from the years 1959 and 1960 has been incorporated by the original author.

To the reviewer's knowledge there exists no monograph in any language similar to the present one, which treats hydrogen substitution and, in particular, hydrogen isotope exchange from the point of view of acid–base theory. The work is a compilation rather than a critical survey. Since the author and several other Russian chemists have made important contributions to the field and the original language makes their papers somewhat difficult to read for most scientists in other countries, the value of the translated edition of the book is evident. Thus, for instance, Section 4.5 gives access to the theories concerning the dissociation of acids and bases as formulated by the school of Ismailow.

The translation seems to be good, and relatively few errors have been introduced by this procedure. Most errors of that type are also too obvious to be harmful; for instance, the translation of equilibrium constant by rate constant on p. 225 or the errors introduced in reproducing the mathematical equations (3a and 5) on p. 70. Somewhat worse are the translation "1,2,3-Trimethoxy-4,6-ditritiumbenzol" for a compound containing tracer amounts of tritium in the positions referred to (the Russian name is not misleading in this way) and the decimal errors introduced in the reproduction of Table 63. In some respects, the German edition has a more clear typographic arrangement than the original. Its table of contents has a more far-going breakdown, and the different sections have been equipped with a helpful decimal system. As most Russian books, the original lacks a subject as well as an author index. The German edition lacks the latter and has a rather scanty subject index.

In spite of its merits, the German edition of Schatenstein's book is not likely to find an appreciable market within the United States because there is already a translation into English. In addition to the language, the latter has the advantage of a much more moderate dollar price.

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