Book Reviews

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XIIIth International Colloquium of Group Theoretical Methods in Physics. Edited by
W. W. ZACHARY. (Singapore: World Scientific and Chichester: John Wiley & Sons, 1984.)
£80·60. ISBN 0 97196687 5.

This is a collection of the communications presented at Maryland in May 1984, and it is
divided into four sections. The first one, on Plasma, Chaos and Nonlinear Dynamics, is
particularly timely in reflecting the rapidly growing interest in and understanding of chaos and
its related problems; it begins with a useful review by Ling-Lie Chau on methods for solving the
Yang–Mills equations. The second section, on Mathematical and General Methods, starts with a
very readable review on alternative space-times by I. E. Segal. The third section covers a wide
range of problems, dealing with atomic, nuclear, chemical and condensed matter applications of
group theory. Quantum Hall effect, band structures, space group representations, symmetry
breaking and phase transitions are some of the subjects treated here. The last section, on
Elementary Particles and Relativity, contains mainly contributions on gauge theory and
supergravity. In an appendix, Professor Wigner discusses changes in the roles of the symmetry
principles in his usual interesting and anecdotal style.

In a publication of this type one must expect, of course, that many of the communications
report work in progress and thus that they will find a less ephemeral form in other publications. A
few more wider review papers would probably have been very useful for the general reader and
would have redressed the balance towards more permanent contributions.

S. L. ALTMANN
Department of Metallurgy and Science of Materials,
Oxford University

Symmetry and Structure. By S. F. A. KETTLE. (Wiley, 1985.) [Pp. 330.] £8·95 (paper), £22·00 (cloth).
ISBN 0 471 90705 7.

This book is an introduction to group theory for chemistry students. In it the author adopts a
deliberately non-mathematical, pictorial approach, using discussion of chemical bonding as a
vehicle for group-theoretical concepts.

The first seven chapters take us through a series of molecules from H_2O to SF_6 serving as
examples of increasingly complicated point groups. At each step the exposition is lucid and well
illustrated; new material is tested in problems and worked examples. Chapters 8 to 10 treat
descent in symmetry, molecular vibrations and selection rules. Chapter 11 deals with π-electron
systems. All the mathematical details are relegated to a series of appendices which take up about
a third of the book and in themselves constitute a concise summary of elementary formal group
theory. The pace of the main text is much more gentle.

Most of the material that would be taught in an introductory course on group theory is
presented in the early chapters, but sometimes in an unusual order. Thus, it is not until p. 164 that
we are told how to assign a general molecule to its point group. In order to illustrate a group with
complex characters, the author treats the π-bonding of cyclobutadiene not in D_{4h} but in the C_4
subgroup (Chapter 11). Optical activity of C_4 molecules is discussed in the same chapter, at the
risk of some confusion.

To some extent the choice of topics for a general textbook must be subjective. This book
includes a useful Appendix on reduction of representations in the linear groups. On the other
hand, it leaves out symmetric and antisymmetric direct products. I would have liked to see some
mention of Brester tables in the chapter on vibrations, and of the use of group theory to *count*
independent force constants and other molecular properties.

There are a few misprints, mostly trivial. Perhaps the only one likely to cause difficulty is in
the captions to the D_{2d} character table and figures A3.7/8 where a polyhedron variously
described as a pentagonal dodecahedron or a pentagonal bipyramid is in fact the D_{2d} triangular
dodecahedron.

In summary, this is a well written and well produced introductory text on the chemical
applications of group theory that can be recommended to students first encountering this
subject.

P. W. FOWLER
University Chemical Laboratory,
Cambridge