mary of some interesting types of solution reactions. "Determination of Active Intermediates in Reactions" by G. M. Burnett and Sir H. H. Melville is concerned almost exclusively with chain (free-radical) reactions. "Polymerization and Polymer Reactions" by G. M. Burnett provides a résumé of the various aspects of polymerization and degradation reactions. Chapter XXII is entitled "Enzymic Reactions." Part 1 by F. M. Heunnekens is mainly concerned with steady-state methods. The material is clearly presented, but is unfortunately somewhat incomplete and out-of-date. Part 2 by B. Chance is essentially an exposé of the author's interesting transient-state studies with rapid mixing devices of catalase and peroxidases.

The last section in this book contains a description of some nonkinetic methods of elucidating reaction mechanisms. "Thermodynamics and Reaction Mechanisms" by M. M. Kreevoy has virtually nothing to do with thermodynamics, unless one considers, as the author does, that transition-state theory is thermodynamics. A formal derivation of the usual equations is given, and the results are discussed in terms of mechanistic implications. The following four chapters, "The Product Criterion of Mechanism" by E. S. Lewis and C. E. Boozer, "Evidence for the Formation of Intermediates in Organic Chemical Reactions" by M. L. Bender, "Use of Isotopes and Tagged Groups" by W. H. Saunders, Jr., and "Sterochemistry and Mechanism of Reactions" by S. L. Friess present different, but related, methods of elucidating organic mechanisms. All are well written and instructive. Of particular note is the general chapter by M. L. Bender.

Taken as a whole, this book would be a valuable asset to the book shelf of any person interested in kinetics and reaction mechanisms. Unfortunately, when this opinion is tempered with the price of this volume, one would perhaps be more prudent to recommend it as interesting library reading.

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Chemical Applications of Group Theory. By F. ALBERT COTTON, Department of Chemistry, Massachusetts Institute of Technology. John Wiley and Sons, Inc., Interscience Division, 605 Third Ave., New York 16, N. Y. 1963. 23.5 × 15.5 cm. 295 pp. Price, $12.50.

More than 30 years ago, Wigner, Weyl, Wilson, Bethe, and others showed that group theory is useful in the study of certain quantum mechanical problems. At that time, some chemists and physicists were disturbed by what appeared to be excessive formalism in the mathematics involved, and symmetry arguments were often avoided. In recent years, they have been used freely, especially by chemists. The simple methods and rewarding results have made group theory almost routine in many kinds of problems. Without its use, our present knowledge of the polyatomic molecule and the solid would probably be meager indeed. Unfortunately, some still believe the subject to be difficult and hard to understand. Nothing could be more untrue for it can be easily understood by those with only a modest amount of mathematical prerequisite. This book will help to dispel such ill-founded fears.

Let us first ask why the chemist should know something about group theory. Unless one is satisfied with the few systems that can be solved exactly by quantum mechanics, the only present alternatives appear to be intuitive, qualitative approximations or lengthy, laborious, numerical calculations. To its devotees, group theory seems to be the magic panacea, for it derives many exact answers with the simplest kinds of manipulations. It may be very difficult, for example, to evaluate the integrals which determine the infrared or Raman activity of certain spectral lines. By symmetry arguments alone, however, one may predict with confidence that such integrals do or do not vanish and thus the selection principles are known. As a second example, we note that secular determinants occur in many problems. Solving them can be a formidable task even for simple cases, but symmetry again may be used to factor the problem into smaller and more manageable determinants.

The physical chemist must now ask himself a question. If he is interested in theory and expects to contribute in that field, he should begin a serious study of group theory along with other mathematical techniques which he will need. This book will be of little help to him. On the other hand, if he wants to understand the results of others and to apply group theory methods to his own problems, his task is relatively simple. He will find it much easier to learn what he needs than he did to get a working knowledge of calculus. The present book is designed for such students and it will be of great help to them.

Written as a text for seniors or first-year graduate students, the basic principles are presented in the first part of 86 pages. Its five chapters include discussion of formal definitions and theorems, a detailed and understandable description of molecular symmetry and symmetry groups, and a less satisfactory consideration of group representations and what they mean in quantum mechanics. Here, as elsewhere, the serious reader will want to consult other sources. The author himself admits his lack of mathematical elegance and rigor, he is often verbose, and he sometimes omits proofs, especially when the going gets rough. Nevertheless, most of the necessary material is present and it is always easy to follow.

When the reader feels comfortable with this part of the book, he will be ready for the more exciting second part. Its four chapters discuss the construction of hybrid orbitals, molecular orbital theory, ligand field theory, and molecular vibrations. In each case, the examples are well chosen, beginning with simple ones and progressing to more complicated cases so that the reader should be able to envisage the variety of problems that can be attacked. In view of current interests, it is regretted that color groups and others used in studying the solid state are omitted. A separately bound table of group characters, together with the customary auxiliary information, has been thoughtfully provided as an appendix. Additional material appended is so trivial that one wonders why it was included.

With the reservations noted, this book is recommended to the class of readers for which it was intended. If some are bored with the many intermediate steps given, others will thank the author for the lack of remarks such as "it is obvious that . . . ."

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