picture of what the programmer does.

The next three chapters give the details of coding, using a fictitious machine with a simple three-address order code for the examples. The basic ideas of looping, address modification, transfer of control, use of subroutines, and the like are all clearly described. The description may be rather technical for the general reader, but it is not sufficiently detailed for use in training programmers. The basic ideas of autocodes, or compilers, as they are usually called in the United States, is described in chapter 7. The description is brief and basic, but it gives no hint of the power and widespread use of problem-oriented languages which one observes today, especially in the United States. Chapter 8, the concluding chapter, contains a description of variations in computers and peripheral equipment —such items as word length, size and type of store, magnetic tape, and input/output are mentioned.

The emphasis is strongly on machine-language coding, which is probably more widely used in England than in the United States.

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Comprehensive, Well Arranged

Particle Accelerators. M. Stanley Livingston and John Blewett. McGraw-Hill, New York, 1962. xvi + 666 pp. Illus. $17.50.

The literature on accelerators, while extensive, consists mostly of papers in journals and project reports. There are only a few books and review articles. In *Particle Accelerators* the authors have produced the most comprehensive volume so far published on this subject.

The arrangement of the book is good. Most of the material is organized around accelerators, by types, with a few topics treated separately. Particle motion in magnetic and electric fields and certain components—ion sources, magnets, and shielding—are given separate chapters, which are generally good. The level of the book is appropriate to a beginning graduate student in physics or engineering, but substantial portions can be understood by undergraduates. The indexing is good, and the extensive references will be useful to all workers in the field.

The physical principles of all presently useful types of accelerators are clearly and completely explained, and the relevant mathematical expressions are presented for convenient reference. Considerable emphasis is also properly given to a technical description of accelerators and components, and some space is devoted to historical material. In these areas the book has shortcomings which mar an otherwise excellent effort. There are interesting descriptions of some pioneering accelerators—for example, the early low-voltage generators —and valuable material on the latest alternate gradient accelerators, on magnetic measurement techniques, and on shielding, for example, but there are also tiresome details on accelerators that are neither pioneering types nor examples of the latest technology. The treatment of sector focused cyclotrons, which have undergone intensive development in the last decade and which now dominate the field in the energy range of tens of Mev, is disappointingly brief. Heavy ion accelerators, another recent development that has interesting special features, are little more than mentioned. The selection of historical material is spotty—there is a good treatment of electrostatic accelerators and of betatrons, but the treatment of Lawrence's development of cyclotrons at Berkeley is not sufficient to convey the extent to which modern accelerators and accelerator laboratories derive from that development. The faults are probably due to the authors' having relied too much on their own personal experiences, which, while undeniably extensive, are not quite great enough to provide a framework for a definitive work covering the entire field.

Despite the faults enumerated and a few errors of fact, the book on the whole is good and will be a valuable addition to every physics library.

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Magical Minerals

Applied Clay Mineralogy. Ralph E. Grim. McGraw-Hill, New York, 1962. viii + 422 pp. Illus. $12.50.

In this, his second excellent book on clay mineralogy, Grim has successfully compiled much of the scattered and unorganized information on the indus-

trial uses of clays. Although information about some areas is abundant, much of it is empirical, and application is often based on rule-of-thumb. Grim has made an effort to explain many of the observed phenomena and properties in terms of the structure and composition of the clay minerals. Although these minerals play a vital role in many industries, the reason for many of their functional properties is not well known.

Kaolinite and montmorillonite are the clay minerals most widely used in industry, although illite, attapulgite, halloysite, and sepeolite have many uses. Some of the more important properties of clay minerals are their small grain size, their sheet-like shape, their charged lattice, and their ability to disperse, adsorb a wide variety of materials, and orient water molecules.

The structure and properties of clay minerals are briefly covered in the second chapter. The chapter on clays in ceramic products (89 pages) is the most complete and covers the field with which the author is most familiar. Such properties as plasticity, stress, strain, green strength, shrinkage, drying, dry strength, firing, high-temperature modifications, fusion, color, vitrification, permanent moisture expansion, translucency, glaze properties, and reheat volume changes are discussed. A large number of graphs are presented showing how these properties vary as a function of the type of clay mineral and the size, temperature, water content, and the like.

A chapter on clays in foundry molding sands (63 pages) describes how sand, various clays, and water are prepared to meet property specifications necessary to produce the wide variety of molds used in the metallurgical industry, and one on clay mineralogy in relation to the engineering properties of clay materials (74 pages) describes such properties as compression strength, permeability, swelling, consolidation, penetration, and density. Two brief chapters (29 and 26 pages) review the role of clays (in the discovery, recovery, refining, and preparation) in the petroleum industry. Here, even more so than in other industries, the reason for the effectiveness of clay minerals in producing desired results is seldom known.

A final chapter (78 pages) describes a large number of other uses for clays. For example, a cement floor may contain 40 percent clay; the paint on your wall is probably 25 percent kaolin; your cotton shirt may be finished with

kaolinite, this paper and ink have a high kaolinite content, and for the cramps you drink a solution of kaolinite; your soap, if it is an efficient dirt remover, may contain 10 to 40 percent sepiolite; the impurities have been adsorbed from your dinner wine by montmorillonite, your shoe polish contains montmorillonite, and your grapes can be kept in perfect condition for at least 5 months if they are properly packed in montmorillonite.

Although the use of clay minerals in industrial processes is growing rapidly, more fundamental research is needed in order to make maximum use of these magical minerals.

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New Books

Mathematics, Physical Sciences, and Engineering

Algebraical and Topological Foundations of Geometry. Hans Freudenthal, Ed. Pergamon, New York, 1962. 215 pp. Illus. $10. Proceedings (27 papers in English, German, or French) of a colloquium held at Utrecht in August 1959, which was sponsored by the International Mathematical Union on behalf of the Netherlands Mathematical Society.

Algebraic Logic. Paul R. Halmos. Chelsea, New York, 1962. 271 pp. $3.75. A collection of ten papers, reprinted from various journals, originally published between 1954 and 1959.

Alkyd Resin Technology. Formulating techniques and allied calculations. T. C. Patton. Interscience, New York, 1962. 206 pp. Illus. $9.75.

Analogue Computation. Techniques and components. R. W. Williams. Academic Press, New York, 1961. 271 pp. Illus. $9.50.

The Analysis of Titanium, Zirconium, and Their Alloys. W. T. Elwell and D. F. Wood. Wiley, New York, 1962. 209 pp. Illus. $7.75.

Calculus of Variations. vol. 19, International Series of Monographs in Pure and Applied Mathematics. L. E. Elsgolc. Translated from the Russian. Pergamon, London; Addison-Wesley, Reading, Mass., 1962. 178 pp. Illus. $4.50.

Dictionary of Geological Terms. Prepared under the direction of the American Geological Institute. Doubleday, Garden City, N.Y., 1962. 558 pp. Paper, $1.95. An abridged and revised edition of the AGI's *Glossary of Geology and Related Sciences* (ed. 2, 1960). The *Dictionary* contains some 7500 terms, while the *Glossary* contains nearly 17,000 terms.

A Dictionary of Geology. John Challinor. Univ. of Wales Press, Cardiff; Oxford Univ. Press, New York, 1962. 251 pp. $5.

Differential and Integral Calculus. Clyde R. Love and Earl D. Rainville. Macmillan, New York, ed. 6, 1962, 596 pp. Illus. $7.50.

Forces and Fields. The concept of action at a distance in the history of physics. Mary B. Hesse. Philosophical Library, New York, 1962. 328 pp. $10.

Functions of a Complex Variable. And some of their applications. vol. 2. B. A. Fuchs and V. I. Levin. Translated from the Russian by J. Berry. T. Kövari, Ed. Addison-Wesley, Reading, Mass., 1961. 296 pp. Illus. $7.

Heat Engines. John F. Sandfort. Doubleday, Garden City, N.Y., 1962. 317 pp. Illus. Paper, $0.95.

Hypersonic Flow Research. vol. 7, Progress in Astronautics and Rocketry. Frederick R. Riddell, Ed. Academic Press, New York, 1962. 768 pp. Illus. $10.50. The papers are based mainly on those presented at a symposium of the American Rocket Society held at Massachusetts Institute of Technology in August 1961.

An Index of Mathematical Tables. vol. 1, *Index According to Functions.* vol. 2, *Bibliography, Lists of Errors in Published Tables, References.* A. Fletcher, J. C. P. Miller, L. Rosenhead, and L. J. Comrie. Scientific Computing Service, London; Addison-Wesley, Reading, Mass., ed. 2, 1962. 1005 pp. 2 vols., $42.

Introduction to the Physics of Vibrations and Waves. Norman Feather. Edinburgh Univ. Press, Edinburgh, 1961 (order from Aldine, Chicago, Ill.). 338 pp. Illus. $6.

An Introduction to Probability and Mathematical Statistics. Howard G. Tucker. Academic Press, New York, 1962. 240 pp. $5.75.

Introduction to Thermodynamics of Irreversible Processes. I. Prigogine. Interscience, New York, ed. 2, 1961. 130 pp. $5.

Introductory Organic Quantum Chemistry. Georg Karagounis. Translated from the German and edited by F. C. Nachod. Academic Press, New York, 1962. 212 pp. Illus. $6.50.

Invitation to Mathematics. William H. Glenn and Donovan A. Johnson. Doubleday, Garden City, N.Y., 1962. 373 pp. Illus. $4.95.

Les Livres Arithmétiques d'Euclide. Jean Itard. Hermann, Paris, 1961. 231 pp. Plates. Paper, NF. 15.

Microminiaturization. G. W. A. Dummer, Ed. Pergamon, New York, 1962. 365 pp. Illus. $15. Proceedings (25 papers and discussion, in English or French) of the AGARD conference held at Oslo in July 1961.

The Moon: A Russian View. A. V. Markov, Ed. Univ. of Chicago Press, Chicago, 1962. 400 pp. Illus. Plates. $8.

Moving Field Radiation Therapy. Felix Wachsmann and Gunther Barth. Translated from the German by Elisabeth F. Lanzl; adapted and expanded by Lawrence H. Lanzl and James W. J. Carpender. Univ. of Chicago Press, Chicago, 1962. 283 pp. Illus. $10.95.

New Ways in Math. Arthur Jonas. Prentice-Hall, Englewood Cliffs, N.J. 70 pp. Illus. $2.95.

Numerical Methods for Scientists and Engineers. R. W. Hamming. McGraw-Hill, New York, 1962. 428 pp. Illus. $11.

On the External Characters of Minerals. A. G. Werner. Translated from the German by Albert V. Carozzi. Univ. of Illinois Press, Urbana, 1962. 149 pp. $4.50.

Physical Principles and Applications of Junction Transistors. J. H. Simpson and R. S. Richard. Oxford Univ. Press, New York, 1962. 533 pp. Illus. $10.10.

Physics and Astronomy of the Moon. Zdeněk Kopal, Ed. Academic Press, New York, 1962. 533 pp. Illus. $16.50. Thirteen chapters, written by 15 authors, including Kopal.

Polyolefines. A. V. Topchiev and B. A. Krentsel. Translated from the Russian by A. D. Norris. Pergamon, New York, 1962. 103 pp. Illus. $3.50. (A translation of *Poliolefiny—Novyye sinteticheskiye materialy,* Academy of Sciences of the U.S.S.R., Moscow, 1959.)

Principles of Physics. Earnest S. Greene. Prentice-Hall, Englewood Cliffs, N.J., 1962. 839 pp. Illus. $9.75.

Principles of Structural Equilibrium. A study of equilibrium conditions by graphic, force-moment, and virtual displacement (virtual work) principles. G. C. Ernst, G. R. Swihart, A. R. Riveland. Univ. of Nebraska Press, Lincoln, 1962. 169 pp. Illus. $4.50.

Radio Surface Waves. H. M. Barlow and J. Brown. Oxford Univ. Press, New York, 1962. 211 pp. Illus. $6.75.

Rock-Forming Minerals. vol. 1, *Ortho and Ring Silicates.* W. A. Deer, R. A. Howie, J. Zussman. Longmans, Green, London; Wiley, New York, 1962. 341 pp. Illus. $15.50.

Rutherford Jubilee International Conference, Manchester 1961, Proceedings. J. B. Birk, Ed. Academic Press, New York, 1961. 856 pp. Illus. $32. The conference, which was held at Victoria University of Manchester in September 1961, was sponsored by the International Union of Pure and Applied Physics, the Royal Society, the Institute of Physics, the Physical Society, and Victoria University of Manchester.

Superconductive Devices. John W. Bremer. McGraw-Hill, New York, 1962. 196 pp. Illus. Plates. $8.

Synthetic Lubricants. Reigh C. Gunderson and Andrew W. Hart, Eds. Reinhold, New York; Chapman and Hall, London, 1962. xiv + 497 pp. Illus. $15 (11 contributed papers).

Theory of Molecular Excitons. A. S. Davydov. Translated from the first Russian edition by Michael Kasha and Max Oppenheimer, Jr. McGraw-Hill, New York, 1962. 183 pp. Illus. $7.95.

The Theory of Probability. B. V. Gnedenko. Translated from the second Russian edition by B. D. Seckler. Chelsea, New York, 1962. 472 pp. Illus. $8.75 (a translation of *Kurs Teorl Veroyatnostei*).

Topology of 3-Manifolds and Related Topics. M. K. Fort, Jr., Ed. Prentice-Hall, Englewood Cliffs, N.J., 1962. Illus. Trade ed., $10; text ed., $7.50. Proceedings (47 papers, either summaries or full length reports) of papers presented at the institute held at the University of Georgia in 1961.

Valence. C. A. Coulson. Oxford Univ. Press, New York, ed. 2, 1961. 417 pp. Illus. $6.