

dimensional mosaics (1957); one-dimensional groups (1956). Finally, the derivations in part II lack a central unifying theme. The general scheme is to introduce, as they appear to be needed, tricks for deriving antisymmetry groups from classical ones.

I feel that this derivation of antisymmetry groups, while valid, is not the best. Just as every group that has operations of the second sort can be derived from the groups composed only of operations of the first sort, so all antisymmetry groups can be derived from the classical groups by systematically adding to each classical group an antisymmetry operation which transforms the classical group into itself. Derivation of the antisymmetry groups in this way would give a simple routine, and might also lead to a simpler symbolism for antisymmetry groups. But this is work for the future.

Meanwhile, all who are interested in symmetry, especially crystallographers, are not only indebted to the authors of the original papers, but to the publishers, the translators, and the editor, for making this part of the original literature on antisymmetry available. Many of us would like to have translations of some of the other original works on symmetry—especially Federov's fundamental work, Shubnikov's other works, and possibly the works of Herman, Weber, Motzok, Heesch, and Ginzburg.

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Chemistry

Chemical Thermodynamics. Basic theory and methods. Irving M. Klotz. Benjamin, New York, revised ed., 1964. xvi + 468 pp. Illus. \$9.75.

Introduction to Chemical Thermodynamics. Irving M. Klotz. Benjamin, New York, 1964. xviii + 244 pp. Illus. Paper, \$3.95.

Chemical Thermodynamics is intended to be a textbook suitable for senior or first-year graduate courses. In format, it is divided into two parts. The first of these, consisting of chapters 1 to 12, treats the three basic laws of thermodynamics and their application to pure phases. Chemical reactions are treated in great detail, but the discus-

sion is restricted to reactions between pure phases or to reactions between ideal gases. Nonideal gases are discussed, but the calculation of their thermodynamic properties is deferred to the second part of the book, where the concept of fugacity is introduced.

The second part, chapters 13 to 22, is devoted to phases of variable composition. Most of the conventional topics are discussed; among those topics excluded which one might expect to find in a book on chemical thermodynamics are phase equilibria, electrochemical systems, and the thermodynamics of surfaces. These are not completely neglected, however. The Clapeyron equation is derived, and the colligative laws are discussed; on the other hand, the phase rule is not mentioned. Electrochemical cells are discussed in connection with Gibbs function changes, and with the determination of activity coefficients, but no general treatment is given.

The pace is leisurely and the treatment is thorough, especially with respect to the detailed working out of examples. Many examples are worked two, or even three, ways. Average students will find this useful, but such detail will probably bore better students. It is also possible that, with the welter of detail given, the novice may miss the woods for the trees. Nevertheless, to the average student, the pedagogical value of seeing things done several different ways constitutes one of the book's strong points. The discussion of standard states and of extrapolation procedures for determining standard values of thermodynamic functions is well presented.

Teachers who use this book as a textbook will have to supplement the discussion of basic principles. The treatment of temperature is inadequate, and this carries over into the development of the second law, always the most difficult task of any expositor of thermodynamics. Entropy is defined in the usual way—" $dS = DQ_{rev}/T$ "—and " T is the absolute temperature at which the heat is absorbed." This precedes the demonstration that there is, in any sense, an "absolute" temperature. The absolute temperature scale is defined earlier in the book, essentially as an ideal gas temperature scale on which the ice point is given a conventional value. But the definition of a temperature scale by means of only one fixed point rests on the validity of the second law. Another less serious point is the implication that an iso-

thermal compression always evolves heat; this implication is made in the discussion of the efficiency of a Carnot cycle with arbitrary working fluid, but is untrue for a substance with a negative coefficient of expansion, such as water below 4°C.

On the whole, however, I believe that the good points outweigh the faults and that the book could be a useful text for an intermediate level thermodynamics course intended for organic chemists and biochemists as well as for physical chemists.

Introduction to Chemical Thermodynamics is an unaltered printing of the first part of *Chemical Thermodynamics*. It therefore has exactly the same faults and good points as the parent volume, but the fact that the contents are restricted to pure phases severely limits the utility of the brief version as a textbook.

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Plant Morphology

Recent Advances in the Embryology of Angiosperms. P. Maheshwari, Ed. International Society of Plant Morphologists, University of Delhi, Delhi, India, 1963. x + 467 pp. Illus.

State of the Art books, usually entitled "Annual Review of . . ." or "Recent Advances in . . ." have become a part of the biological scene. They characterize fields considered active, with a sufficient readership and subscribership to justify publication of hardbound volumes which are, in effect, international symposia. Plant morphologists, currently alarmed about the shrinking proportion that their field occupies in the economy of today's biology, have cause to applaud the appearance of a volume that registers marked productivity and progress in a descriptive discipline. Plant embryology, although not a new science, has in fact been progressing rapidly in recent years, and no small degree of this achievement has emanated from India. In embryology as well as other areas of morphology, American academic institutions have fallen behind, despite the broad spread of interests in which they supposedly pride themselves. Because of and in spite of this tendency, Maheshwari's book should, and probably will, be acquired by many libraries; will it