Phosphorus chemistry and technology

Phosphorus: An Outline of Its Chemistry, Biochemistry and Technology. By D. E. C. Corbridge. Pp. 455. (North-Holland: Amsterdam, New York and Oxford, 1977.) $59.60; Dfl.146.

THE chemistry of phosphorus is second only to that of carbon in its richness and diversity. Writing a single-volume text is thus a hazardous as well as an ambitious undertaking. The inevitable omissions and compressions can scarcely fail to disappoint specialists in the field. On the other hand, most readers prefer to use a single volume as the way in to a new subject, in the hope that they will find the answers to simple questions, and references to the secondary literature.

This book represents a brave attempt to cover "all aspects of phosphorus chemistry: organic, inorganic, biochemical, physical, environmental and technical". The level is intended to be basic and introductory; defined here as accessible to readers with at least one year of university chemistry. It is thus in direct competition with Emsley and Hall (*The Chemistry of Phosphorus*, reviewed by R. A. Shaw in *Nature*, **264**, 302; 1976).

Happily the two approaches are largely complementary. Dr Corbridge gives us a traditional treatment, packed with factual information, which is particularly strong on technological, inorganic and structural chemistry (the book has clearly developed out of the same author's *Structural Chemistry of Phosphorus*), whereas Emsley and Hall are particularly stimulating on organic and environmental aspects. How to deal with the biochemistry of phosphorus is a traditionally difficult problem, which neither book solves very satisfactorily. Dr Corbridge provides a long chapter, which illustrates very clearly the strengths and drawbacks of his approach. Everything of importance gets a mention: terms are meticulously defined even where reference to standard biochemical texts might seem more appropriate ("Enzymes are a special type of catalyst which are part protein . . ."); and compounds are evidently real things, not just formulae on paper ("Absolute glycerophosphoric acid . . . is a colourless, odourless, syrupy liquid . . .").

On the other hand, interpretation, and especially speculation, is practically absent: reaction mechanisms for example, are fairly rudimentary. This has helped to keep down the size of the book, at the expense of much of the sense that phosphorus chemistry can be intellectually exciting. What does come across very clearly, however, is the author's fascination with the subject. The history of phosphorus is nicely sketched in, and the ten-page description of the properties of the element beautifully done. The reader who wants to know what safety matches are made of will not be disappointed, and as a bonus will also find out about tov pistol caps.

A workman-like book, then, with solid virtues; but not a beautiful book. The cover, in four shades of purple with green spots, will not be to everyone's taste. And reproduced typescript is always unattractive; though at least the number of words per page compares not unfavourably with similar printed books (partly a result of using smaller type for specialised passages). Errors, too, are more plentiful than one would like; from harmless, even amusing, typing errors (lethicin; lithiosphere; and even, enzymes that can be used "in vitrio") to the more serious problem of incomplete structural formulae in a number of places.

A well-stocked chemistry library will want to have this book, which works well on its own terms as a basic introduction to the subject. As such there is also a case for it to be in more general reference libraries which have nothing up to date in the area.

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Interactions between molecules

Intermolecular Interactions: From Diatomics to Biopolymers. Edited by Bernard Pullman. Pp. 447. (Wiley: London, New York and San Francisco, 1978.) £19.50.

MOLECULAR structure is, from a theoretical point of view, essentially a solved problem. The reactivity of molecules on the other hand remains beyond the scope of theoretical calculation. The interactions between molecules are a halfway house and Bernard Pullman, with his customary nose for a good problem, has chosen this topic for a second volume of his series on perspectives in quantum chemistry and biochemistry.

Although to the experimentalist, the problem of 'intermolecular' forces is dominated by the properties of the rare gases, the theoretician is less inhibited, so that the volume includes discussion not only of the Argon-Argon potential but also $(H_2O)_2$ and even an extensive section on DNA.

The volume contains only four chapters; these are by no means equal in weight, being set out more in the manner of a dinner menu. As an hors d'oeuvres we have a review of the basic theory by A. D. Buckingham. This chapter includes applications to small molecules and is a clear summary which will be welcomed by students as well as active researchers in the field.

The main course which follows, occupies well over 200 pages and is Claverie's elaboration of the approximate formulae for the interactions between large molecules. It is by no means an easy read but includes a detailed account of the theoretical foundation and derivation of formulae. This chapter gives ample reference to applications but less actual examples, so that one is left wondering just how well the theory actually stands up in practice.

The sweet, after a heavy main course, is as enjoyable as such things should be: the principles of nucleic acid structure and function from the point of view of constituent interactions, by Rein. There is no doubt about the fascination or importance of this topic, but one is left far from totally convinced about the quality and value of the theoretical calculations described. Theory makes predictions which are "within reason", or comparison with experiment is "somewhat favourable". Difficult problems such as the influence of solvent are not avoided; nor are they solved. The biological inferences are appealing but there still seems to be some way to go before computational methods are an essential contributor to understanding.

The savoury course to complete the experience is a chapter by Schuster on the hydrogen bond. This is a useful updating of the many reviews on this important topic. Indeed, so central is this aspect of interaction that all four chapters contain sections on hydrogen bonding. Alternatively this could be viewed as an overlight application of the editorial hand, as separately suggested by a referencing system which is not consistent among the four chapters. As hydrogen bonds are taken so seriously, it is a pity that a book published in 1978 makes no mention of the important experimental study of the water dimer by electric resonance spectroscopy published by Dyke *et al.* in the spring of 1977. These results are slightly uncomfortable for the theoretician, and had they been to hand for the authors, they might have been more guarded in their optimism.

The final impression is of a subject in which much is left to do, but the problems are by no means intractable: an attractive research situation and one for which this book will serve as an admirable basis.

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