it is unfortunate that an author who spends so much time in assembling a critically selected bibliography will consent to have its utility diminished by limiting it to unidirectional use.

In spite of these minor flaws, the book will be found to be of great value to all scientists interested in the field, whether from the chemical, biological, or medical point of view or whether they are beginners or experienced in these studies.

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Topics in Phosphorus Chemistry. Volume 1. Edited by M. GRAYSON, American Cyanamid Co., Stamford, Conn., and EDWARD J. GRIFFITH, Monsanto Chemical Co., St. Louis, Mo. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. vii + 262 pp. 16 × 24 cm. Price, $12.00.

This volume is the first of a new series which has been inaugurated "to provide the general scientific reader as well as the specialist in phosphorus chemistry with a series of critical evaluations and reviews of progress" in this rapidly growing division of the chemical science. No pattern of topic coverage has been established for the series and the editorial view is toward a flexible attitude.

A series, such as this one, certainly has a place in the "permanent" chemical literature today. Numerous and rapid strides of research expand the existing knowledge so rapidly that a truly comprehensive piece of writing, even in such a restricted area as phosphorus chemistry, would require at this time a volume of ponderous size, at best. Such a volume would lack a fair amount of the most recent information and, thus, would be out of date, even at the publication date, in several topics if the writer is fortunate.

The present volume contains the following chapters, in addition to the usual author and subject indexes: "Synthesis of Organophosphorus Compounds from Elemental Phosphorus," by M. M. Rauhut; "Nucleophilic Displacement Reactions on Phosphorus Halides and Esters by Grignard and Lithium Reagents," by K. D. Berlin, T. H. Austin, M. Peterson, and M. Nagabhushanam; "The Michaelis–Arbuzov and Related Reactions," by R. G. Harvey and E. R. De Sombre; "Lower Oxo Acids of Phosphorus and Their Salts," by Sh. Ohashi; and "Condensed Phosphates Containing Other Oxo Acid Anions," by Sh. Ohashi.

While the general approach of the individual authors to their chapters varies expectedly in this book, some similarities are clear. The descriptive approach predominates in all of them. This is unavoidable in the last two chapters which deal with very young material, with topics that really did not exist but a few years ago. Probably the best balance between the theoretical and the descriptive approaches is attained in the third chapter on the Arbuzov–Michaelis reaction. This is facilitated, of course, by the relative wealth of data which has appeared in the literature in this connection in the past decade. Unfortunately, this information was made use of much more sparingly by the other authors in this volume. Possibly, at the present time, this reluctance to theorize is wise; however, the time is ripe for a well-founded theoretical analysis of the behavior of phosphorus compounds and a volume such as this one could well be expected to provide a home for such a discussion.

The book is nearly equally divided, space-wise, between the organic and the inorganic phosphorus compounds, so that enthusiasts in both areas would find this volume a useful literature survey up to about mid-1963. The literature coverage from mid-1940's is quite complete, but occasional misses of important points have been found. For example, in the report on the reaction of elemental phosphorus with phenols and alcohols, appearing on pages 12 and 13, the author reports some work by Soviet chemists but for some reason omits the finding that considerable amounts of triphenyl phosphate result from the reaction with phenol. Since this is a commercial product of some considerable importance, this omission would be very hazardous one to an industrial chemical reader.

The make-up of the book is good and attractive. However, in the second chapter the authors make use of heavy Arabic numerals to designate the various compounds that appear throughout the text. This notation is rather hard on the reader who has been brought up on the Roman numerals in such cases. Furthermore, the need for such numerals seems absent in a printed volume of some size, in comparison with the relatively restricted space of a journal article. More generous use of chemical names and formulas would have added but a few lines to the total size of the chapter, but would have added very greatly to the general readability of this chapter.

More generous use of tables of reported compounds, and/or their properties, would have been a most useful addition to this book, particularly for those wishing to make a quick search for a known and recently reported substance. It is to be hoped that such tables will be more frequently employed in the future volumes.

Only a few misprints were found in this volume. One of these is glaringly evident in the second equation on page 7.

While the chapter titles are a clear indication of the contents for the first three chapters, this may not be the case for the last two. These are directed primarily to the inorganic chemistry of the indicated substances and deal with very recent and difficult areas of phosphorus chemistry. The last chapter deals with condensed "polyphosphates" in which links of silicon, sulfur, vanadium, arsenic, calcium, and barium occur.

It is to be hoped that the future volumes will preserve the fine impression given by the first volume of this infant series.

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Introduction to Infrared and Raman Spectroscopy. By NORMAN B. COLTHUP, American Cyanamid Company, Stamford, Conn., LAWRENCE H. DALY, State University of New York at Albany, Albany, N. Y., and STEPHEN E. WIBERLEY, Department of Chemistry, Walker Laboratory, Rensselaer Polytechnic Institute, Troy, N. Y. Academic Press, Inc., 11 Fifth Ave., New York, N. Y. 1964. xii + 511 pp. 16 × 23.5 cm. Price, $12.00.

This book was written for the analytical or organic chemist. It aims to provide the reader with an understanding of the molecular basis of infrared and Raman spectra, so that he can make better use of vibrational spectroscopy in his own work. It starts off with three chapters on the elementary physics of molecular spectra, on instrumentation for infrared and Raman spectroscopy, and on molecular symmetry as the basis of the spectroscopic activity of molecular vibrations. This introductory material, which makes up one-third of the book, is intended to provide a background of molecular physics for Chapter 4 on "The Origin of Group Frequencies." Then follow eight chapters on the characteristic frequencies of the most common organic and inorganic functional groups, an excellent chapter, "Major Spectra–Structure Correlations by Spectral Regions," and two entitled "The Theoretical Analysis of Molecules" and "The Calculation of Thermodynamic Functions."

As a bridge covering the gap between Herzberg's formidable monograph "Infrared and Raman Spectra" and Bellamy's comprehensive treatise on the infrared spectra of large molecules, this book serves a useful purpose. For the most part it compares favorably with the half-dozen or more such books which have appeared in English in the past few years.

The best features of the book for its intended readers are contained in Chapters 4–13, summarizing functional group frequencies and their origins. Not only are group frequencies discussed in authoritative detail, but 624 infrared spectra in condensed form are presented to illustrate the appearance of the infrared bands from which these frequencies are derived. The conditions under which the various spectra were obtained are carefully stated and the spectra are well indexed both as to functional groups and as to molecular formulas.

This reviewer's chief criticism would be directed at Chapter 3, entitled (somewhat inaccurately) "Classification of Molecules." It seems of doubtful value to try to present the mathematical theory of group representations in a few pages to the organic or analytical chemist if the chief objective of the presentation is to show him how to calculate the number of molecular vibrations belonging to each symmetry species. This calculation can be explained in simple terms without explicit appeal to group theory, and generalized in the form of tables, as has been shown for example by Herzberg (*loc. cit.*, pp. 131–135). The latter approach is no less exact than the group-theoretical procedure, to which it is entirely equivalent, but with proper exposition (such as that of Herzberg, for example) it gives the beginner more insight into the form of vibrational modes.

The discussion of the physical basis of infrared and Raman selection rules in Sections 3.7 and 3.8 is also needlessly obscure because of its burial under group theoretical formulas which are taken from the literature without explanation. This discussion in particular is at odds with the claims in the Preface that "the theory presented