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 discussion 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 isothermal 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

be appreciated? There are many fine papers among the 14 contributions assembled here, admirable both as reviews and as stimuli for further research. The laudable trusteeship of Maheshwari, who has fostered many students and many studies, is evident. Additionally, there are workers becoming worthy of recognition for consistently fine production. To mention selected names would only be invidious, for many chapters are excellent. The chapters dealing with so-called descriptive aspects are the best, and demonstrate that, instead of reaching a point of exhaustion, embryology is opening unexpectedly broad vistas for new research. Because recent studies show relationships with physiology, cytology, genetics, and plant breeding, the editor's hope that this book will reach a wider audience is reasonable. The editor has deliberately cultivated a spectrum of interests, and the reader is likely to find much of value in the taxonomic and genetic implications. One brief chapter, which deals with a problem in morphogenesis and offers predictions of what evidence will be needed and prophecies of what will be found, should have been omitted, however.

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Satellite Probes

Space Physics. Donald P. LeGalley and Alan Rosen. Eds. Wiley, New York, 1964. xx + 752 pp. Illus. $25.

This book, which contains 18 "chapters" first presented as lectures in a statewide series sponsored by the University of California in the spring of 1964, answers a need that has been growing during the past few years for an organized, effective presentation of the physics of our space program. The editors and the 19 contributors are outstanding men in their fields and well qualified for their roles as authors; they have correlated their efforts and present an integrated coverage of the subject. The book is divided into four basic parts: Experimental Techniques for Space Physics, Solar and Planetary Physics, Fields and Plasmas in Interplanetary Space, and High Energy Radiation in Space.

For the scientist, the book will provide an excellent review of rocket and satellite experiments as well as the pertinent theory for understanding the results. An advanced background in physics is generally required for complete appreciation of the many topics. However, the beginner in the field can follow the general outlines, and he can refer to the excellent bibliography for further study. In many chapters there are concise theoretical developments of certain topics not previously presented in unified form; thus, the nonspecialist can quickly achieve an insight that will prepare him for original research in the space field. The problem of the solar plasma is an example.

Space engineers will find the book valuable as an aid in the design of spacecraft and instruments for space physics research. Part 1, which is devoted to general problems of this kind, presents knowledge acquired from space experiments to date. Throughout the book, along with the physics of the experiments, the authors make frequent reference to details of specialized instruments and to the basic engineering problems involved.

The technical administrator will welcome the many hints about worthwhile problems for research. Most of the chapters conclude with a summary of the state of progress in a given field and with suggestions for experimental programs. Despite the large number of contributors, the book is basically well written, and the reader can obtain qualitative understanding without appreciating all the mathematical and esoteric details. Naturally, since many of the topics are particularly difficult, there are some exceptions. The excellent introductory chapter is a fine general review of the broad features of the various past and present space programs that have yielded results in scientific missions.

A partial list of the specific topics covered in the book includes radiation spectrum of the sun; physical and chemical aspects of the atmospheres of the planets, including the earth; observational and theoretical results of aurora measurements; micrometeoroids; interaction of the geomagnetic field in the solar plasma; interplanetary magnetic fields, hydromagentic waves; trapped-radiation zones; effects of high-altitude explosions; solar and general cosmic rays in space; and problems of radiation hazards in space.

In most chapters the historical background for the topic is sketched, so that the reader may become quickly familiar with the evolution of the topic during the years before the advent of space measurements (Sydney Chapman's chapter, "Aurora and geomagnetic storms," is a case in point). As one reads further in a given chapter, the enormous contribution of the space age is thus more forcefully apparent. The book will inspire enthusiasm for the importance of the space effort to date, and for its continuation as a necessary component of our search for solutions to many problems in the understanding of our natural environment.

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A General Reference Source

The Harper Encyclopedia of Science. vols. 1–4. James R. Newman, Ed. Harper and Row, New York, 1963. 1379 pp. Illus. $35.

There is, no doubt, always room for another well-done general reference work on science, and *The Harper Encyclopedia* fulfills its editor's avowed intention of producing a useful work for the "common reader"—that is, the student, the teacher, and the nonspecialist.

This new work with its four Britannica-sized volumes occupies a middle ground between the one-volume encyclopedias and its longer and considerably more expensive rival in the field, the 15-volume *McGraw-Hill Encyclopedia of Science and Technology*.

Despite its title, articles in the Harper encyclopedia are well divided between science, narrowly defined, and technology. Substantial space is given to articles on medicine, engineering, and photography, for example. And what might be viewed as auxiliary subjects, such as logic and the history and philosophy of science, figure fairly prominently among the 4000 articles.

In general, the editor has adhered to his announced policy of opting for longer and fewer articles, and the reader is seldom compelled to pursue a subject back and forth through the four volumes. The credentials of the 450 authors are impeccable, the prose is clear, and the editor seems to have been quite successful in pruning the articles of nonessentials. Difficult subjects, however, have not been oversimplified or popularized.

The volumes are attractively de-