

sponsors behind the present collection of American studies has interacted more closely than in other parts of the world, and has gained in power accordingly.

Recent molten salt research is stimulated by the prospect of several important technological prizes, conveniently summarized in a paper on phase equilibria (38 pages). Potential uses in nuclear reactors, and in certain types of chemical reactors, depend on the long liquid range of molten salts, and their solvent power for many inorganic ions. Difficulties arising from their high corrosive power are being overcome in various ingenious ways. More restricted uses in electroplating of refractory metals, or in fuel cells, may become critically significant in special cases. Surprisingly, large-scale almost old-fashioned uses of molten salts in the older electrometallurgical industries, for the production of aluminium, sodium, magnesium or fluorine, seem to generate proportionately far less published literature.

The present symposium starts with a very readable but necessarily somewhat superficial review (54 pages) of some of the theoretical problems that concern both thermodynamics and structure of molten salts. Several papers grapple with the nature of nearest neighbour interactions in molten salts. Novel features include NMR studies on the degree of covalent bonding in crystalline and molten thallium halides. Absorption spectroscopy points to interesting changes of coordination on melting nickel halides. Raman spectroscopy has made great advances in the elucidation of local structure of inorganic melts, chiefly through the use of laser light sources of high intensity, though the conclusions are not undisputed. Electronic absorption spectra, infrared absorption spectra, and neutron spectroscopy have likewise revealed interesting complications in the interaction between nearest ion neighbours in melts.

Even more novel problems are thrown up by certain studies of mass and charge transport in molten salts. Mass motion in some ionic melts involves cooperative displacements, rather than hopping of single ions from one site to the next. Unfortunately, clear structural models are not discussed in this symposium at all factually. Particularly interesting evidence is cited about unusual modes of electron transport, which may be found in solutions of either metals or halogens in molten metal halides. But though the phenomena described are suggestive, no very definitive theories are presented.

The reproduction of a collection of papers direct from typescript, as in the present volume, should very properly help to keep the price down, to match its rather limited useful life. The fact that the book presents nearly five hundred references concerning molten salts in an orderly and logical way is bound to be helpful, but parts of the text fail to define the areas where really major advances can be hoped for.

A. R. ÜBBELOHDE

CHEMICAL KINETICS

Quantum-Statistical Foundations of Chemical Kinetics
By Sidney Golden. (Oxford Mathematical Monographs.) Pp. 163. (Clarendon Press: Oxford; Oxford University Press: London, June 1969.) 55s.

THIS is rather a difficult book to review. Chemical kinetics is, of course, a subject of great importance with an enormous literature; nevertheless, it is fair to say that until recently there has been no basic microscopic theory. Lately, however, chemical reactions using molecular beams have become feasible, and theoretical work has by ingenuity and computing power also reached a similar level, so that the study of the very simplest reactions with experiments to check real quantum mechanical theories is prospering. At this level, it is, of course, an extension, albeit a very complicated one, of normal scattering theory and experiment. A proper theory of reactions in aqueous solution, for example, is still far off. Now, if one considers

the established scattering theory, a good many tricky mathematical points arise and are indeed discussed in textbooks which aim to give a complete theoretical treatment; for example, texts by Newton and by Gellman and Goldberger. It must be emphasized that the historical development of the subject was a rapid development of a fairly comprehensive theory and experiment, and a subsequent refinement and study of the mathematical points which arose. Professor Golden, in this book, develops those foundations of quantum statistical mechanics which are employed in chemical kinetics in full and rigorous detail. The treatment is much fuller than one finds elsewhere and is illuminated by a large number of footnotes which are remarkably well documented and full of interest. But no theory of reactions exists in the sense of starting with the Schrödinger equation and ending with a reaction rate. When this theory is complete, no doubt numerous tricky points will arise and need to be sorted out; indeed, they are arising right now. But they are not, at least to my mind, the ones considered in this book. The book rather deals with the very broad foundations of quantum statistical mechanics and ends at the point where the fighting is just starting, and I can see little value in it to people who are really trying to get from Schrödinger to chemical constants. It will, however, be of great interest to the mathematically minded student of the subject who wants to see the foundations clearly and fully discussed.

S. F. EDWARDS

GUIDE TO THE MOON

Exploring the Moon Through Binoculars
By Ernest Cherrington. Pp. 211. (Peter Davies: London, September 1969.) 63s.

ANY attempt to explore the Moon through binoculars from the distance of the Earth at the time when men have stepped on to the lunar surface appears as a hopeless or childish task, so that anybody who reads only the title of this book no doubt wonders how many or what sort of people are going to spare time in order to go through its text. Under the title, however, is hidden one of the most comprehensive works describing the main features of the lunar surface. It is indeed a very good guide for the layman of today, who hears about the various stages of the Apollo project and wishes to know where and what are the features mentioned.

There are only a few points which should have had better judgment from the author. There was no need to spend two pages in defence of Galileo. Because Galileo's drawings and the actual figure of the Moon are both included in the book, the reader himself can compare them and see whether any similarity occurs. In the estimation of altitudes of lunar features, there is also a deceptive accuracy of 100 feet in the text. For example, the fact that the high peaks of the Carpathian Mountains have an average altitude of about 2 kilometres is presented in the words, "The range, which includes peaks 6,600 feet high . . .". It is obvious how the "precise" value of 6,600 feet has been produced. The same appears in several cases. Apart from these points and some minor slips like the statement that the departure of the lunar limb from a true circle was not noticed until 1966 (the author should know about the Yakovkin effect), this book is the fruit of careful work and the presentation of the material is very successful. The quality of the printed pictures is very good and the seven charts included in the text extremely handy. On one occasion only will the reader not find the features described in the text on the chart to which he has been referred (Shiller and Doerfel Mountains are not visible in Chart III).

At the time when so much irresponsible "scientific" information is being spread through the news media, books like this should be welcomed very warmly.

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