research. Of particular interest to the radiochemist are the chapters concerned with the synthesis of complex labelled compounds, measurement techniques and standards. The new material included in this edition is found mainly under the heading of associated administrative topics and covers radiological safety, waste disposal and the packaging and carriage of radioactive materials. To prospective users, the information on legislation introduced in the past few years to regulate the ownership and use of radioactive substances will be particularly valuable. This sets out clearly and concisely the various laws and codes of practice applicable to factories, research institutes and schools. Another useful addition is a short guide to the literature on radioisotopes.

In the second half of the manual, information is presented in readily accessible form in tables and charts. These include the physical data pertaining to more than 250 radioisotopes with information on their availability, synthetic routes to many labelled compounds of carbon-14, phosphorus-32, sulphur-35 and chlorine-36, and graphs showing the transmission of gamma-radiation through shielding materials.

In brief, the *Radiochemical Manual* is a remarkably comprehensive source of information relating to the preparation and application of radioisotopes and should find its way on to the shelves of all concerned with radioactive materials. It is particularly good value at 50*s*.

A. MORGAN

# GLASS ELECTRODES

## The Glass Electrode

By G. Eisenman, G. Mattock, R. Bates and S. M. Friedman. (An Interscience Reprint.) Pp. 327. (New York and London: Interscience Publishers, a Division of John Wiley and Sons, 1966.) 53*s*. paperback.

To bring four review articles on the glass electrode under the same cover is a good idea. It is unfortunate, however, that the publishers were content to make the book a collection of reprints and no more. The four contributions do not appear to follow any logical sequence which might help the reader, and the absence of an index and retention of the original pagination considerably reduce the value of the book as a work of reference. The publishers excuse themselves for some of these deficiencies on the grounds of cost and difficulties of cross referencing, but few people in this country will regard 53*s*. as cheap for a paperback of this kind whereas some may have been prepared to pay rather more for a book easier to use.

The two middle chapters are concerned with the classical application of the glass electrode to the measurement of *p*H. On this subject there are few sounder accounts than Bates's admirable book *Electrometric pH Determinations*. The chapter on glass electrodes is reprinted here from the latest edition (which has undergone a slight change of title). Reading it in isolation, I felt that some of its importance had been lost.

Perhaps the best balanced review is that by Mattock which stands happily as a comprehensive but critical account of *p*H measurement. There is a sensible section on the circuits of *p*H meters which is just right for the person with a limited knowledge of electronics, and a useful section on the causes of failure of glass electrode systems.

The first and quite the longest chapter is Eisenman's monumental review taken from *Advances in Analytical Chemistry and Instrumentation*. The bulk of this article is devoted to the electrochemistry of cation sensitive glasses, a subject to which the author has been a major contributor over the past few years. A concluding section consists of a review of the literature of cation sensitive glass electrodes, and this is useful because it is comprehensive even if it is rather uncritical. The final chapter, by Friedman, is concerned with sodium and potassium electrodes and draws attention to their applications in animal physiology and medicine. The physiologist or clinician wishing to measure $Na^+$ and $K^+$ by the potentiometric method should find this section most useful.

C. C. MICHEL

# SCHOOL CHEMISTRY

## Chemical Principles

By William L. Masterton and Emil J. Slowinski. Pp. xxiv + 668. (Philadelphia and London: W. B. Saunders Company, 1966.) 61*s*.

THE first impression of this new American text-book is of the excellence of its lay-out and presentation. How often has this been said of transatlantic books, and how seldom does any British publisher respond ? The contents are perhaps less outstanding, but the book contains enough good material to make it worth a place in the teacher's bookcase and in the school library. The book starts, no doubt in deference to the peculiar structure of school science in the United States, with a rather dull review of first principles under the heading of basic concepts. To the reader from the United Kingdom, however, it is the relative modernity of certain sections of the rest of the book which makes it interesting. One of these is energy. That the concept of energy is introduced early in the course is itself significant. Only the Nuffield chemistry course in this country lays similar stress on the subject. The concept is treated sensibly and clearly by introducing heats of reaction and by leading from this to the Gibbs free energy. There are few problems to be faced in introducing the heat of reaction, although the authors make things difficult for themselves by rather sharply differentiating between the heat of reaction treated as an algebraic part of the chemical equation, and the enthalpy which they treat as a separate thermodynamic function. The sign change involved leads to unnecessary difficulty. Gibbs free energy is described as the maximum amount of useful work that can be obtained from a chemical reaction and entropy is introduced by means of the difference between $\Delta H$ and $\Delta G$. Some thermodynamicists will be disturbed by the inclusion of the idea of randomness even if it is heavily qualified. It is surprising to find no mention of Hess's law.

Other interesting aspects of this book are its approach to structure and bonding and the fact that inorganic chemistry is grouped by types of reaction (acid base, redox, precipitation, and so on) rather than by elements in their periodic groups. It is a pity that the introduction of many interesting modern ideas is not followed up by their use in the text which follows.

M. J. W. ROGERS

# NEW INORGANIC CHEMISTRY

## Inorganic Chemistry

By C. S. G. Phillips and R. J. P. Williams. Vol. 1: Principles and Non-Metals. Pp. xiii + 685. Vol. 2: Metals. Pp. x + 683. (Oxford: Clarendon Press; London: Oxford University Press, 1965, 1966.) 65*s*. net both vols.

THIS important book begins, as do most modern inorganic texts, with brief and, therefore, to some extent unsatisfactory chapters on fundamentals such as wave mechanics, chemical thermodynamics, kinetics and the solid state; brief though the treatment is, this part of the book occupies 379 pages. The remainder of Volume 1 is devoted to the non-metals—40 pages to the halogens but