deficient in its treatment of the naturally occurring complexes—the haemoproteins, chlorophyll and vitamin B_{12} and its derivatives.

When the time comes to prepare a new edition it is hoped that more attention will be directed to these natural chelates. In the meantime, those concerned with the writing of the book are to be congratulated on the production of a work that is well worth possessing.

G. LEAF

A COURSE IN STATISTICAL MECHANICS

Equilibrium Statistical Mechanics

By Prof. Frank C. Andrews. Pp. xii+206. (New York and London: John Wiley and Sons, Inc., 1964.) 38*s*.

Statistical Mechanics and Dynamics

By H. Eyring, D. Henderson, B. Jones Stover and E. M. Eyring. Pp. xiii+508. (London, New York and Sydney, John Wiley and Sons, Ltd., 1964). 113*s*.

Ergodic Theory in Statistical Mechanics

By I. E. Farquhar. (Monographs in Statistical Physics and Thermodynamics, Vol. 7.) Pp. viii+235. (London and New York: Interscience Publishers, a Division of John Wiley and Sons, Ltd., 1964.) 90*s*.

ONE of the main aims of statistical mechanics is to obtain a more perspicuous insight into the macroscopic behaviour of matter from a knowledge of some of its microscopic properties. Conversely, we are also often able to extend our understanding of its microscopic behaviour by means of judicious comparisons between theory and experiment on the macroscopic scale. From the educational point of view, it is therefore of considerable importance to the professional scientist in many fields. Unfortunately, as Andrews points out in his preface to *Equilibrium Statistical Mechanics*, all too often there is little time in the busy undergraduate curriculum for a unified treatment of the subject, although incursions are frequently made into it from other related disciplines. In this connexion, the three books under review, although published independently, can be regarded as a course in statistical mechanics, of gradually increasing depth and scope of treatment. At a comparatively elementary level, Andrews has set himself the task of providing an introductory account of the basic theory, illustrated by a number of the more important applications, while maintaining a high degree of mathematical simplicity. On the other hand, Eyring *et al.* in *Statistical Mechanics and Dynamics* have produced a much more detailed treatment embracing a wide range of applications, including, for example, such topics as chemical kinetics. *Ergodic Theory in Statistical Mechanics*, by Farquhar, is obviously for the specialist who is interested in a more formal approach to the fundamental ideas of statistical mechanics.

Andrews approaches the problem of developing a logical introduction to the subject by first discussing the elements of probability theory, leading to the concept of the ensemble average. It is commendable that the microcanonical, canonical and grand canonical ensembles are mentioned at an appropriately early stage in the book, although most of the treatment is in terms of the canonical ensemble. The probability distributions corresponding to the various ensembles are defined and their significance explained in a straightforward manner without recourse to the all too familiar device, involving the rather indiscriminate use of Stirling's theorem and Lagrange's undetermined multipliers, that is so often characteristic of books at this level, in which it is rarely explained with sufficient care to be meaningful (with notable exceptions, of course). Andrews then establishes a link between entropy and probability through the ensemble average of the energy; the discussion here, although adequate, could profitably have been expanded. He then goes on, in roughly the remaining two-thirds of the book, to a number of illustrative applications, including ideal classical and quantal gases, dense gases and fluctuations. In particular, the relationship between fluctuations and the mechanical view of thermodynamics is explained in order to complete the outline picture of the subject.

While this outline represents quite a satisfactory achievement of the original limited aims, it inevitably lacks completeness in comparison with the more extensive treatment afforded by Eyring's book, to which it would nevertheless form a helpful introduction. Eyring has set a much higher target: that of describing the main basic techniques and including all the applications one could hope to see mentioned in a single volume. We are presented with three methods of approach to the fundamental theory: the technique of compounding a known and an unknown system, the classical approach of Gibbs and the Darwin–Fowler method of steepest descents, with supporting chapters on classical mechanics, thermodynamics and quantum theory, which comprise admirable summaries, in their own right, of their respective contributions to the main theme. It is indeed a luxury to have all this information so neatly assembled. Furthermore, the list of applications is impressive, ranging through specific heats, radiation, electric and magnetic properties, etc., to surface chemistry, with a concluding chapter on relaxation times. Although the treatment of each individual topic is necessarily somewhat compressed, it is still very complete and taken to quite an advanced standard, with many references. It is this completeness which enhances the value of the book, since it extends also to considerations of reaction rates, thus emphasizing, in accordance with the title, the dynamic nature of all physical processes, including equilibrium and the approach to equilibrium. From this point of view, the book is highly to be recommended.

While Eyring tends to regard statistical mechanics as better to be justified *a posteriori*, he does give a short, clear account of the difficulties associated with the ergodic and quasi-ergodic hypotheses. On the other hand, Farquhar quite definitely regards the purely pragmatical view of statistical mechanics as reducing it to the status of an *ad hoc* technique unrelated to the rest of physics. Ergodic theory is concerned with just this problem of examining the precise circumstances in which it is possible to pass from a dynamical to a thermodynamical description of a macroscopic system.

Farquhar's book is the seventh volume of a series of monographs in statistical physics and thermodynamics. It is divided into three sections, dealing in turn with the general principles of the theory and their subsequent application in both classical and quantal statistics. The approach is intended for the physicist rather than the mathematician, and includes an outline of any necessary mathematics, such as Lebesgue measure, as part of the treatment. It is limited also to a consideration of ergodic theory within classical and quantal statistics, and it does not deal with the approach of a system to equilibrium; these restrictions being in accordance with the aims of the series of which the book forms a part. Nevertheless, it constitutes a unique and lucid survey of the problem, as it relates to statistical mechanics, without in any way disguising the various points that still await elucidation. The usefulness of this kind of exercise lies particularly in the stimulation it provides towards a more critical appraisal of the foundations of the subject.

Of these three books, it is more than likely that Eyring's will be found to be the most generally useful, as a recent and most welcome addition to what are usually regarded as the standard texts for the serious student. This judgement does not detract from the contributions made by the works of Andrews and Farquhar in their respective spheres —the latter, especially, warranting the careful attention of the specialist.

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