

dissolved metals, the aqueous electrode potentials of which are broadly related, and also by anions; oxidations by anions and free halogens; metatheses involving the reciprocal Coulombic effect complete a neatly arranged section.

It is a matter for conjecture whether the page title heading "Non-aqueous Solvents in Inorganic Chemistry" might not have opened up a slightly wider field than the cover title but the authors are presumably the best judges of the area to which they wished to confine themselves.

S. R. C. HUGHES

Molecular Beams

Edited by John Ross. (*Advances in Chemical Physics*, Vol. 10.) Pp. viii+419. (New York and London: Interscience Publishers, a Division of John Wiley and Sons, 1966.) 113s.

THIS volume of the *Advances in Chemical Physics* is in the form of a series of review articles by leaders in the field of elastic and inelastic molecular scattering: polarizabilities, repulsive intermolecular forces, quantum effects on elastic scattering, chemical reactive scattering, excited atom collisions, charge transfer, ion-molecule reactions and supersonic molecular beam sources are discussed.

Although the upsurge of interest in these and related topics has produced much understanding of importance, it is likely that the decisive working out of the subject will take place over the next five or ten years. This volume is therefore not definitive but it does represent a great advance on ten years ago when Taylor and Datz discovered the first molecular beam detector capable in itself of responding differently to different molecules; this can be said to have made possible the commencement of study of a limited number of chemical reactions by particle scattering technique, years before it could otherwise have been achieved.

The field is one which the British chemical fraternity largely ignores, to its ultimate discomfort. This volume should go some distance towards stimulating the necessary interest.

J. B. HASTED

Solar-Activity Forecasting

By Yu. I. Vitinskii. Translated from the Russian by Z. Lerman. Edited by R. Hardin. Pp. iv+129. (Jerusalem: Israel Program for Scientific Translations; London: Oldbourne Press, 1965.) 54s.

SOLAR radiation rules the lives of everyone on Earth, and its fluctuations, though barely noticed by the sun-bathers on our beaches, are vitally important for satellites in low orbits, which end their lives prematurely if the Sun is unduly active and makes the air density increase. The fluctuations will be even more vital for interplanetary travellers, who may end their lives prematurely if the Sun is unduly active in shooting out streams of ions.

The prediction of solar activity is at present even more chancy than long-range weather forecasting, because there is no accepted physical theory of solar disturbances and no agreement on the best index of activity. The Wolf sunspot numbers are usually regarded as the best index, although, as the author of this book points out, the Wolf numbers are even to-day slightly subjective and used to be far less reliable. Nevertheless the Wolf numbers provide the only index which goes back more than 100 years, and have to be used by anyone attempting long-term prediction.

Sunspot maxima recur on average every 11.1 years, but the period can be as low as 7 years (as in the 1830s) or as high as 17 years (1788-1805). The maximum monthly smoothed sunspot number in a cycle can be as low as 50 (in 1805) or as high as 200 (in 1957-58); the minimum is usually less than 10. So far no satisfactory

method of predicting the dates and intensities of future cycles has been developed, though various recurrence tendencies have been detected. Predicting the monthly smoothed numbers a year ahead offers a better chance of success, essentially because each cycle, once it has started, shows some resemblance to a previous cycle, or to the average of several previous cycles, and is open to statistical treatment. On a still shorter time-scale, prediction is bedevilled by the unexpected appearance of new sunspot groups.

Vitinskii's book, published in the Soviet Union in 1962, is the most thorough survey available and can be strongly recommended to anyone interested in the subject. The author reviews all the methods that have been suggested, with admirable impartiality, and does not hesitate to conclude that many of them are worthless. It still seems likely, however, that a causal relationship underlies the seemingly irregular variations; and if any mathematician, intoxicated by such a thought, wishes to enter this dangerous field, the book will provide him with both an excellent guide and a sobering view of the reputations lying slaughtered among the man-traps.

D. G. KING-HELE

Solids

Elementary Theory for Advanced Students. By Gabriel Weinreich. Pp. xii+163. (New York and London: John Wiley and Sons, 1965.) 53s.

THIS textbook is based on lectures to American graduate students and presupposes a thorough grounding in quantum mechanics, including operator theory, second quantization, and perturbation theory using Feynman diagrams. The term "elementary" in the subtitle is to be understood in the Gibbsian sense.

The ground covered consists mainly of selected portions of the quantum theory of solids and includes Brillouin zones, band theory, the use of Bloch and Wannier functions, vibrational properties of solids and singularities in the vibrational spectrum. The treatment is succinct but thorough, and can be studied with profit given the requisite background.

The opening chapter is devoted to crystallography and is particularly well set out; the illustrations both of lattices and of crystallographic point groups are presented with unusual clarity.

The experimental consequences of the theory have been consciously—one might also add conscientiously—ignored. In a book of limited size, this attitude is certainly justified.

The book is written in a pleasant as well as lucid style and the presentation leaves nothing to be desired. It is warmly recommended.

M. BLACKMAN

Dog Breeding

Reproduction and Genetics. By S. A. Asdell. Pp. viii+194. (London: J. and A. Churchill, Ltd., 1966.) 45s.

THE dog is much the oldest of domesticated animals. He is also, not excluding man, physically, emotionally and mentally the most diverse. The breeding of dogs is therefore, as Darwin has explained, of evolutionary interest beyond the range of dog-lovers. Prof. Asdell, however, has written his book from the veterinary or dog-lovers' point of view. To be sure he mentions Darwin by name and he also devotes a chapter to "The Science of Genetics". But the account he gives us is a personal one in which he adds to the established misconceptions a few new ones of his own. The dog breeder will do well to skip this chapter.

On the practical side Prof. Asdell describes the breeding experiments of Stockard—which were carried out in his own university 25 years ago—but he misses the point of this classical work. The four photographs he gives from Stockard will, however, show the reader something of what he has missed.

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