by the theoretical work of Nevill Mott and the applied work of Stanford Ovshinsky.

Until something better comes along, this collection of seven articles edited by Tauc will remain a standard. Most of the chapters are well written and informative, although they are not of uniform caliber. Some stand on their own, others require extensive use of supplementary references. The introductory article by Bagley on the nature of the amorphous state is quite good, although it demands some previous knowledge of the field; a self-contained version of this material would require a book in itself. The chapter has several weaknesses, particularly in its treatment of the free-volume model of the liquid state, where some important concepts, such as excess volume and nucleation, are poorly defined, and the equations presented would not be useful to anyone unfamiliar with the theory. No explanation of the recent specific-heat data is offered despite their implications for the structure and entropy of amorphous solids. The classification of these materials as relaxation semiconductors is accepted without experimental confirmation or further explanation. However, the important subject of phase separation is handled well. Less successful is the chapter by Grigorovici on structure, which, although it contains a great deal of information on the recent experimental diffraction studies of a large class of materials, will be comprehensible primarily to those who are already somewhat familiar with the field.

The theoretical chapter by Economou *et al.* leaves much to be desired. The presentation is not completely logical, and few quantitative results are presented. The chapter is primarily a summary of the work of the authors, which, although in the forefront of the field, is not representative of all the recent advances. This chapter is also the most out of date; only two references as recent as 1972 appear. No mention is made of the contributions of Joannopoulis, Weaire, Yonezawa, Brenig, Kramer, Alben, Thorpe, Emin, or Taylor, or the recent work of Anderson or Thouless. The chapter on optical properties by Tauc is an excellent review of the subject. My only disappointment is that it does not point out the absorption-edge problem in amorphous silicon and germanium, where the optical gap is still undetermined to within a factor of 2!

In my opinion, the two chapters by Fritzsche, on electronic properties and on switching, are the best in the book. They are the least out of date, a considerable achievement in an area in which the literature is still growing exponentially. But, more important, both chapters are real contributions of a sort not available elsewhere. Finally, Enderby's chapter on liquid semiconductors appears to be present only to avoid the necessity of changing the title of the book. The beginning of the chapter is overly mathematical and not very informative to nonexperts. The end does put the field in perspective and makes the chapter worthwhile, but a much longer work would be necessary to do justice to the entire subject.

The editing appears to have been minimal; the chapters are not very well integrated either in style or by cross-referencing, and no author index has been provided.

The major defect of this collection of papers stems from the fact that the field is simply too young and growing too fast to be encompassed in a book, given present-day publication speeds. It is hoped that another such book is in preparation. For the time being, this one is the best starting point for a novice in the field. But more recent publications must be checked out before anyone can feel really knowledgeable.

DAVID ADLER
Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge

Toward a Theory of Water

Water and Aqueous Solutions. Introduction to a Molecular Theory. ARIEH BEN-NAIM. Plenum, New York, 1974. xvi, 474 pp., illus. $29.50.

The development of a molecular theory of liquids has trailed far behind that of theories for gases and solids. Whereas physical chemists can compute many properties of a gas or solid from the properties of the molecules that compose it, they have had scant success in computing properties of liquids. Similarly, though they can extract many molecular properties from measurements on solids or gases, they derive little information about molecules from observations on liquids.

The reason for this lag is that the molecules in a liquid interact strongly with each other, but have no long-range order. A gas is simpler for the theorist to treat because the molecules may, at low pressures, be regarded as exerting no forces on one another. A crystalline solid is simpler because of its near-perfect spatial regularity. But a liquid presents the most difficult situation: an irregular arrangement of strongly interacting particles. Water and aqueous solutions offer an especially difficult challenge because the forces, in addition to being strong, are highly asymmetric. The hydrogen bonds that endow water with its fitness for sustaining life are the source of difficulty to the liquid theorist.

Ben-Naim's book summarizes the progress of theorists during the last decade in forging a molecular theory of aqueous systems. Its scope is restricted to thermodynamic properties and to the radial distributions of molecules determined by x-ray and neutron scattering. There is no discussion of nonequilibrium properties (such as viscosity, ionic conductivity, or the various types of relaxation phenomena), which are far harder for the theorist to treat. Nor is there discussion of spectroscopic or electrical properties (such as nuclear magnetic resonance or dielectric constant).

The book is addressed to readers who are familiar with the material of a typical graduate-level course in statistical thermodynamics. An initial chapter reviews the rudiments of statistical mechanics. The concepts are discussed concisely and with great clarity, and the notation to be used in the rest of the book is introduced. The next four chapters are also introductory, in that they develop concepts of molecular distribution functions, statistical thermodynamics, and the statistical theory of solutions. The meat of the book is found in the final three chapters: one on liquid water, one on water containing a single dilute solute, and one on the hydrophobic interaction.

The chapter on water develops the statistical mechanical basis of mixture and interstitial models for this liquid. Here the author shows considerable cleverness in devising mathematical descriptions of such traditionally qualitative concepts as "water structure" and "two state liquid." In addition, it describes the recent computer simulations of water carried out by Rahman, Stillinger, and others. These simulation studies show that numerous equilibrium properties of water can be computed by assuming little more than a potential energy function for the interaction of

water molecules. The first of the solution chapters concentrates on the possible molecular significance of "structure-making" and "structure-breaking" solutes. The final chapter expresses the hydrophobic attraction of two nonpolar solutes as a consequence of an averaging of all configurations of the solvent molecule that surround them.

Ben-Naim's book is essentially a progress report on a difficult but important topic in physical chemistry. Its clarity and imaginativeness will stimulate continued progress toward a molecular theory of water.

DAVID EISENBERG
Molecular Biology Institute
and *Department of Chemistry,*
University of California,
Los Angeles

Nonmetallic Crystals

The Major Ternary Structural Families. O. MULLER and R. ROY. Springer-Verlag, New York, 1974. x, 488 pp., illus. $31.20. Crystal Chemistry of Non-Metallic Materials, vol. 4.

Though the last in the numbering sequence, this is the first volume to be published in a proposed four-volume series, edited by Rustum Roy, on the crystal chemistry of nonmetallic materials. The philosophy of the series, as set forth in Roy's general preface, will probably be developed more clearly in the volumes dealing with principles of crystal chemistry and properties of solids in relationship to crystal structures.

The present volume is an excellent reference source. The tables that summarize the various structural types include appropriate references. More important still are the many fine figures, which are of tremendous value to the research scientist. The first four chapters deal with the A_2BX_4, ABX_4, and ABX_3 structures. Although oxides are emphasized, there is a detailed treatment of many other structure types formed when the anion is a chalcogenide or halide. A 177-page appendix contains useful additional tables summarizing a wide variety of structural data. The book includes a rather complete set of effective ionic radii for the most common ions, based on work of Shannon and Prewitt, who considered the particular structure type in arriving at their values.

The authors have put together in one book a large amount of information useful to the solid state scientist.

This reviewer looks forward to the appearance of the other volumes. As reference books, the set should be indispensable to scientists doing research on solids.

AARON WOLD
Departments of Chemistry and
Engineering, Brown University,
Providence, Rhode Island

Books Received

Advances in Electronics and Electron Physics. Vol. 36. L. Marton and Claire Marton, Eds. Academic Press, New York, 1974. xiv, 390 pp., illus. $34.50.

Advances in Heterocyclic Chemistry. Vol. 17. A. R. Katritzky and A. J. Boulton, Eds. Academic Press, New York, 1974. xii, 360 pp., illus. $39.50.

Air Pollution and Atmospheric Diffussion—2. M. E. Berlyand, Ed. Translated from the Russian edition (Leningrad, 1973) by H. Olaru. P. Greenberg, Transl. Ed. Halsted (Wiley), New York, and Israel Program for Scientific Translations, Jerusalem, 1974. vi, 242 pp., illus. $26.75.

Anti-inflammatory Agents. Chemistry and Pharmacology. Vol. 2. Robert A. Scherrer and Michael V. Whitehouse, Eds. Academic Press, New York, 1974. xviii, 382 pp., illus. $28.50. Medicinal Chemistry, vol. 13-2.

Architectural Psychology. Proceedings of a conference, Lund, Sweden, June 1973. Rikard Küller, Ed. Studentlitteratur, Lund, and Dowden, Hutchinson and Ross, Stroudsburg, Pa., 1974 (distributor, Halsted [Wiley], New York). 450 pp., illus. $24.

Art and Environment in Native America. Papers from a symposium, Lubbock, Tex., Oct. 1971. Mary Elizabeth King and Idris R. Traylor, Jr., Eds. Texas Tech Press, Lubbock, 1974. 170 pp., illus. Paper, $5. Special Publications of The Museum, Texas Tech University, No. 7.

Asimov on Chemistry. Isaac Asimov. Doubleday, Garden City, N.Y., 1974. xviii, 268 pp., illus. $8.95.

Color Atlas of the Diseases of Fishes, Amphibians and Reptiles. E. Elkan and H.-H. Reichenbach-Klinke in collaboration with Marsha Landolt. T.F.H. Publications, Neptune City, N.J., 1974. 256 pp. $30.

A Concrete Look at Nature. Central Park (and Other) Glimpses. Eugene Kinkead. Quadrangle (New York Times), New York, 1974. xiv, 242 pp., illus. $8.95.

Contemporary Topics in Molecular Immunology. Vol. 3. G. L. Ada, Ed. Plenum, New York, 1974. xiv, 260 pp., illus. $16.50.

Current Topics in Membranes and Transport. Vol. 5. Felix Bronner and Arnost Kleinzeller, Eds. Academic Press, New York, 1974. xii, 330 pp., illus. $29.50.

Dermatophytes in Human Skin, Hair and Nails. James T. Sinski. Photographs by Kurt C. Kamps. Thomas, Springfield, Ill., 1974. xiv, 44 pp. $7.95. American Lecture Series, No. 946.

Electrical Conductivity in Ceramics and Glass. Part B. N. M. Tallan, Ed. Dekker, New York, 1974. xxiv pp. + pp. 313–674, illus. $29.75. Ceramics and Glass: Science and Technology, vol. 4.

Elementary Excitations in Solids, Molecules, and Atoms. Part A. A NATO Advanced Study Institute, Antwerp, June 1973. J. T. Devreese, A. B. Kunz, and T. C. Collins, Eds. Plenum, New York, 1974. xii, 376 pp., illus. $28. NATO Advanced Study Institutes Series B, vol. 2.

Energy in Perspective. Jerry B. Marion. Academic Press, New York, 1974. xii, 208 pp., illus. Paper, $4.95.

Enzyme Engineering. Vol. 2. Papers from a conference, Henniker, N.H., Aug. 1973. E. Kendall Pye and Lemuel B. Wingard, Jr., Eds. Plenum, New York, 1974. xiv, 470 pp., illus. $27.50.

Ethnic Groups of America. Their Morbidity, Mortality and Behavior Disorders. Vol. 2, The Blacks. Ailon Shiloh and Ida Cohen Selavan, Eds. Thomas, Springfield, Ill., 1974. xvi, 296 pp., illus. Cloth, $17.50; paper, $12.95.

Initial Reports of the Deep Sea Drilling Project. Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). Vol. 24. May–June 1972. Prepared for the National Science Foundation by the Scripps Institution of Oceanography, La Jolla, Calif., 1974 (available from the Superintendent of Documents, Washington, D.C.). xx, 1184 pp., illus. $19.20.

Insolubilized Enzymes. M. Salmona, C. Saronio, and S. Garattini, Eds. Raven, New York, 1974. x, 226 pp., illus. $18.50. Monographs of the Mario Negri Institute for Pharmacological Research.

The Interaction between Science and Philosophy. Papers from a symposium, Jerusalem, Jan. 1971. Y. Elkana, Ed. Humanities, Atlantic Highlands, N.J., 1974. xx, 482 pp. $17.50. The Van Leer Jerusalem Foundation Series.

Interfaces in Polymer Matrix Composites. Edwin P. Plueddemann, Ed. Academic Press, New York, 1974. xxii, 294 pp., illus. $25. Composite Materials, vol. 6.

Intracellular Parasitic Protozoa. Masamichi Aikawa and Charles R. Sterling. Academic Press, New York, 1974. iv, 76 pp., illus. Paper, $7.50. Ultrastructure of Cells and Organisms.

Intrauterine Devices. Development, Evaluation, and Program Implementation. Proceedings of a workshop, Seattle, Oct. 1973. Robert G. Wheeler, Gordon W. Duncan, and J. Joseph Speidel, Eds. Academic Press, New York, 1974. xviii, 260 pp., illus. $16.50.

Introduction to Noise Analysis. R. W. Harris and T. J. Ledwidge. Pion Limited, London, 1974 (U.S. distributor, Academic Press, New York). x, 102 pp., illus. $6.50. Applied Physics Series, 7.

Introduction to Quantum Optics. H. M. Nussenzveig. Gordon and Breach, New York, 1973. xvi, 246 pp., illus. $19.95. Documents on Modern Physics.

Low Temperature Physics—LT 13. Proceedings of a conference, Boulder, Colo.,