chemist's point of view of this subject, this book is probably the best. The subject matter is treated in such a way that undergraduate students in their final year will find it readable and useful.

The first of the seven chapters gives a historical introduction followed by the concept of non-stoichiometry, emphasis being laid on the phenomenon being more general than exceptional. This is followed by a consideration of the lattice energy of ionic crystals including the Born–Haber cycle, theoretical calculations of lattice energies and the contribution of the crystal field. The third chapter deals with the shapes of ionic crystals.

The remaining four chapters consider the structural, thermodynamic and experimental aspects of lattice defects with a final comment on how the subject impinges on so many other fields. These include solid state physics, heterogeneous catalysis, pigment manufacture, corrosion and photography.

Particular attention is given to the work of Magneli and his colleagues in relation to the X-ray studies of the oxides of molybdenum and tungsten and to Wadsley's investigation of various phases of ReO_3 formed by crystallographic shearing. It is comparatively free of errors and well produced.   M. W. ROBERTS

COMPUTER METHODS FOR ANALYSTS

Computer Calculation of Ionic Equilibria and Titration Procedures

With special reference to Analytical Chemistry. By David Dyrssen, Daniel Jagner and Fredrik Wengelin. Pp. 250. (Almqvist and Wiksell: Stockholm; Wiley: New York and London, January 1969.) 85s.

QUANTITATIVE analytical chemistry is undoubtedly one of the areas of chemistry which demands more calculation of a tedious repetitive nature than most others. Many modern physico-chemical techniques of analysis are now conducted with instrumentation which provides direct digital read-out in parts per million, and the like, of the analyte, and information from these can easily be fed directly to a computer. In this way, entire programmes of industrial manufacture may be fully automated without direct participation of analysts in a control laboratory. Similar instrumentation can be devised for the classical referee method of titrimetric analysis for special purposes, but there are many instances when calculations based on measurements made by titration become very tedious and protracted because of the complicated equilibria involved.

This book deals specifically with this problem and is designed to permit analytical and inorganic chemists to make use of computer programming to solve such problems without any detailed knowledge of the functioning of a computer. As the authors point out in their preface, it is extremely difficult to find a mathematician who can devise useful calculations devoid of chemical errors, and such consultations and experiments can be very tedious. In the authors' experience it is simpler and much more satisfactory to teach the chemist to write his own program, and they go on to show how this may be done without consuming much computer time. They have done this by illustrating the selection of relevant equilibria for particular calculations and by discussing chemical arguments to support the use of a particular computer program. The chemical meaning of the results of computer calculations is also well illustrated and discussed, because such data are clearly of little use unless they can be interpreted chemically once they have been obtained.

All the programs are written in ALGOL, but with experience they could be readily transferred to FORTRAN. The contents of this book are based on two programs written by Sillen and his co-workers, namely LETA-

GROPVRID (*Arkiv. Kemi.*, **23**, 97; 1964), relating to stability constants of complexes, and HALTAFALL (*Talanta*, **14**, 1261; 1967), which deals with the concentrations of ions and complexes from a knowledge of stability constants and total (analytical) concentrations. The use of the latter program permits such calculations without the use of difficult approximations or of "conditional" or "apparent" stability constants.

The text divides into nine chapters which deal *inter alia* with various aspects of programming computers for problems in analytical chemistry and particularly with the selection of stability constants and activity factors. Use is made of normalized curves and of concentration calculations by a computer based method of successive approximations. There are specialized separate chapters on distribution diagrams, solvent-extraction curves, solubility curves and indicator titrations. Research students and many industrial analysts will particularly welcome the first chapter on computerized end-point calculation for potentiometric titration, particularly in the light of recent work on specific ion electrodes.

The text is written clearly and unequivocally with a commendable economy of expression so that the reader is not distracted by too many words getting in the way. There are many examples and illustrations and with one exception each chapter has a set of about four problems set out in detail with hints for their solution. Much thought has obviously gone into this compilation and it has all the signs of being a very successful and worthwhile introduction to computer methods for "wet" chemistry. The book is somewhat expensive for its size, but it does appear to be well worth purchasing. The three authors are to be congratulated on producing a palatable and useful "chemical" book on the uses of computers.
                                                        T. S. WEST

ANALYTICAL CHEMISTRY

Analytical Applications of 1,10-Phenanthroline and Related Compounds

By Alfred A. Schilt. (International Series of Monographs in Analytical Chemistry, Vol. 32.) Pp. viii + 193. (Pergamon: Oxford, London and New York, January 1969.) 70s; $9.

Thermometric Titrimetry

By L. S. Bark and S. M. Bark. (International Series of Monographs in Analytical Chemistry, Vol. 33.) Pp. ix + 126. (Pergamon: Oxford, London and New York, December 1968.) 45s; $6.

IT is stimulating to find a good book on organic reagents in these days when most analytical texts are devoted to instrumental methods of analysis. This, moreover, is a specialist one on a particular class of organic reagent which has the rather novel property of forming unusually stable and intensely coloured complexes with the lower oxidation states of metals such as iron and copper. 1,10-Phenanthroline and the related reagents reviewed in this book do, however, form complexes with a wide variety of other metals, many of which have extensive application in analytical chemistry in absorptiometry, fluorimetry, gravimetry, titrimetry, concentration-isolation, and in several other areas. These are all reviewed here in considerable detail, and the literature is covered from Blau's original synthesis of 2,2'-dipiridyl in 1888 up to 1967 when these reagents were being used extensively for the wide range of purposes mentioned here.

The text opens with a chapter which sets the historical perspective and which lists many of the physical parameters of the 1,10-phenanthroline reagent. The next chapter deals with the different types of chelate formed