

ponents of the F_{1u} species, which have been split owing to the monoclinic environment, then a single band of reasonable intensity would be expected in the spectrum of the iodide. According to Nakamoto, *et al.*, this is not the case, and the spectrum obtained by Shimanouchi and Nakagawa therefore imposes an indeterminate answer.

In view of these uncertainties, we suggest that the nature of the Co-N stretching and deformation modes remains to be resolved. We plan to observe the

spectra of appropriate complexes below 200 cm^{-1} and undertake a complete (as possible) normal coordinate analysis.

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Book Reviews

Chromatographic Methods. By R. STOCK and C. B. F. RICE, Department of Chemistry and Biology, College of Technology, Liverpool. Chapman and Hall Ltd., 37 Essex Street, London W. C. 2. 1963. viii + 206 pp. 13.5 × 21.6 cm. Price, 40 s.

The importance of chromatography to chemistry is readily apparent from its phenomenal growth and widespread use. There are many books that deal with special types of chromatography, but considerably fewer that attempt to cover the spectrum. The appearance of a book with such a general title, therefore, might be expected to elicit interest from several sectors. This book is an introductory treatment of chromatography, with primary emphasis on techniques. It is intended principally for advanced undergraduates, but will also be of value to chemists who want an introduction to the chromatographic techniques with which they are unfamiliar.

The first chapter gives a short and excellent classification of chromatographic processes and an introduction to the principles of chromatography. Partition and adsorption methods are compared and the advantages of each discussed. After classifying the techniques according to phenomenon, *i.e.*, adsorption *vs.* partition, and giving a breakdown depending on the physical states of the stationary and mobile phases, the authors choose in the remainder of the book to discuss the topics according to similarities in techniques. In Chapter 2, for example, they discuss all types of liquid-phase column chromatography including liquid-solid, liquid-liquid, and ion-exchange processes.

The longest and most detailed chapters deal with paper and gas chromatography. The chapter on paper chromatography presents methods of development (ascending, descending, and horizontal), selection and preparation of solvent and paper, and methods of detection and identification of the separated components. In the same chapter there are brief discussions of thin-layer chromatography and zone electrophoresis. The latter, though not strictly a chromatographic method, was included because the techniques are closely related to those in paper chromatography. In the chapter on gas chromatography, the section entitled "Inorganic Separations" will be of special interest to the inorganic chemist. The number and variety of studies reported is indicative of the recent intense research in inorganic applications of gas chromatography. The first portion of the chapter is devoted to a description of techniques and apparatus, and at the end of the chapter there is a discussion of the theory of chromatography. The placement of this all-important section at the end of the next to the last chapter could be criticized. It would have been better to present the discussion earlier.

On the whole, the explanations are clear, but an exception is found on p. 141 where the limitation of gas chromatography to volatile samples is discussed. It is correctly stated that the vapor pressure of substances to be separated need only be a few millimeters, but the accompanying explanation implies that the ease of elution is a function of the sample size.

The last chapter describes eighteen model experiments based on the authors' experience in teaching a course on chromatography. The experiments were chosen to give an example of each of the main procedures and demonstrate the principles involved. There are frequent references to earlier discussions that are germane to the various experiments. For reasons of simplicity, paper chromatographic experiments are the most numerous. There are two experiments in gas chromatography that merit special comment. For the laboratory without gas chromatography equipment, the authors have thoughtfully described a simple apparatus, attributed to Cowan and Sugihara, which can be quickly assembled from glass tubing and cleverly makes use of the eye as a detector. A second experiment requires a conventional apparatus of the type now available in most laboratories. The student is asked to perform a variety of separations and to determine the efficiency of the column by measurement of HETP values.

Aside from the minor objections noted earlier, the book is written clearly and concisely. It is well referenced at the end of each chapter and has a valuable bibliography following the Appendix. The volume gives an excellent treatment of the practical aspects of chromatography and will be welcomed as a teaching aid. It must be recognized, however, as introductory in scope; therefore it will be necessary for those anticipating the use of chromatography in their research to supplement their reading by reference to more comprehensive works.

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The Constitution of Glasses. A Dynamic Interpretation. Volume I. By WOLDEMAR A. WEYL and EVELYN CHOSTNER MARBOE. Interscience Publishers, 440 Park Avenue South, New York 16, N. Y. 1962. xix + 427 pp. 15 × 23 cm. Price, \$16.00.

Volume I of this two-volume series is subtitled "Fundamentals of the Structure of Inorganic Liquids and Solids." In keeping with this subtitle, some ten or eleven of its sixteen chapters are devoted to a summary of the properties of condensed systems in general and a discussion of forces and bonding in such systems. The remaining chapters deal with the glassy state, its formation and constitution, and experimental approaches to studying constitution. The discussions are documented by some 300 references. Both an extensive author index and a somewhat abbreviated subject index are included.

The book is substantially a presentation of a case for a dynamic approach to glass formation as opposed to the structural approach that stems from the classic studies of Zachariasen. To this end, much emphasis is laid upon an electrostatic approach to bonding in terms of extensions of the Fajans quanticule approach and in-

clusion of screening effects. The arguments advanced, although somewhat nonquantitative in character, are indicative both of Professor Weyl's depth of understanding of the glassy state and of the fact that the glassy state is one that really defies exact definition. It seems highly probable that both approaches have elements of correctness and that a complete understanding of the nature of glass will require a combination of these concepts.

The volume is rich in factual information about vitreous systems. Anyone seeking material relating to the properties of glasses will do well to consult this treatment. Many of the discussions are interpretative as well as factual and reflect Professor Weyl's wealth of knowledge about the subject and his substantial contributions to it. Unfortunately, from the point of view of the reader, information about a particular subject is often widely scattered and thus difficult to collect. Equally unfortunately, the discussions are often excessively repetitious. The styling is sometimes awkward and the explanations commonly circuitous. These difficulties and the unnecessarily brief subject index detract from the over-all utility of the book. The book is, however, a substantial contribution to an important subject.

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Chemical Applications of Group Theory. By F. A. COTTON. Interscience Publishers, Inc., 605 Third Avenue, New York 16, N. Y. 1963. ix + 295 pp. 15.5 × 23.5 cm. Price, \$12.50.

This book is perhaps the first to prove that there is a "king's road" to a subject which traditionally gets the esoteric treatment; it is probably the best introduction for the nonprofessional, as long as he has a fair imagination regarding molecules. Mathematical relevancies and conceptual motivations are lucidly communicated, definitions and relationships are clearly elaborated, and numerous molecular examples, many with illuminating figures, are used with skill to illustrate important points and generate in the reader a working knowledge.

The coverage is well chosen. A first chapter on basic principles deals with group theoretical fundamentals, molecular symmetry groups, representation theory, and the relation to quantum mechanics. Subsequently, four areas of application are discussed: hybrid atomic orbitals, molecular orbitals, ligand field theory, and molecular vibrations. The section on hybrid orbitals is particularly welcome since this subject is rarely elaborated. The section on molecular orbitals covers not only the standard π -systems, but deals also with less conventional cases such as three-center bonds, binding perpendicular to the π -orbital nodal plane, and sandwich compounds. The section on ligand field theory provides, in 60 pages, a complete introduction *in nuce* with an absolute minimum of quantum mathematical formalism. In the section on vibrations there are discussed not only the standard subjects of normal modes, selection rules, differences between infrared and Raman spectra, but also Fermi resonance and site symmetries.

A study of the book should give beginners basic insight as well as manipulative working ability and put them in an excellent position to absorb rigorous representations. In short, the book appears to be destined to become an eminently usable text for a first course.

The well-deserved praise notwithstanding, there are parts of the volume which will profit from improvements in future editions. First, the discussion of the basic relationship between

group theory and quantum mechanics is well below the general standard of the book. The fundamental equation (5.12) and the vanishing of the integral in Section 5.2 are inadequately derived. Sections 5, 7.1, 8.6, and a few other scattered items ought to be combined in a somewhat fuller chapter on these very fundamentals. Second, one might wish for a greater balance between the treatment of ligand field theory and that of the other fields. While the former is admirable and a pleasure to the initiated, the novice will be overwhelmed by the overcondensation. In the section on π -electrons, on the other hand, a somewhat more sophisticated approach might not have been out of place. Whereas the ligand field section requires a nonnegligible versatility in understanding configuration interactions, an analogous discussion is missing for the π -systems. Also, somewhat more explicit attention to molecular vibrations might be argued. Finally, there is no excuse for omitting the stereographic projections of at least the 32 crystallographic point symmetry groups.

The separate folder containing a complete collection of character tables of molecular groups is a very useful item indeed. In a future edition, these could perhaps be augmented by explicit matrices for the two and three dimensional representations. The author would do a great service to chemists by introducing the Hermann-Mauguin symbols for point groups and giving them at least as much weight as the Schoenflies symbols.

In conclusion, a highly welcome and recommendable text.

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BOOKS RECEIVED

March, 1964

- WILLIAM L. JOLLY. "The Inorganic Chemistry of Nitrogen." W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1964. xi + 124 pp. \$5.75.
- DEAN F. MARTIN and BARBARA B. MARTIN. "Coordination Compounds." McGraw-Hill Book Company, Inc., 330 West 42nd St., New York, N. Y. 1964. vii + 99 pp. Cloth, \$4.95; paperback, \$1.95.
- ROSS STEWART. "Oxidation Mechanisms." W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1964. xi + 179 pp. \$7.50.
- H. J. EMELÉUS and A. G. SHARPE, Editors. "Advances in Inorganic Chemistry and Radiochemistry." Volume 5. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. 1963. ix + 429 pp. \$14.50.
- ANDERS RINGBOM. "Complexation in Analytical Chemistry." John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1963. x + 395 pp. \$15.
- A. N. FRUMKIN, Editor. "Surface Properties of Semiconductors." Consultants Bureau Enterprises, Inc., 227 W. 17th St., New York 11, N. Y. 1964. 171 pp. \$22.50.
- "IUPAC: 19th Congress On Pure and Applied Chemistry." Butterworth Inc., 7235 Wisconsin Ave., Washington 14, D. C. 1964. 374 pp. \$14.50.
- A. D. PETROV, V. F. MIRONOV, V. A. PONOMARENKO, and E. A. CHERNYSHCHEV. "Synthesis of Organosilicon Monomers." Consultants Bureau Enterprises, Inc., 227 W. 17th St., New York 11, N. Y. 1963. 492 pp. \$22.50.
- JURG WASER. "Quantitative Chemistry." W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1964. xiii + 432 pp. Cloth, \$6; paperback, \$3.95.