Measuring Reactions

Thermometric and Enthalpimetric Titrimetry. (Van Nostrand Reinhold Series in Analytical Chemistry.) By G. A. Vaughan. Pp. xiv+255. (Van Nostrand Reinhold: London and New York, July 1973.) £7.50.

ALTHOUGH the basic principles of thermometric titrimetry and those of enthalpimetric methods have been known for some time (thermometric methods were first reported in 1913 and enthalpimetric methods as early as 1910), the techniques have not been as extensively used as their potential warrants. This is only the third book dealing with these techniques to be published, but it does indicate that in the five years which have elapsed since the first two books appeared, the techniques are becoming more widely applied.

The essentials of a thermometric method are the temperature sensor and the monitored delivery of titrant. The non-selective nature of the temperature sensor makes it essential that there is an awareness and an understanding of the chemistry of the reactions that are occurring in the system used, and not merely a knowledge of the reaction used for the determination of the analyte, and thus brings back some chemistry into analysis.

This non-selectivity also makes the method applicable to all types of reactions; it is applicable to organic analysis, inorganic analysis and to the conglomerate area of general industrial analysis. Thus the task of an author in deciding how best to arrange and classify the methods is not easy, especially if the book is not to degenerate into a catalogue or be repetitive.

The author is to be congratulated on his arrangement. Approximately one half of the book deals with the inorganic applications, one sixth deals with organic applications and the rest deals with the theory and the apparatus. This is a judicious proportioning of the work since it reflects, to a reasonable degree, the amount of work which has been devoted to the respective areas.

The book is well presented. It should serve as a stimulus to further work in these fields.

L. S. BARK

Eclipsing Stars

Eclipsing Variable Stars. Edited by V. P. Tsesevich. Translated from the Russian by R. Hardin. (IPST Astrophysics Library.) Pp. ix+310. (Israel Program for Scientific Translations: New York and Toronto, June 1973.) £11.25.

THIS book is a useful and timely contribution to the problem of conjuring the nature of eclipsing binary systems from their light curves. The main contributors are A. M. Cherepashchuk,

D. Ya. Martynov, A. M. Shul'berg, V. M. Tabachnik and V. P. Tsesevich, and the last named has succeeded in coordinating individual articles into a cohesive and readable whole.

After a brief introduction to the subject, the first two-thirds of the book are devoted to a fairly thorough and up to date review of the classical approach to the problem. Initially the going is rough: the basics are hurried through with a consequent sacrifice, here and there, to clarify the direction. Thereafter the pace eases, and on the whole this first part of the book is clearly written and easy to grasp. It is, however, aimed rather at the practical astronomer with a light curve in need of analysis and there is a tendency to refer the reader elsewhere for justification of the procedures under discussion.

Then a chapter on some "Unique Systems", which herald the demise of any universal applicability of the classical approach, is followed by a chapter by Cherepashchuk on the basics of light curve synthesis and, finally, and for completeness, one on the effects of orbital ellipticity. Cherepashchuk's contribution provides a refreshing quasi-rigorous approach to the problem of extracting the maximum amount of information, with the minimum of assumptions, from a given set of observations.

J. E. PRINGLE

Surfaces of Solids

Friction: An Introduction to Tribology. By Frank Philip Bowden and David Tabor. Pp. xi+178. (Anchor Press: New York, June 1973.) \$2.50.

THIS book is part of the *Science Study Series* which aims to bring to the student and to the layman "the writing of distinguished authors on the most stirring and fundamental topics of science". These authors need no introduction and the results described are based on a mass of careful and precise experimental work carried out chiefly in the surface physics section of the Cavendish Laboratory in Cambridge during the last 25 years.

The adhesion theory of friction is well established. The surfaces of solids such as metals contain microroughnesses or asperities having a normal distribution of heights. When two such solids touch, contact occurs only at the peaks of asperities which first deform elastically and then flow plastically until the load can be supported without further increase in the real area of contact. During the plastic flow the surfaces cold-weld and form junctions at these minute points. The frictional force is primarily the force required to shear the junctions so formed. The friction of metals, the transfer of material from one surface to the other,

the effects of oxides and other surface films, the ploughing of asperities through the surface when one of the solids is soft and the importance of these effects on the design of bearing materials are discussed. Another chapter shows that these ideas can be carried over to polymers. The friction is again due to interfacial adhesion but differences in behaviour occur primarily because the deformation of polymers is visco-elastic rather than plastic. The frictional behaviour of other non-metals such as rubber, wood, lamellar solids including graphite and the well known low friction coating molybdenum disulphide, the carbides, diamond and ice is discussed and correlated with their structure and physical properties.

There is an interesting chapter on lubrication. Here the reader may learn how a single layer of adsorbed molecules can reduce the frictional force by as much as a factor of ten. The astounding thing, however, is that these same molecules may reduce the transfer of material between the surfaces and hence the rate of wear by a factor of 10,000 or more.

The theory of rolling friction, which I regard as one of the outstanding achievements to come from this laboratory, is dealt with only briefly and could well have been allocated more space. This chapter also contains information about systems in which a high friction is desirable such as brakes and clutches and tyres on wet roads.

Although such progress has been made in the study of friction that the basic mechanisms are clear, wear has always proved to be somewhat intractable. There appear to be no simple laws of wear because the phenomenon is usually very complex. A chapter devoted to this subject describes the way in which a number of factors influence wear. These include the environment, the speed of sliding and surface fatigue.

The book is well written, entertaining and easy to read, with many historical anecdotes and a wealth of examples drawn from everyday life. The reader is given a clear insight into the physical processes occurring in the interface between two solids. He is provided with an overall picture of the present state of knowledge of the subject and an indication of the regions where further developments may be expected to occur. The book fulfils the purpose for which it was written and can be understood by the intelligent layman. It provides an excellent introduction to the field for students of science and technology from which they may proceed to a study of the two volumes already published by these authors which embody the scientific work on which the monograph is based.

ANITA I. BAILEY