
 BOOK REVIEWS

Symposium on Radiobiology. The Basic Aspects of Radiation Effects on Living Systems. Oberlin College—June 14–18, 1950. By JAMES J. NICKSON (Editor). John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. xii + 465 pp. 15.5 × 23.5 cm. Price, \$7.50.

This symposium was organized under the auspices of the National Research Council to review the more fundamental aspects of radiobiology, beginning with the processes of absorption of radiation by matter and proceeding through the consequent chemical, biochemical and cytological changes to a consideration of certain physiological, genetic and lethal effects in the mammal. The ultimate objective of relating all these phenomena satisfactorily is probably a distant one, but a definite advance was made by critical summarization of those factors which appear to be established and by designation of those gaps in present knowledge which might be filled in readily.

Of twenty-three papers the first eight deal about equally with physical and chemical interactions of radiation, including particles, with matter. This is followed by a long chapter by Platzman on that topic of especial pertinence to biological systems, the absorption of radiation by water. The succeeding five chapters review the findings in biochemical systems including studies of factors altering radiosensitivity in organisms. The papers of the three European contributors Dale, Hevesy and Latarjet are in this group. Three of the final nine chapters deal with hereditary problems, chromosome aberrations, gene mutations and mammalian genetics. One of these is a full expression of Muller's views on gene mutations. The remaining papers are on separate topics including factors modifying the sensitivity of cells to high energy and ultraviolet radiation, discussions of the effect of the rate of energy loss along the path of ionization, the development of a diffusion theory by Tobias which accounts for the different sensitivities of different ploidys in yeast, the influence of quantity and quality of radiation on the biologic effect, some physiological effects on mammals and, finally, a concluding chapter by Brues and Sacher giving an analysis of mammalian radiation injury and lethality using, in part, the Gompertz equation and in part, a function developed previously by Sacher.

Owing to the arrangement, the editing and the discussions following each subject, the continuity of the story is much better than is usual in an effort of this kind. For this reason students will find it useful for orientation although it is not sufficiently detailed for a text. However, there are over 700 references leading to original sources.

Teachers and researchers in this field will find the volume very useful for reference and review.

UNIVERSITY OF ROCHESTER
SCHOOL OF MEDICINE AND DENTISTRY HENRY A. BLAIR
ROCHESTER, NEW YORK

Les Théories Électroniques de la Chimie Organique. By BERNARD PULLMAN, Docteur ès Sciences, Chargé de Recherches à l'Institut du Radium de Paris, and MME. ALBERTE PULLMAN, Docteur ès Sciences, Chargée de Recherches à l'Institut du Radium de Paris. Masson et Cie, Éditeurs, 120 Boulevard Saint-Germain, Paris, VI^e, France. 1952. x + 665 pp. 17 × 25.5 cm. Price, 2800 Fr.

Extensive applications of quantum-mechanical principles have been made recently to structural problems of organic chemistry, and to some extent to the problems of chemical reactivity. The present book reviews the results of theoretical calculations of resonance energies, bond orders, charge distributions and related topics. The authors have made important contributions to the development of these theories, and discuss the subjects in a comprehensive and critical manner. The principal results are collected in numerous tables and the book is well illustrated by appro-

priate diagrams. The mathematical details are confined to a minimum, and these details should not offer too much difficulty to the serious student who wishes to understand modern theories of organic chemistry.

The first three chapters (114 pages) give a condensed summary of wave-mechanical principles on which the whole structure of the book is built. The central problem of conjugation is treated in detail in Chapter IV on the basis of valence-bond and molecular orbital wave functions. Extensive use is made here and in subsequent chapters of molecular diagrams of approximate bond orders and charge distributions derived from molecular orbital and valence-bond computations. Resonance energy (Chapter V, 111 pages) is discussed in relation to oxidation-reduction systems, isomerization and tautomerism and to some chemical processes, in particular to free radical reactions.

The treatment of electronic spectra is relatively brief (70 pages) and is largely an empirical discussion of selected topics. This chapter does not appear to constitute a satisfactory general account of recent developments in the interpretation of spectra.

The last chapter on applications of molecular diagrams to chemical reactivity is concerned principally with reactivity of conjugated hydrocarbons and their simple derivatives. Different types of reactions are compared in some detail with corresponding diagrams, and the utility of these diagrams is made convincing. An appendix gives the results of approximate molecular orbital computations on a large number of hydrocarbon molecules. It is of some value to have these data collected together in one place, but more discussion should have been made of individual cases, since these results are certainly not all of equal merit. As the data stand, they are of little use in qualitative prediction of energy levels unless a constant value of γ (resonance integral) is assumed, and this is surely unjustified for some of the molecules in the tables.

This text is recommended to students of organic chemistry who are interested in the application of approximate theoretical methods to their problems. The progress which has been made in the explanation of properties of conjugated hydrocarbons, as recorded here, is impressive and should inspire extension to other types of organic compounds.

UNIVERSITY OF ROCHESTER
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A. B. F. DUNCAN

Proceedings of the London Conference on Optical Instruments—1950. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1952. xv + 264 pp. 15 × 22.5 cm. Price, \$7.00.

The book contains a collection of papers on optical instruments which were presented at the London conference in 1950. Phases of optics discussed may be divided into the following categories: (1) Use of mirrors in optical instruments to extend the working range into the ultraviolet and the infrared. (2) Phase microscopy. (3) Spectrographic and spectrophotometric equipment. (4) New materials.

The following papers are mentioned to indicate the broad interest of the conference. R. Kingslake, H. H. Hopkins and D. Grey covered the major present day problems in optical design. G. R. Harrison presented a paper on echelle spectroscopy. A compact and highly informative talk on "The Modern Reflecting Telescope" was given by E. H. Linfoot, and E. Bergstrand described a new instrument for measuring distance by high frequency light chopping. Optical glass and plastic materials were discussed by I. Gardner and H. C. Raine.

The articles on spectrographic and spectrophotometric equipment will probably be of most interest to chemists. Stanley Ballard's article will prove worthwhile to chemists considering the purchase of a spectrophotometer.

Since the papers are of general interest and lacking in detailed information, the non-specialist may find the book dis-

appointing if he expects more than a summary of each subject. It may be of great value to him as a starting point, however, for the authors have done an excellent job at reporting the status of their field of interest, and many of the articles have extensive bibliographies.

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Elektrochemie, Theoretische Grundlagen und Anwendungen. By GIULIO MILAZZO, Istituto Superiore di Sanita, Rom, Prof. Inc. fur Elektrochemie an der Universitat Rom. Springer-Verlag, Vienna 1, Molkerbastei 5, Austria. 1952. xiii + 419 pp. 17.5 × 25 cm. Price, \$8.60.

This book was originally written in Italian and has been translated, with some modifications, into German. It rests heavily on German texts of a generation ago, and is comparatively uninfluenced by recent work in electrochemistry, particularly the parts originating in English speaking countries. If this appears to be severe criticism let us examine some of the evidence.

The book starts with a formal discussion of thermodynamics, without pointing out that the potentials of certain types of galvanic cells measure the Gibbs free energy of the cell reactions. The use of cells without appreciable liquid junctions has greatly increased the precision of measurement and the clarity of the theoretical interpretation, but it is quite ignored by the author. In the discussion of the determination of transference numbers the moving boundary method is mentioned briefly. The table of values of the number is, however, based on measurements which have largely been superseded by the extensive and highly accurate moving boundary results obtained by Longworth and by Gordon and associates. Furthermore, the more recent use of transference numbers in interpreting the results of the measurements of concentration cells is not discussed.

Probably the most serious deviation from the modern point of view is the author's rejection of the Debye-Hückel theory. That theory has, of course, been amazingly successful in organizing the field of the electrochemistry of solutions and in stimulating research in that field. The data in the book do not include the activity coefficients which are in accord with that theory for widely differing types of strong electrolytes, and throughout the concentration ranges in which the theory would be expected to be valid. Furthermore, weak electrolytes are considered in terms of the Arrhenius assumptions, no mention being made of the contribution of the interionic attraction theory to this field.

The author has not kept up with modern thought in dealing with the related ideas of absolute potentials, single electrode potentials, and activity coefficients of single ionic constituents. None of these are now considered to be operational, and all require non-thermodynamic assumptions to yield numerical values. However, the otherwise inadequate treatment of pH includes at least an indication that the problem exists.

The list of electrochemical topics that are given unmoderated discussion, or are not even mentioned, could be considerably extended, but enough has probably been said to indicate that the reviewer does not consider the book to be a safe source of electrochemical information for readers of THIS JOURNAL. The book might be worth keeping on one's shelves if it were a good source of literature references. The problem of leading the reader to the relevant and important articles in a field is a difficult one. It has been met, by different authors, by giving no references or by publishing overwhelming bibliographies, and by all gradations between these extremes. It appears to the reviewer that a text book or treatise fails if it does not lead a reader readily to the more important of the original publications. Many otherwise excellent recent books are seriously lacking in this respect. The references might well include, in the first place, the articles in which the ideas discussed first occurred. These are frequently stimulating and informative reading. To these should be added the more recent publications giving the latest data and the more advanced ideas. And finally, it is useful to have listed the review articles and books dealing with the field. Too much concentration on the latter may, however, lead to uncertainty as to the author's

scholarship. In the case of the book under review it is not evident that any policy as to references has been maintained, since many references are given for certain topics, and none at all for others. Many data are given with no indication as to their original source. An author index would have been particularly useful for the volume under discussion but was omitted.

ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH
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The Phase Rule and its Applications. Ninth Edition. By A. N. CAMPBELL, Professor of Chemistry in the University of Manitoba, and N. O. SMITH, Associate Professor of Physical Chemistry in Fordham University. Dover Publications, Inc., 1780 Broadway, New York 19, N. Y., 1951. xii + 494 pp. 13.5 × 20.4 cm. Price paper-bound \$1.90, clothbound \$5.00.

This major revision of Professor Findlay's book of this title involves so many deletions and additions that it should be regarded "as largely a new book." Only six of its twenty chapters are essentially identical with chapters in the previous editions, five or six more are not modified radically, but the rest are either new (three) or extensively rewritten. Two new appendices are given, one on thermodynamic deductions of temperature-composition diagrams in two- and three-component systems by means of molar free energy curves, and the other on the determination of binary solid-liquid equilibria (stresses principles and procedure rather than apparatus).

The book retains much of its original simplicity, but at the same time has become more comprehensive. Thus, for the first time it deals systematically with liquid-vapor equilibria in two- and three-component systems.

The authors and publishers are to be congratulated on keeping the price within the reach of all. The printing is easily read in the text and in many of the graphs. However, several of the graphs contain lettering which has been reduced too much for satisfactory legibility (*cf.* Figs. 146, 160, 189).

The authors question the existence of the sixth type of binary solid solution described by Ricci, THIS JOURNAL, 57, 807 (1935). In this case solid solution is said to occur only in the intermediate range of compositions, the pure components A and B crystallizing at compositions near pure A or pure B. Possibly this is an oversimplification due to experimental difficulties in recognizing a very limited solubility of B in A and *vice versa*. But in any case the reviewer sees no reason why such an equilibrium is impossible. Because of its rarity, the investigator will naturally want to examine his data critically when he encounters such a case.

A few statements seem out of place simply because much material from earlier editions has been used verbatim. For example, on page 206 it is stated that a certain portion of the iron-carbon phase diagram "has been more fully studied in recent times by Honda" and the dates of Honda's work cited range from 1915 to 1925. Again the use of "superfused" to mean supercooled (page 43) is inconsistent with modern usage.

The authors prefer the term allotropy for what many scientists call polymorphism.

The reviewer feels that "The Phase Rule and Its Applications" will continue as one of the more convenient and readily grasped texts on the utilization of heterogeneous equilibria to interpret chemical and physical interactions and transformations.

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Selected Values of Chemical Thermodynamic Properties. Circular of the National Bureau of Standards 500. By FREDERICK D. ROSSINI, DONALD D. WAGMAN, WILLIAM H. EVANS, SAMUEL LEVINE AND IRVING JAFFE. United States Government Printing Office, Washington 25, D. C. 1952. iv + 1268 pp. 22 × 26.5 cm. Price, \$7.25.

The publication of this volume marks an important milestone in the systematization of the data of chemical thermo-

dynamics. Chemical science is hereby further indebted to the National Bureau of Standards (and the Office of Naval Research whose interest and assistance are acknowledged in the preface).

An important step in the systematization of thermochemical data was made when the late F. R. Bichowsky, then of the U. S. Naval Research Laboratory, collated all published data involving heats of reaction and prepared therefrom a self-consistent table of "best" values for the heats of formation of the chemical substances for the "International Critical Tables." This treatment was revised and extended (to include heats of transition, fusion, vaporization, solution, ionization, dissociation and excitation) by F. R. Bichowsky and F. D. Rossini in their "Thermochemistry of the Chemical Substances" (1936).

Since 1940 the maintenance of a complete table of chemical thermodynamic data has been established as a project at the Bureau under the direction first of F. D. Rossini and now of D. D. Wagman. Most of the present data were issued (without references) in loose leaf form in three series to various laboratories during the three years ending March 31, 1950. Loose leaf sheets of Series III (not included in the present volume) are still being distributed periodically. This more ambitious section which gives the various thermodynamic functions to high temperatures at regular intervals is understandably much less complete than Series I and II.

In the introduction (6 pp.) concise and careful statements are given of units and values of units, the conventions and definitions regarding the properties and reference states. Values of energy are expressed in terms of the thermochemical calorie, which is defined in terms of the absolute joule and the old international joule.

The tables of Series I (530 pp.) give values of ΔH_f° at 0°K . of ΔH_f° , ΔF_f° and $\log_{10} K_f$ for the formation of the given substance from the elements, at the reference temperature 298.16°K ., as well as values of entropy and heat capacity in the thermodynamic standard state at 298.16°K . Of these properties only the heat of formation (at 18°C .) was given in Bichowsky and Rossini's "Thermochemistry." The usefulness of the tables is greatly enhanced by the choice of 25° as the reference temperature, and it is noted with pleasure that the heat effects are now stated in terms of increments.

The temperature, ΔH , ΔS and frequently also ΔC_p for changes of state are given in the tables of Series II (286 pp.). There are a considerable number of substances for which only the temperatures of the phase changes are given. The initial and final states are clearly indicated. For all changes involving the gaseous state, and for many involving only condensed phases, the pressures are given. For many processes of vaporization the heat effects are given at one or more pressures besides the normal boiling point. Data for triple point changes can be picked out readily. The omission of such processes as dissociation and solution which are readily obtainable from the tables of Series I is readily countenanced, though it is admitted that the direct data for the latter processes was a feature of considerable interest in Bichowsky and Rossini's "Thermochemistry."

The next three sections give specific reference for the tables of properties of Series I and II and the general list of references (202, 146 and 96 pp.). These are admirably planned and easily used. The reviewer wishes that initials had been used in the general list of references.

The book has been produced by the photo offset process, the tables being made from the same typescript sheets from which the loose leaf sheets were made (reduced by a factor of about 0.9). Thus the essential tables have been proof-read by the numerous users of the loose leaf sheets. Errors appear to be extremely rare, several in the names of references. The difficulty of keeping such a compilation up-to-date is illustrated by the fact that errors involving aqueous cuprous ion, known to one of the editors in July, 1951 (THIS JOURNAL, 73, 5463 (1951)) are not corrected.

The legibility is excellent. Roughly two-thirds of each sheet is used. The breaks have been skillfully made and serve as an inner index.

The low price should encourage many users of this important volume to procure a copy for their own shelves and thus prolong the shelf-life of the library copy. Though substantially bound, the volume is large and heavy and will

inevitably lead a life only less strenuous than that of a volume of "Chemical Abstracts."

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HUGH M. SPENCER

Absorption and Extraction. Second Edition. By THOMAS K. SHERWOOD, Professor of Chemical Engineering, Massachusetts Institute of Technology, and ROBERT L. PIGFORD, Professor of Chemical Engineering and Chairman, Department of Chemical Engineering, University of Delaware. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, N. Y. 1952. ix + 478 pp. 16.5×23.5 cm. Price, \$7.50.

In this second edition of a work that was first published in 1937 and is well-known to chemical engineers, Dr. Pigford has joined Dr. Sherwood as co-author. Both authors are leading research contributors in the area of phase change operations. The book has been substantially rewritten and expanded. It reflects recent advances and the authors were critical in selecting subject material from a voluminous literature.

As may be noted from the following proportions in the text, the subject of gas absorption receives greater emphasis than solvent extraction: principles of diffusion and mass transfer, 26%; gas absorber design and equipment, 61% and solvent extraction, 13%. Noteworthy additions are new chapters on eddy diffusion and transfer of material between phases. The theoretical treatment of simultaneous chemical reaction and gas absorption is greatly extended in this edition.

The number of illustrative problems has been more than doubled between editions, the present number being 45. The book has been enriched further for textbook use by the introduction in the second edition of 60 selected problems at ends of chapters.

This book should be of interest as an intermediate text to chemical engineers and to others interested in the phase change separations treated.

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R. H. WILHELM

BOOKS RECEIVED

October 10, 1952–November 10, 1952

RICHARD T. ARNOLD (Editor-in-Chief). "Organic Syntheses—An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals." Volume 32. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. 119 pp. \$3.50.

CHARLES S. BARRETT. "Structure of Metals—Crystallographic Methods, Principles, and Data." Second Edition. McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N. Y. 1952. 661 pp. \$10.00.

G. B. COOK AND J. F. DUNCAN. "Modern Radiochemical Practice." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1952. 407 pp. \$8.50.

C. COURTY. "Charbons Actives (Adsorption des Gas et des Vapeurs)." Gauthier-Villars, 55 Quai des Grands-Augustins, Paris (6e), France, 1952. 534 pp. 4.500 fr.

WILHELM EITEL. "Thermochemical Methods in Silicate Investigation." Rutgers University Press. New Brunswick, New Jersey. 1952. 132 pp. \$4.75.

LAWRENCE H. FLETT AND WILLIAM HOWLETT GARDNER. "Maleic Anhydride Derivatives—Reactions of the Double Bond." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. 269 pp. \$6.50.

A. J. C. WILSON (General Editor), C. S. BARRETT, J. M. BIJVOET, AND J. MONTEATH ROBERTSON (Section Editors). "Structure Reports for 1949." Volume 12. N.V. A. Oosthoek's Uitgevers MIJ., Doinstraat 1-3, Utrecht, Holland. 1952. 478 pp. 45.—Dutch florins.