

The author begins with a short account of natural and artificial sources of radiation, which includes brief descriptions of the working principles of nuclear reactors, X-ray machines and particle accelerators. Next come chapters on the absorption of radiation in matter and on dosimetry. Chapter 4 is a description of the manner in which the primary species of excited molecules, electrons, positive ions and free radicals are produced as a result of radiation absorption by matter, and of the extent and importance of their roles in the ensuing processes. Brief descriptions of the methods by which such short lived intermediates are observed include electron spin resonance spectroscopy, mass spectrometry and pulse radiolysis. This chapter lays the foundation for the succeeding chapters which deal with the particular systems of inorganic solids, gases, water and aqueous solutions, organic compounds, polymeric systems and substances of biological interest. These topics reflect the broad scope of the book, which should give newcomers to radiation chemistry a good introduction to the whole range of the subject, as well as provide radiation chemists with useful starting points in areas outside their specialised fields of research.

The book is produced in an easy style with good use of footnotes and cross referencing in the text. Selected references to other works are given at the end of each chapter, and there is a good subject index and a useful appendix of units and conversion factors. The author has set a number of problems, with answers, at the end of each chapter which should aid the reader in his understanding of the subject. The book is well illustrated, and there are several quite extensive tables of data on such quantities as bond energies, proton and electron affinities and rate constants which would seem more appropriate to a reference work.

On the whole this is a book to be recommended and it should find a place in most science libraries.

G. V. BUXTON

Quantitative Materials

Problems in Materials Science, Vol. 1. Edited by H. D. Merchant. Pp. x+476. (Gordon and Breach: New York, London and Paris, 1972.) £12.30.

ONE of the interpenetrating pecking orders that bedevil life in universities is the hard science/soft science hierarchy. Ever since Lord Kelvin uttered his memorable chestnut about the impossibility of knowing anything properly unless one can measure it, the applied mathematicians and their imitators have played upon the inferiority complexes of the botanists, mineralogists, zoologists, metallurgists and many others. Each of the sciences has become pro-

gressively more quantitative, and this is a natural and inevitable progression. What can be seriously misleading is the suggestion that close observation, pattern perception, the recognition of correlation between events (whether or not correlation coefficients are estimated) are no part of the stuff of science but rather a kind of pre-scientific pap. The quantitative approach is central to science and has been at least since the time of Tycho Brahe, but so is the skill of the close observer. Tycho Brahe and Johannes Kepler are coupled in scientific history.

This slightly exaggerated outburst is prompted by contemplation of the volume under review. The editor complains that metallurgy or materials science is apt to be taught in a qualitative manner, and to counteract this he intends the book as "an aid to solving problems". Individual authors deal with fields such as diffraction, diffusion, nucleation and growth, thermodynamics, interfaces, magnetic fields, mechanical testing. Each chapter has an introduction which is essentially a minitext on quantitative aspects of the field, then some problems are solved *in extenso*, finally a number of bare problems are added, without solutions.

Certainly a skilled university teacher can mine this quarry and find a number of helpful problems to illustrate his own systematic teaching, though it must be said that for this purpose a complete set of model answers would have been distinctly helpful. But it is hard to see how a student (final-year undergraduate or first-year graduate, at whom the book is aimed) could possibly hope to cope with more than a modest fraction of the (mostly) very advanced subject matter. Complicated tensor treatment of crystal elasticity jostles with first-principle estimates of elastic moduli of various rubbers, the Boltzmann transport equation and its implications, and the advanced treatment of thermal vibrations. No undergraduate I have ever encountered in the materials field could (or should be expected to) cope with some of this subject matter, though other parts, such as Tegart's treatment of mechanical testing or Nussbaum's of magnetic fields, should be more readily accessible.

The impulse which led to the writing of this book is entirely understandable, but the consequent search for particularly quantitative fields has led to a choice of topics and a level of treatment which are generally more appropriate to a graduate theoretical physics course. This is not materials science, but parts of the book (rather less than half, probably) can be used by an experienced teacher in the field as useful source material. The book cannot be recommended for self-study.

The names of two of the contributors

(McLean and Tegart) are misspelled and the page numbers in the table of contents are incorrect.

R. W. CAHN

Canadian Fish

Pacific Fishes of Canada. (Bulletin 180: Fisheries Research Board of Canada, Ottawa.) By J. L. Hart, Pp. ix+740. (Information Canada: Ottawa, 1973.) \$8.

THE study of the fish fauna of the North Pacific commenced with the explorations of the Imperial Russian expeditions of the early nineteenth century, and while some of the fishes described, such as the salmon, *Oncorhynchus* spp., occur on the Canadian Pacific coast, knowledge of that fauna was sparse until almost the present century. Such descriptions as existed were the result of British surveying expeditions, and later of the work of the early school of American ichthyologists, notably D. S. Jordan and C. H. Gilbert.

This history resulted in the literature on Canadian Pacific fishes being scattered through numerous sources until 1946 when Clemmens and Wilby published the first faunistic treatment of the region. The publication of their *Fishes of the Pacific Coast of Canada* stimulated further research and a second, revised edition appeared in 1961. The present volume by J. L. Hart, although ostensibly a lineal descendant of Clemmens and Wilby's book, is an original work and a totally new synthesis of the literature. The contents are organised systematically, each species is well illustrated with new and excellent drawings, and major headings include a description, life history, and distribution. The description is the conventional listing of body proportions but has subsections for meristic data for fin elements and scales, as well as colour notes. A most helpful innovation is the separate heading "Recognition" where characteristic features are itemised. Dichotomous keys to families or orders are clearly set out with quite unambiguous couplets and there are general keys to the classes of fish treated.

Up to date faunistic treatments are of fundamental importance and, with this new work, the Canadian fish fauna is one of the most competently and exhaustively treated. Hart's book will be of great value to fishery workers and students of other disciplines, for it is a modern synthesis of high standard. The author is to be congratulated on the conciseness and clarity of presentation of his material, and the editorial staff of the Fisheries Research Board of Canada deserve commendation for their foresight in commissioning such a fundamental work and for producing it at a very reasonable price.

ALWYNE WHEELER