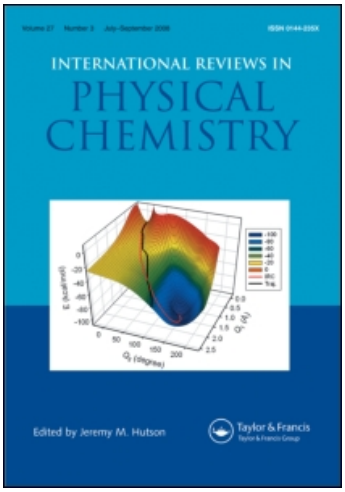

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Book reviews

Radiation Chemistry. Principles and Applications. Edited by FARHATAZIZ and M. A. J. RODGERS. (VCH Inc., 1987.) [Pp. 641 + xii.] ISBN 0 89573 127 4.

It is a pleasure to welcome a new account of radiation chemistry. The literature has not been overburdened with treatises on this subject in recent years, although progress in research continues to be made.

This is a substantial work, running to some twenty chapters. Between them practically every aspect of the subject receives attention, from the physics of the primary interactions of ionizing radiations with matter to the more chemical aspects of the biological effects of such radiations.

It is a co-operative work, the chapters written by some two dozen authors. Such books have glaring weaknesses, omissions or duplication of topics, lack of continuity leading to a disjointed impression, but in this case the editors have done a very good job and none of these disadvantages are apparent. On the other hand the advantage of all the chapters being written by experts actively engaged in advancing our knowledge of the topic concerned is very noticeable.

It is interesting, especially to the readers of this journal, that nearly a third of the book deals with that intellectually challenging and complex part of the subject, the detailed analysis of the way in which the ionizing radiation leads to chemical effects in different kinds of media. Progress is still being made in this intriguing area but it looks as though some time will elapse before we shall gain a reasonably complete understanding of what happens in the condensed phase.

In two areas radiation chemistry has stimulated a large amount of research of significance to many other parts of physical chemistry. The subject presents a number of important problems in the kinetics of non-uniform systems. Three chapters are devoted to these questions. Two, contributed by Chatterjee and Magee, are particularly interesting for their account of the progress made towards a unified treatment of electron (low LET) and heavy particle (high LET) radiations.

Two further chapters treat the important matter of electrons in liquids. Broadly speaking, one chapter concentrates on non-polar liquids and the other on polar liquids and solvated electrons. The practical problems which inhibited the development of the first of these topics are now well understood and a substantial body of reliable data has become available.

The change of emphasis with the development of the subject is reflected in the chapter on the radiolysis of gases being nearly twice as long as that on the radiolysis of aqueous solutions. The extensive coverage allows short chapters on colloidal systems, biopolymers and the alkali halides.

It is a book that can be recommended for all chemistry department libraries and the price is not unreasonable for such a substantial and well-produced volume.

A. G. MADDOCK
University Chemical Laboratory,
Cambridge

Symmetry Through the Eyes of a Chemist. By ISTVÁN and MAGDOLNA HARGITTAI. (VCH Publishers, 1986.) [Pp. 458.] DM 156·00. ISBN 0 89573 520 2.

I am not sure that the authors of this book had a clear picture of their typical reader. In the preface, they say that 'this book did not have to be written, but we felt the need to write it'. They seem to have had an urge to communicate their delight in the manifest symmetries of the natural world and of the mathematics that is used to describe it, and in this they certainly succeed. The book is full of pictures and other examples illustrating symmetry in all its aspects, in plants and animals, snow crystals and molecules, art and design, music and even literature. However, the mixture of often whimsical irrelevancies with the serious mathematics can be irritating. For instance, the discussion of antisymmetry, while entertaining in itself, is based on colour symmetry and is a distraction from the mathematical development in which it occurs. Only later, in the discussion of atomic orbitals, do we meet an example of antisymmetry that is relevant to chemistry. Colour symmetry is in fact of interest in connection with the magnetic properties of crystals, but that is not mentioned anywhere.

The attraction of the authors' approach is that they provide a sound introduction to group theory and its chemical applications that is well sugared with entertaining diversions. Many readers with a reasonable understanding of mathematics will find the treatment rather pedestrian, but for chemists with little mathematics it provides a careful and thorough account of the elements of group theory, and a useful survey of its applications in chemistry. Some of the applications are given rather limited coverage; for example, the detailed account of molecular vibrations contains only a couple of sentences suggesting that vibrational spectroscopy can be used to determine molecular structures.

There is some imprecision in the use of language, which could be confusing to a beginner. For instance, the word 'generally' is used on p. 158 with its customary meaning of 'usually but not always', but on p. 161 in a context which demands the meaning 'always'. Some of the mathematical statements are similarly imprecise: there is no identity axiom in the definition of a group, and the rotation matrix derived on p. 165 would be correct if the rotation angle α were positive, but the accompanying figure shows a rotation in a negative direction. There are few serious errors, though the reader is told that the atomic orbital p_x has quantum number $m_l = +1$ and that p_y has $m_l = -1$.

The index is reasonably extensive, but not as helpful as it might be; for instance, there are 33 references in the index to 'Symmetry plane', but they are quite undifferentiated except that some are shown as being longer than others. Cross-references in the text are not always specific ('... using the procedure detailed earlier', for instance). There is an extensive bibliography at the end of each chapter, but there are few references later than 1980 except to the authors' own work.

All in all, this is an attractive and reasonably thorough introduction to group theoretical methods in chemistry, spiced with entertaining if not always relevant illustrations of symmetry in a great variety of aspects. It is certainly more appealing than most introductory textbooks on group theory, and as good as most in its account of the theory.

ANTHONY STONE
University Chemical Laboratory, Cambridge

CRC Handbook of Chemistry and Physics. 1st Student Edition. Editor-in-Chief R. C. WEAST. (CRC Press, 1988.) [Pp. 1761.] £19·95. ISBN 0 8493 0740 6.

The *CRC Handbook of Chemistry and Physics* was first published in 1913. It has been revised 68 times and has become a familiar aid to chemists and physicists throughout the world.

This is the first Student Edition and it contains a selection of topics from the *CRC Handbook*. There are only seven pages of mathematical tables instead of the 109 in the 68th edition of the *Handbook*, but the vital 'Physical constants of inorganic compounds' and 'Physical constants of organic compounds' are reproduced in full. The Preface states that the 1st Student Edition 'provides certain core data and information that are constant or which change only slightly over an extended period of time'.

Any selection is bound to be controversial, but this reviewer was disappointed to find that the useful little table on the composition of the atmosphere is absent. He believes that the full *CRC Handbook*, with its hard cover, is nearly as convenient as this abbreviated version and will continue to find favour with students as well as with teachers and research workers, even though the cost of the newest edition is two or three times greater.

DAVID BUCKINGHAM
University Chemical Laboratory, Cambridge

Relativistic Theory of Atoms and Molecules. A Bibliography 1916–1985. By P. PYYKKÖ. (Lecture Notes in Chemistry, vol. 41, Springer-Verlag, 1986.) [Pp. 389.] DM 74·00. ISBN 3 540 17167 3.

This bibliography lists 3119 references relating to the relativistic theory of atoms and molecules. It is divided into nine chapters with titles as follows: introduction; one-particle problems; quantum electrodynamical effects; multielectron atoms—methods; multielectron atoms—results; symmetry; molecular calculations; solid-state theory; relativistic effects and

heavy-element chemistry. It will be helpful to specialists but is little more than a compilation of references.

DAVID BUCKINGHAM
University Chemical Laboratory,
Cambridge

Advances in Gas-Phase Photochemistry and Kinetics: Molecular Photodissociation Dynamics. Edited by M. N. R. ASHFOLD and J. E. BAGGOTT. (Royal Society of Chemistry, 1987.) [Pp. 243.] £59·50. ISBN 0 85186 373 6.

The understanding of the dynamics of chemical interaction has been a primary aim of chemical kinetics. The development of crossed molecular beams and of chemiluminescence produced major advances in the study of reaction dynamics. The advent of the laser has produced a corresponding advance in the study of the dynamics of photodissociation with the added advantage of a highly directional monoenergetic source of excitation which can readily be polarized. The subject has shown remarkable advances in the last decade and few of the references in this volume are more than ten years old; the recency of many of these references speaks well for the speed of publication. One may regret the demise of the comprehensive Specialist Periodical Reports on Photochemistry, but a collection of accounts of one fast developing topic is a welcome alternative. The editors have succeeded in getting many of the best-known names in the field to contribute and the standard of the contributions is high.

The first chapter by R. Bersohn is an exceptionally clear account of the basic features of the topic and of the aims of investigations, and as such can be commended as reading for all research students. Many research students would also benefit from reading Andresen and Schinke's account of the photodissociation of water in its first absorption band. This sets out clearly, and without need to refer to the literature cited, the relevant theory and the corresponding experimental observations of the energy distribution in the OH fragment which can give rise to the OH astronomical maser. The role of molecular orbitals in determining the distribution of the fragments between λ-doublets is also relevant to the chapter by H. Reisler, M. Noble and C. Wittig who show that NO is formed rapidly in the photodissociation of nitrites but more slowly via an intermediate state in the photolysis of nitro compounds. M. P. Docker, A. Hodgson and J. P. Simons give a useful account of the vector correlations associated with the conservation laws governing photofragmentation but this would benefit from diagrams illustrating their points.

The chapters by A. M. Wodtke and Y. T. Lee on photofragmentation—translational spectroscopy and by F. F. Crim on dissociation of highly vibrationally excited molecules are both more oriented upwards the authors' own work and give the reader less of a feel for the relevant background material. The final chapter by I. Powis on photoionization processes provides a series of insights into an area which is developing rapidly but cannot yet be described in terms of generalities and exceptions.

This is a useful collection of articles which conveys well the excitement of an important growth area in chemical physics. It can be commended to libraries but, sadly, few individuals will be able to afford to buy it.

B. A. THRUSH
Department of Physical Chemistry,
University of Cambridge