Chapter 4 gives detailed studies of intermolecular distances in some structures containing molecules of various symmetries. Cubic symmetry is first dealt with, the examples being adamantane and hexamethylenetetramine, and some cases of freely rotating molecules are also considered. Following on tetragonal and hexagonal symmetries the study is made of axial molecules: in the case of the I_2 molecule, for example, a detailed and somewhat curious 'shape' is worked out. Some consideration is then given to the conditions for axial rotation of molecules, and then molecules of lower symmetries are discussed. A lengthy study is made of long chain compounds, a number of possible structures being deduced and compared with observed arrangements where possible. The clathrate compounds are next described, and here the author suggests strong disapproval of the structure of the 'empty' hydroquinone, as its packing coefficient is too small. Finally the chapter concludes with a discussion of isomorphism and solubility in the solid state, again insisting on the importance of structure and packing in these phenomena.

Chapter 5 is the concluding chapter of the book and consists of more than 280 pages of description of the detailed structures of 209 compounds or types of compound. These are quite full and critical accounts. In the case of ascorbic acid, for instance, the author says: 'Determination by trial; hence of low accuracy ($\pm 0{\cdot}07$ Å), also because there is no centre of symmetry': he goes on to complain that the ring is flat and contradicts the results from other structures. However there is some doubt about the validity of this criticism since the ascorbic acid ring contains a double bond, and is thus not strictly comparable with the other ring structures quoted.

It is refreshing to find a book like this which although something of a compendium, yet has a definite thesis, and the thesis strongly declaimed is that shape is of prime importance in organic structures and should be more thoroughly studied. Some readers would probably prefer a little less geometry and a little more chemistry, and indeed the author in his foreword is aware of this likely line of attack. However it is undoubtedly the crystallographer's work to promote the application of geometrical ideas as far as possible, and this book is a notable contribution in this direction.

The translation is extremely well done, although the use of the word 'spacing' for 'distance' is unfortunately common. There are very few errors. The diagrams (more than 500 of them) are excellent and the author has also used many space-filling models to illustrate his material. The book will be welcomed as a vigorous contribution to the literature of X-ray crystallography.

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The Rare Earths. Edited by F. H. Spedding and A. H. Daane. Pp. xi + 641. London: Wiley. 1961. Price £5·18·0.

This collective work has twenty-four chapters and involves about thirty authors. It is divided into four sections: Occurrence and extraction of rare earths (71 pages), Preparation of rare-earth metals (98 pages), Properties of rare-earth metals and alloys (276 pages), and Applications of rare-earth metals and compounds (159 pages). There is a good subject index (27 pages), but no author index.

The third section is crystallographically the most interesting. Chapter 13 contains a summary table of the structures of the metals, and chapter 14, by K. A. Gschneider Jr., discusses the structures and their allotropic relationships in some detail (25 pages). Cerium leads, with four allotropes, lanthanum has three, and about half the rest have two, some being high- or low-temperature forms. Neutron-diffraction studies and magnetic structures are treated only briefly. Chapter 16, Rare-earth metal phase diagrams, by C. E. Lundin, is the longest in the book (162 pages). This gives, after an introduction, 95 binary phase diagrams and brief particulars of what is known about another 300 or so binary systems. The unit cell, and sometimes other structural information, is given when known, and there are many references. 'Alloys' is interpreted liberally, to include borides, hydrides, nitrides, oxides, phosphides, sulphides, selenides, and tellurides. It is probable that it is for this chapter that the book will be consulted most frequently, though some of the technical applications make fascinating reading ('burnable poisons are actually long-term shim controls').

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Chemical Crystallography. An Introduction to Optical and X-ray Methods. By C. W. Bunn. Pp. XIII + 509. Second Edition 1961. Oxford: Clarendon Press. Price 60*s*.

The scope and plan of this book are unchanged from the first edition (1945), but the later chapters are now brought up to date by the inclusion of material on intensity statistics, optical-transform methods, the determination of absolute configuration, and a few other recently developed topics.

The first part of the book deals with the identification of materials by means of the study of crystal shape and symmetry, by optical examination (refractive-index determination), and by X-ray powder photography. Excellent accounts are given of all these subjects, written in a clear and logical yet 'down to earth' fashion which could only be done by someone really familiar with the practical aspects of the subject. At the same time the underlying theory is very well displayed and with the advantage of appropriate illustration from actual crystals.

The second part of the book deals with single crystal methods, starting with the determination of cell dimensions by means of rotation photographs (including the 'tilted-crystal' procedure) and the uses that can be made of such measurements. Then follows a chapter on the measurement of X-ray reflexion intensities and the underlying theory, and on the determination of space groups. Trial-and-error methods are fully illustrated and structure-factor charts and graphs discussed, along with optical-transform methods. The effect of structure on physical properties is outlined, so that these properties can be made use of in structural work. A number of

examples of crystal structures are then worked through as problems in X-ray analysis, ranging from the simple to the quite complex, and including some important polymer and defect structures in which the author has himself made distinguished contributions. Then in a chapter on direct and semi-direct methods an account is given of Fourier and isomorphous replacement methods, including the error and difference syntheses, and methods of calculation. Resolving power and determination of absolute configuration are also dealt with, and a very effective summary of the interpretation of Patterson maps is given. The use of molecular transforms is next described, with an interesting account of their use in aromatic ring systems, in polymer helices, and in haemoglobin. In a final chapter on crystal size and texture, consideration is given to the different causes of line broadening in X-ray diffraction, to small-angle scattering, and to diffraction effects shown by non-crystalline materials.

In this part of the book also is shown a wise and thoughtful approach, combined with much practical experience. Some of the methods described (for example of computation) are perhaps a little old-fashioned in these days of computer programmes, but only good can come to any student by a careful study of these earlier methods. Indeed they might be usefully regarded as essential training for the later developments.

The only error of fact that the reviewer could discover is the statement on page 403 that the Rochelle-salt structure is monoclinic. It is, of course, orthorhombic in the form used for the work described. Everywhere else the book is a model of lucid and accurate statement. It should be ideal for all chemists who are interested in crystallography or who have to concern themselves with the identification of materials. All students of X-ray crystallography would find it an excellent introduction to the subject. It is a most readable book, not too tedious and yet quite thorough in every topic with which it deals. It can be very strongly recommended.

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Reports on Progress in Physics. Volume 24.

Edited by A. C. STICKLAND. Pp. iv+424. London: The Institute of Physics and The Physical Society. 1961. Price £4·4·0.

The present volume of 'Reports on Progress in Physics' contains a number of articles of special interest to the crystallographer and solid-state physicist. H. Fröhlich gives a brief, excellently written account of the 'Theory of the Superconductive State'. An unusual, but very interesting feature is the section on 'The Psychology of Superconductivity'. In an article on 'Magnetic Domains' D. J. Craik and R. S. Tebble review the recent progress in the study of ferromagnetic domains in metals, alloys and ferrites. Emphasis is laid on experimental techniques and results of domain observations. The observations should be seen against the background of the theory of micromagnetism. This theory is not developed, but enough theoretical background is given for a discussion of the experimental results. The longest contribution to the volume is that of W. P. Wolf on 'Ferrimagnetism'. It forms a full account of the subject, starting from discussions of crystal structures and preparation of compounds, and providing a bibliography of about 450 references. The emphasis is on physical properties and their present understanding in terms of the theory. Technical applications are only occasionally mentioned. Finally we should like to mention D.ter Haar's article on 'Theory and Application of the Density Matrix', which is also mainly concerned with solid-state problems. It surveys a large number of applications of the density-matrix technique to transport problems, relaxation phenomena, equilibrium statistical mechanics, and other fields, and gives an extensive list of references. Presumably it is too concisely written in order to allow the non-specialist to gain familiarity with this now widely used theoretical technique.

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X-ray Analysis of Organic Structures.

By S. C. NYBURG. Pp. xii+434. New York and London: Academic Press Inc. Price $13·00. 93*s*.

This volume is in two parts. The first outlines the nature of X-rays and the symmetry properties of crystals, and then goes on to discuss the intensity of X-ray reflexion, Fourier methods, etc., and finally the accuracy of X-ray results. In short it is a miniature text-book on the subject of X-ray analysis. It differs from many such texts in that its mathematics is extremely brief, being limited to a few formulae, and in the place of mathematical derivation it uses descriptive methods with the aid of many diagrams. In some places the book goes into considerable detail, for example arithmetic calculations are given of sample structure factors and of Fourier projections. Incidentally, here the author inadverdently illustrates a common form of mistake in that he has incorrectly transferred figures from Table 5·1 to the Table on p. 108. His use of the symbol $\pm F(hk0)$ on these pages is also rather curious. The final sign should surely be inserted when numerical values are given to the F's, and meantime there is either a positive or a negative sign needed, but not both. There are, naturally, many subjects omitted from this part of the book, e.g. least-squares methods, and the author admits in his preface that other 'cherished concepts' are absent. However, the brief account fulfils its aim quite well and should assist many readers to understand and use X-ray methods. The style is good, and many subjects are discussed in an interesting fashion. The determination of absolute configuration, for example, is given an excellent non-mathematical account, and the 'photo-sommateur' of von Eller is well described and illustrated.

The second and larger part of the book is a review of the structures of organic compounds, based almost entirely on X-ray work. Using a chemical system of classification, the account starts with the structures of the normal paraffins, and then goes on to deal with compounds containing the different functional groups. Then aromatic and alicyclic compounds, heterocyclic,