growth in the use of tritium as a tracer, and there is little doubt that the timely appearance of this book by Dr Evans, of the UKAEA Radiochemical Centre, will further accelerate this growth.

The book was written to illustrate the principles of working with tritium rather than as a laboratory guide or a fully comprehensive review of all aspects of the use of the isotope. Of the six chapters, the first, rightly brief, outlines the physical properties and methods of production of tritium, while the second, of fifty-nine pages, is a thorough and well-exemplified survey of uses of tritium under the separate headings of "Physical Uses", "Chemical Uses", "Non-biological Uses", "Biological Uses", "Biological Research", and "Clinical Medicine". The third chapter presents an authoritative account of the simple essential precautions in handling tritium which no worker with this isotope should fail to read. A fourth chapter is devoted to methods of preparation of tritium-labelled compounds by isotope exchange reactions, direct chemical synthesis, biochemical methods, and recoil labelling; in a volume of this size there can be no question of listing all the reported preparations of tritiated materials, but the general methods are well illustrated with examples, and about 500 references to the original literature are cited. Another authoritative chapter, of eighty-eight pages and with 519 references, describes the measurement and analysis of tritium compounds, and includes a useful account of the specificity of labelling associated with the several methods of introducing the isotope. A final chapter considers "Properties Peculiar to Tritium Compounds", including nomenclature, isotope effects, decomposition by self-irradiation, and the reactivity of the tritium atom in various types of organic and inorganic molecules. An appendix extends the accounts in the chapters already mentioned to include publications appearing before March, 1966. Extensive lists of references are given with each chapter, with appropriate emphasis on specialized review articles. There is an index of all the compounds mentioned, and an adequate subject index.

This volume will be of great value to workers using tritium, and even more to those contemplating its use. Large parts of it could also be read with profit by post-graduate and even advanced undergraduate students for the interesting accounts of general chemical and radiochemical techniques, methods of synthesis of simple and complex labelled organic compounds, and mechanisms of organic and biochemical reactions. C. EABORN

HOW TO MAKE COMPOUNDS

Organometallic Compounds

Methods of Synthesis, Physical Constants and Chemical Reactions. Edited by Michael Dub. Vol. 1: Compounds of Transition Metals, Covering the Literature from 1937–64. Second edition. Pp. xviii + 828. (Berlin and New York: Springer-Verlag, 1966.) 98 D.M.

THIS is a valuable compilation of references, including those from the patent literature, to organo–transition–metal compounds described from 1937 to 1964 inclusive. The mono- and di-metallic compounds considered are those with organic groups with at least one carbon–metal σ-bond and those with aromatic, *cyclo*-olefinic, olefinic and acetylenic groups π-bonded to the metal. Organo–isocyanide complexes are also included, but not metal carbonyls, metal cyanides and salts with cyanometal anions as such.

The material is arranged chiefly in terms of the individual metals and sub-divided into the different types of compound. Each sub-section is introduced by a brief description of general methods of preparation and other general comments, but thereafter each individual compound is treated separately, even where the members of a class of compounds may be very similar. The syntheses, properties, chemical reactions, uses and derivatives of each compound are given in a very abbreviated but clear form, including many tables.

The information, derived largely from *Chemical Abstracts*, is uncritical and contains some errors, but there is such a wealth of references that this book must surely be of considerable use to all workers in this field.

M. D. JOHNSON

TWO VIEWS OF EQUILIBRIUM

Chemical Equilibrium

By Allen J. Bard. (Harper's Chemistry Series.) Pp. xi + 202. (New York and London: Harper and Row, Publishers, 1966.) n.p

The Principles of Chemical Equilibrium, with Applications in Chemistry and Chemical Engineering

By Kenneth Denbigh. Second edition. Pp. xxi + 494. (London: Cambridge University Press, 1966.) 22*s*. 6*d*. net; $3.95.

IN spite of having similar titles, these two books are very different. Bard's book gives an elementary and clear exposition of equilibrium law calculations, with particular reference to ionic equilibria. There are problems and a supplementary reading list at the end of each chapter. By a skilful selection of examples of varying complexity the author shows how material balance and electroneutrality equations are properly used; the situations in which approximations can be made are clearly brought out, and the student who uses this book will not subsequently need to have recourse to memorized formulae. There is an excellent chapter on the use of graphical methods for solving problems and for representing systems over a range of conditions, and a brief chapter on numerical and computer methods. Inevitably, there are a few places where systems are represented as simpler than they are in reality. The statement that almost all salts are completely dissociated in water needs more qualification than it gets, and the hydrolysis of ions such as Al^{3+} and Fe^{3+} is virtually ignored. Misprints are few, but there are two examples of fallacies. In a discussion of gaseous equilibria, the author asserts, on page 156, that the association of NO_2 to N_2O_4 is enhanced by adding an inert gas to the system, as predicted by Le Chatelier's law. If one thinks about the physical situation it is clear that if the inert gas behaves ideally it will have no effect on the equilibrium. The point illustrates how difficult it is to formulate Le Chatelier's law, so much loved by those responsible for school syllabuses, in a satisfactory form. The second fallacy is on page 159, where the steady state of a radioactive disintegration series is described as if it were a conventional chemical equilibrium. But these are minor blemishes in a useful book. There are tables of equilibrium constants and oxidation-reduction potentials in appendixes.

Denbigh's book is the second edition of a well-tried and deservedly popular text-book of chemical thermodynamics which has already been thrice reprinted. It is one of the best books available for the student who has completed an elementary course in the subject and wishes to consolidate and extend his understanding of its basis and to learn how to apply it. As well as numerical examples in the text, there are problems at the end of each chapter. The changes for the new edition are not extensive; the new book is two pages longer because of some rewriting of the first chapter, which discusses the first and second laws. The author has taken note of minor criticisms of the earlier edition and the references have been brought up to date. The symbol A has been adopted for the Helmholtz free energy in accordance with the IUPAC recommendation. The book is a bargain at 22*s*. 6*d*. in paperback. J. E. PRUE