Pleasing all of the people

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General Chemistry. By P. W. Atkins. *W. H. Freeman: 1989. Pp.989. Hbk $49.95, £32.95; pbk $39.95, £16.95.*

WRITERS of textbooks on general chemistry have a problem that their colleagues in subjects such as biochemistry, cell biology and computer science (to name but three examples) do not have. Chemistry is an old subject, many of its foundations being laid in the nineteenth and early twentieth centuries. Thermodynamics, for example, is a product of the second half of the nineteenth century, though it remains as relevant now as it was 100 years ago. Quantum mechanics, as studied by undergraduate chemists, is over 50 years old, but is likewise a vital ingredient of modern chemistry.

At the same time the subject itself has not stood still. So how does one teach both the old and the new, and how is the old kept fresh and stimulating? And then there is the problem of conflicting requirements. Scottish, English and North American universities all have different entry standards, and give courses in the first year that demand different prerequisites, so the author of a general text has to decide the potential market that is being addressed — it is impossible to please all of the people all of the time. The market for such broad-brush textbooks is enormous; most publishers have one or more appropriate titles in their lists, yet most of them are virtually indistinguishable in their approach and presentation.

Peter Atkins is well known as an author of physical chemistry textbooks. His *Physical Chemistry* (Oxford University Press, 1986) is now in its third edition and is widely used by relatively advanced undergraduates. Another of his books, *Molecules* (W.H. Freeman, 1987), presents the concepts of molecular shape, so important in biological aspects of chemistry, in a novel and entertaining way. Atkins also has strong views about the topics which he feels should be taught; in an article published in 1987 (*Chemistry in Britain* **23**, 640–641), he argued the case for teaching through computer modelling and provoked considerable debate. We have, therefore, an experienced author with some controversial views — in turning to general chemistry, has he produced something different from the standard texts?

The initial impressions are encouraging. The book's presentation is attractive, with one-third of each page reserved for a column which displays diagrams, photographs and other figures. Colour is used well, although the pale-blue background to photographs of apparatus sometimes obscures the colour changes that are being shown. The pictures of molecules are especially good, with space-filling models used as in *Molecules*. This new book must rank as one of the best-produced chemistry texts I have ever seen.

The content, however, is pretty conventional with none of the innovation that one might have hoped for. By British standards, organic chemistry is handled only superficially: there is a lightning tour of the subject scampering through everything from alkenes to nucleic acids in two chapters of 70 pages. There is no attempt to introduce mechanism — yet how can students ever make sense of organic chemistry without it? For inorganic chemistry there is a similar tour of the periodic table, and these two factors alone make it clear that a North American audience is what the author and publisher have in mind. As one might expect, physical chemistry fares best; over two-thirds of the text is devoted to the subject, with a commensurate increase in the academic standard.

There are some good touches — a description of how to quote the correct number of significant figures in numerical calculations, and a massive number of problems and worked examples. Indeed, the book is (or will be) accompanied by a study guide, an instructor's manual, a solutions manual (only the odd numbered numerical exercises have answers in the book itself), a laboratory manual, a computer test bank, a video demonstration and overhead transparencies. My prognostication is that, in a very full market place, *General Chemistry* is likely to be a best-seller in North America but less used in Britain. □

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A closer look

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Principles of Electron Optics. By P.W. Hawkes and E. Kasper. *Academic: 1989. Two volumes, pp. 1,188 plus indexes. Vol. 1 £37.50, $84.50; vol. 2 £37.50, $79.50; the two together £65, $140. A third volume is in preparation.*

IT IS 56 years since Ernst Ruska built the electron microscope that broke through the resolution barrier set by the optical microscope and later earned him the 1986 Nobel prize in physics. These instruments now have a huge influence on science and technology, diagnostic medicine, crime detection and food technology, and hence on society itself. The design of modern electron optical microscopes and the interpretation of the resulting atomic images is a scientific challenge. Electron microscopy makes great demands on theoretical physicists because it embraces the whole range of classical and wave optics, newtonian and relativistic mechanics, and quantum physics. Many former theoretical speculations such as 'quantum wells' can now be observed routinely.

A lot of books on the subject have appeared in the past, but *Principles of Electron Optics* is the first attempt, since the advent of the digital computer, to cover the entire subject systematically and critically. There are three volumes, each of about 600 pages. The first two, *Basic Geometrical Optics* and *Applied Geometrical Optics*, are reviewed here; Vol. 3, which will be concerned with wave optics, image interpretation and electron holography, is in preparation. The authors assume that the reader has a knowledge of physics and mathematics to degree level, and aim to provide a self-contained, modern account of their subject for anyone "involved with electron beams of modest current density in the energy range up to a few mega-electronvolts".

In Vol. 1, the emphasis is on basic principles rather than instrumental applications. This, however, is no mere repetition of material to be found in textbooks — Hawkes and Kaspar have reworked their material into a coherent and unified whole, making a careful appraisal of the best way to approach a given topic. Although the role of traditional analytical methods is clearly brought out, the impact of computer methods is rightly stressed. The authors compensate for some inevitable omissions by providing a comprehensive set of notes and further references directing the reader to the original literature. Volume 2 deals with the application of the theory to the calculation of the optical properties of lenses and other electron optical elements. Particularly valuable is the chapter on electron guns, a difficult and widely misunderstood subject.

This is a monumental and timely work — well researched, carefully proof-read, and marked by clarity of thought and expression. That it is in English and uses SI units is an enormous advantage for today's worldwide readership in electron optics and microscopy. It merits close study by all physicists and engineers concerned with the subject, and indeed by all those who wish to gain an insight into the power of theoretical physics to deal, often in a deceptively simple way, with the complex situations that now arise routinely in electron microscopy. □

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