BOOK REVIEWS

Ultraviolet Spectra of Aromatic Compounds. By ROBERT A. FRIEDEL, D.Sc., Physical Chemist, and MILTON ORCHIN, Ph.D., Organic Chemist, Bureau of Mines, Bruceton, Pennsylvania. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1951. vi + 377 pp. 20.5 × 26.5 cm. Price, $10.00.

We welcome the appearance of this beautifully executed catalog containing the ultraviolet absorption spectra of nearly six hundred aromatic compounds. The spectra are shown as uniformly scaled plots of log ϵ *vs.* wave length in ångströms. The spiral binding permits removal of individual sheets so that comparisons may be made more readily by superposition. Many of the spectra are published here for the first time. The arrangement of compounds is according to the number of condensed rings; unfortunately there is no cross-indexing and compounds having similar functional groups but different ring systems cannot be readily compared. As an introduction to the catalog there is an excellent but very brief discussion of the general subject. Although intended for the benefit of the neophyte, the discussion contains numerous practical suggestions concerning the treatment of spectroscopic data which many veterans will find useful.

DEPARTMENT OF CHEMISTRY
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X-Ray Analysis of Crystals. By J. M. BIJVOET, Professor of Physical Chemistry, University of Utrecht, the late N. H. KOLKMEYER and CAROLINE H. MACGILLAVRY, Professor of Crystallography, University of Amsterdam. (Based on a translation by H. Littman Furth.) Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1951. xii + 304 pp. 16 × 25.5 cm. Price, $6.50.

The text of this book seems to divide naturally into three main sections. Chapters 1–5 (pp. 1–122) are devoted mostly to basic relations and procedures, illustrated by specific examples, which are applicable to the study of rather simple structures. Chapters 6–8 (pp. 123–225) contain a brief but generally excellent discussion of representative structural results ranging from the simplest to the very complex. Appendices I–IX (pp. 226–293) for the most part represent a further development or statement of certain fundamental relations which are less fully treated (or omitted altogether) in the first section. There is also (pp. 294–304) an apparently adequate subject index.

One judges that the book is addressed primarily to students having only a modest background in the physics of diffraction theory, who, none the less, wish to obtain a real understanding of the methods and scope of X-ray structural analysis. The subject matter is developed by elementary but direct and convincing arguments commonly aided by excellent diagrams. The terse economical style of the text always is interesting and usually is illuminating. Occasionally a perhaps too nearly literal translation leads to a rather awkward English construction. There are also quite a number of minor, usually obvious, errors which should have been caught in proof.

The important experimental techniques are described in the first section, the powder and rotation methods being illustrated in actual determinations of structure. Practical applications of the powder method in the identification of substances, the determination of crystallite size and of texture, etc., are also discussed. The detailed analysis by the trial method of the six-parameter mercuric chloride structure (Chapter 4) should interest especially the student preparing himself for work on complex structures. A good but very brief introduction to Fourier methods in structure analysis is provided by Chapter V. Anyone wishing to specialize in the field of X-ray analysis probably would find it desirable to integrate with his reading of Chapters 1–5 the more nearly exact and complete treatment of certain topics given in Appendices I–VII. The concept of the reciprocal lattice, for instance, is not used in the first section of the book. The importance of Fourier methods in the study both of completely ordered and partially disordered crystals is made evident by Appendices VI and VII.

In this reviewer's experience with beginning students it has seemed advantageous to insist from the outset upon the meticulous application of lattice theory to the determination (or description) of the unit cell. The Authors do not find it convenient to take up the characteristic differences in the diffraction patterns afforded by the various Bravais lattices compatible with a given crystal system until Chapter 3 (pp. 62–69) is reached. Some of the earlier discussion of Chapter 2, involving use of the Bragg equation, seems almost to ignore the existence of non-primitive lattices. It is stated (p. 24), "If in three measured diffractions by an orthorhombic crystal the three orthogonal planes are known to produce the reflection(s), the calculated net-plane distances immediately determine the cell, ..." This statement is correct only if, in addition, one knows which of the four orthorhombic lattices is involved. The relation between the Laue and Bragg diffraction conditions is derived (p. 23) without comment as to the formalism required for centered cells. Details of this sort together with the extended use, without adequate explanation, of the potassium chloride structure is an example of a simple cubic lattice are likely to confuse the inexperienced reader, at any rate one who must depend altogether on his own efforts. A careful study of the later material (Chapters 3 and 4), to be sure, should tend to clear up ambiguities of the kind cited.

The classification (according to bond type) and properties of structures (Chapter 6) is well done; the correlation of structure with rather diverse physical properties is especially interesting. The treatment of selected inorganic structures (Chapter 7) is equally good, particularly with respect to general structural principles. The twenty pages devoted to silicates constitutes the best short discussion of this subject which this reviewer has seen. Chapter 8 gives a brief survey of structural results in organic chemistry. Well chosen examples of both aliphatic and aromatic structures are first taken up; the whole subject then is brought pretty well up to date through short illuminating discussions of macromolecular compounds, including the various fibrous structures, globular proteins, and viruses. Numerous references to other books and to the journal literature are given, although the method of listing seems rather capricious.

In a book of this character and length it is not feasible to discuss in detail, if at all, some of the elaborate methods now being applied to the determination of complex structures. Nevertheless, the Authors clearly indicate the principal directions of interest current in X-ray crystallography and give to the reader a real feeling for some of the more promising methods of attack. The surprisingly extended coverage of the book is a consequence of the Authors' direct approach and tersely efficient style in writing.

DEPARTMENT OF CHEMISTRY
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Phase Transformations in Solids. (Symposium held at Cornell University, August 23–26, 1948.) By R. SMOLUCHOWSKI (Chairman, Editorial Committee), J. E. MAYER and W. A. WEYL. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1951. x + 660 pp. 15 × 22 cm. Price, $9.50.

This book is a collection of papers on the subject by workers in many diverse fields. The papers can be divided into three main groups: a theoretical physical group, a group dealing with non-metals and a group dealing with metals. In the first group Tisza gives an extension of thermodynamics which enables him to describe and classify critical points in solids. Application is made to ferroelectrics and to solid hydrogen halides. Mayer develops a general statistical treatment which aims at a treatment of melting. The partition function is obtained for the case in which the number of imperfections is not a constant. The imperfections con-

sidered are vacancies, interstitials, and wrong atoms. Kirkwood gives a statistical treatment which assumes that in melting atomic pair correlation is the important feature which when used in a theory which treats coöperation correctly will give satisfactory results. Seitz gives a thorough survey of the fundamentals of diffusion. Smoluchowski's treatment of nucleation by thermal fluctuations is a competent review of this field. Buerger discusses the crystallographic aspects of phase transformations. Rice uses solid data and a definite model of a liquid to treat the melting of argon.

In the second section Huggins gives a qualitative discussion of the theoretical reasons for the phase transformations in the silver halides. There are two papers by Kracek and Schairer on silicates and one by Weyl on glass. Finally Matthias describes conditions necessary for the existence of ferroelectric materials and gives examples.

In the third section Barrett discusses phase transformations which occur in pure metals. His dislocation pictures of the interface between the new and old phase are interesting and suggestive. Siegel describes advances in our experimental knowledge of order-disorder. Geisler gives an excellent review of our present understanding of precipitation; a careful discussion of the X-ray work is given, and a complete bibliography has been compiled. Mehl and Dube give data and some theory for the eutectoid reaction for the production of pearlite in the iron–carbon system. Cohen discusses the experimental data available on martensite reactions.

Although the book was three years in press, it is still the most recent and authoritative book in the field. The book is stimulating because it clearly shows that present phase transformation theory is in its infancy; hence, much more work, both theoretical and guided experimental, remains to be done. The great diversity of the backgrounds of those participating makes the book difficult to read, for it is hard to find the common outlook which ought to hold these papers together. This difficulty is probably a reflection of the fact that actually not much is known about the theory in general. In summary, the papers are individually good and well written but there is little coherence about the work as a whole. The book conveys accurately the present status of this field.

DEPARTMENT OF PHYSICS
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An Advanced Treatise on Physical Chemistry. Volume Two. The Properties of Liquids. By J. R. PARTINGTON, M.B.E., D.Sc., Professor of Chemistry in the University of London (Queen Mary College). Longmans, Green and Co., Inc., 55 Fifth Avenue, New York, N. Y. 1951. xliv + 448 pp. $16\frac{1}{2} \times 25\frac{1}{2}$ cm. Price, $10.00.

The words of high praise given by many reviewers to the first volume of Dr. Partington's treatise will undoubtedly be repeated when they read the second volume. Although the treatise is not a "text-book" in the usual sense of the word, advanced students and research workers will find it an almost inexhaustible mine of information.

The treatment of a given topic is introduced by a short but critical historical survey accompanied by abundant references to the original literature. In general, the theory is not given a detailed exposition; important equations resulting from the theory are given, usually without derivation. Readers are referred to the original articles for methods of developing the equations.

On the other hand, experimental methods are treated very comprehensively with voluminous documentation. This is one of the most characteristic and valuable features of the treatise. In many of the sections, the author has found room for a host of empirical or semi-empirical relations. For example, he lists over sixty equations dealing with latent heat of evaporation.

I remark in conclusion that any person who is seriously engaged in the theoretical or experimental study of liquids can find out, by using this treatise, virtually everything that has been accomplished in this field. I pay tribute to Dr. Partington's inexhaustible energy and scientific skill.

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Statistical Methods for Chemists. By W. J. YOUDEN, National Bureau of Standards, Washington, D. C. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1951. x + 126 pp. 15.5 × 23.5 cm. Price, $3.00.

This book shows, directly, how statistical methodology can be used to help design and interpret experimental work in the field of analytical chemistry. It will be useful to all chemists who make decisions on the basis of quantitative measurements.

The book is characterized by an absence of statistical theory and proof; it assumes that experimenters, who understand the meaning of their measurements, will intuitively see that the formulations of the statistician are in accord with experience. The book can be considered neither a handbook of methods nor a textbook; it presents a discussion of a few statistical techniques in a manner so that they will be understood and used intelligently. Emphasis is placed upon the proper interpretation of experimental work.

The first three chapters are concerned with the concepts of precision and accuracy and the use of simple statistical computations to evaluate and compare analytical results. Methods of studying the relative magnitude of analytical variability and the variability of samples taken for analysis are given in chapter four.

The use of linear regression to detect the presence of constant errors in an analytical method are presented in chapter five on Statistics of the Straight Line. This technique can be used whenever known samples of material are prepared as a check on an analytical procedure.

The last half of the book presents an introduction to the design and interpretation of experiments. The chapter on variance analysis includes a section on precautions to be taken in using this statistical technique. Another chapter is devoted to the interpretation of interactions in factorial experiments. Experimental designs such as latin squares, Youden squares and incomplete blocks, which will help improve the precision of analytical results, are given in the last two chapters.

Numerical examples are used throughout the book to illustrate the techniques presented. A reference list of six books on statistics is included; however, no attempt has been made to give complete references to the literature on statistics. Tables for critical values of Student's t and Fisher's F and a table of squares are given in an appendix.

COLOR CONTROL DIVISION
EASTMAN KODAK COMPANY GRANT WERNIMONT
ROCHESTER 4, NEW YORK

BOOKS RECEIVED

February 10, 1952–March 10, 1952

COMITE INTERNATIONAL DE THERMODYNAMIQUE ET DE CINETIQUE ELECTROCHIMIQUES. "Comptes Rendus de la II Reunion—1950." Libreria Editrice Politecnica, Cesare Tamburini, Milano, Italy. 1951. 406 pp. L. 3800.—.

JONATHAN L. HARTWELL. "Survey of Compounds which have been Tested for Carcinogenic Activity." Second Edition, Public Health Service Publication No. 149. U. S. Government Printing Office, Washington 25, D. C. 1951. 583 pp. $4.25.

WILLARD F. LIBBY. "Radiocarbon Dating." The University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Illinois. 1952. 124 pp. $3.50.

JOHN LUMSDEN. "Thermodynamics of Alloys." The Institute of Metals, 4 Grosvenor Gardens, London, S. W. 1, England. 1952. 384 pp. $5.50.

BERNHARD PRIJS. "Kartothek der Thiazolverbindungen." Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1952. $42.50. Volume I, 347 pp.; Volume II, 334 pp.; Volume III, 335 pp.; Volume IV, 328 pp.

CALVIN E. SCHILDKNECHT. "Vinyl and Related Polymers." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. 723 pp. $12.50.