Low-Temperature Physics

Helium-3 and Helium-4. WILLIAM E. KELLER. Plenum, New York, 1969. xxi + 436 pp., illus. $18.50. International Cryogenics Monograph Series, vol. 6.

For about the last 20 years low-temperature physics has benefited much from the excellent work of the Los Alamos cryogenics researchers. This book, by a member of that group, is in keeping with the tradition.

The book presents the physics of helium-3 and -4 in a form which is understandable to people who know quantum mechanics but are not familiar with macroscopic quantum effects. The general procedure is to interweave comparison of theory with experiment and of helium-3 with helium-4. The treatment is exemplarily well ordered, logical, and clearly written. It starts with a general introduction to the experimental facts of liquid helium, beginning with the liquefaction of helium-4 in 1908 and of helium-3 in 1949, and a brief chapter on ideal quantum gases. These chapters include interesting historical asides and comparisons of the properties of ideal Bose-Einstein and Fermi-Dirac systems.

Gaseous helium and the transition from the gas to the liquid are described in the next two chapters. The gas is more tractable and better understood theoretically than the condensed phases. Keller treats the pair potential in its many forms and shows how the gas properties—virial coefficients, *P-V* isotherms, and transport properties—depend on the potential.

The fifth and sixth chapters are, respectively, on the properties of liquid helium-4 and liquid helium-3, subjects each of which alone could occupy a large book. Keller discusses the theories of a nonideal Bose-Einstein gas and Landau's theory of a Fermi liquid in physical terms and compares the relevant experimental properties of the liquids—that is, their thermodynamic and transport properties and susceptibility—with theoretical predictions. There is a generous supply of figures throughout the book; they are well done and a large number of them are new. They show interesting comparisons between experiment and theory, and helium-3 and -4. These figures will be a welcome aid to low-temperature physics teachers as well as researchers.

There is an elegant brief chapter on critical phenomena which starts with a description of the general problem in thermodynamic terms. This leads naturally into a discussion of the critical-point properties of helium-3 and -4 and of the properties of liquid helium-4 near the lambda temperature. The two final chapters are on flowing helium II and critical velocities and on compressed helium. These two subjects are prime interests of the author and his colleagues, a fact which is reflected in the thoroughness with which current research on them is treated. This account will be a treat for researchers in these areas.

The presentation of the subjects within the chapters is usually historical and somewhat eclectic. Each chapter can be read as a self-consistent review article. In some cases the author makes primary reference to a recent review article and principally describes work in the field since the review. The book tends, naturally, to emphasize the interests of the author, and these interests are certainly broad. However, some subjects, among them rotating helium and ions in liquid helium, are not treated in any detail. The treatments of other subjects are fairly thorough, but it is only fair to note that descriptions of some important and interesting work are not included. Such problems are probably inevitable in a book which covers such a broad area.

In general this is a clearly written and interesting book that will be useful to all who study or use helium for fun or profit.

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Solution Chemistry

Chemical Reactions in Solvents and Melts. G. CHARLOT and B. TREMILLON. Translated from the French edition (Paris, 1963) by P. J. J. Harvey. Pergamon, New York, 1969. viii + 528 pp., illus. $27.

This book is divided into two parts. Part 1 considers, in 142 pages, general properties according to type of reaction, such as acid-base reactions in polar and nonpolar solvents, oxidation-reduction, precipitation reactions, and complex formation. In the two chapters on acid-base reactions, only examples of proton transfer are discussed. However, the electronic theory of acids and bases is given brief mention at the end of the chapter on complexes, followed by nearly a hundred references on "Various definitions of acids and bases."

In part 2, the following solvents are covered: hydrocarbons and halogen derivatives; acids; bases; alcohols and phenols; amides; nitroderivatives, nitriles, and ketones; anhydrides, ethers, and esters; halides; and ionized melts. A chapter is devoted to various other solvents. This section of the book contains a large number of equilibrium constants grouped in tables. Also, many possible titrations are listed.

In the preface the authors write, "The logical argument found to work so well in the case of dilute aqueous solutions can be easily applied to polar solvents analogous to water, and, with certain precautions, to all other solvents including melts. This is what we have mainly endeavoured to set out clearly in this book." They seem to have succeeded.

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Books Received

Abstracts of Papers Presented at the Lactose Operon Meeting. Cold Spring Harbor, N.Y., September 1969. Arranged by David Zipser and Jonathan Beckwith. Cold Spring Harbor Laboratory of Quantitative Biology, Cold Spring Harbor, N.Y., 1969. 48 pp. Paper, $2.50.

Advances in Ecological Research. Vol. 6. J. B. Cragg, Ed. Academic Press, New York, 1969. xii + 238 pp., illus. $10.

Advances in Heterocyclic Chemistry. Vol. 10. A. R. Katritzky and A. J. Boulton, Eds. Academic Press, New York, 1969. x + 350 pp., illus. $17.

Advances in High Pressure Research. Vol. 3. R. S. Bradley, Ed. Academic Press, New York, 1969. x + 394 pp., illus. $17.

Advances in Organic Chemistry. Methods and Results. Vol. 6. Edward C. Taylor and Hans Wynberg, Eds. Interscience (Wiley), New York, 1969. vi + 442 pp., illus. $22.50.

Advances in Organic Geochemistry 1968. Proceedings of the 4th international meeting, Amsterdam, September 1968. P. A. Schenck and I. Havenaar, Eds. Pergamon, New York, 1969. viii + 620 pp., illus. $32. International Series of Monographs in Earth Sciences, vol. 31.

Advances in the Study of Behavior. Vol. 2. Daniel S. Lehrman, Robert A. Hinde, and Evelyn Shaw, Eds. Academic Press, New York, 1969. xii + 369 pp., illus. $15.

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