BOOKS

Viscous Flow Theory: I, Laminar Flow. Shih-I Pai. D. Van Nostrand Company, Inc., New York (1956). 384 pages. $7.75.

The development of aircraft and missiles which travel at velocities in excess of the velocity of sound has necessitated much new research in the hydrodynamics of compressible fluids. For, though it is possible to neglect the compressibility of air at low speeds (about 200 miles an hour), this is not possible at higher speeds. The book under review is concerned with the laminar flow of viscous, compressible fluids with special attention to aerodynamics. Three major topics are discussed: (1) the classical hydrodynamic theory of fluids, including some elementary kinetic theory of gases, (2) generalizations derivable from the theory without explicit solution of the differential equations such as similarity and dimensional analysis and general properties of the Navier-Stokes equation, and (3) boundary-layer theory. The last is by far the largest section, occupying some 216 pages. Considerable detail is given and numerous tables of useful data are included in the text. It is proposed to treat turbulent flow in part II of this work.

This reviewer feels that the major omission from the text is a discussion of the properties of gases at extremely low pressures. Under circumstances prevailing in the upper atmosphere the mean free path of a molecule may easily be of the order of magnitude of the dimensions of the flying object. Under these conditions the relative variation of macroscopic quantities over a mean free path is not negligible. For the limiting case of the Knudsen gas there are striking differences with phenomena under moderate pressures. For instance in Couette flow the force does not depend upon the velocity gradient but rather on the velocity difference, the force depending linearly on the pressure, etc. The transition region between ordinary gas pressures and those for which Knudsen behavior subsists has been the subject of several studies recently. As anticipated, the results differ from those of classical hydrodynamics.

STUART A. RICE

Experimental Physical Chemistry. Farrington Daniels, J. H. Mathews, J. W. Williams, Paul Bender and R. A. Alberty. McGraw-Hill Book Company, Inc., New York (1956). Fifth edition. 482 pages. $6.50.

The latest edition of this well-known text for the physical chemistry laboratory incorporates several new experiments, one entirely new chapter, and the complete rewriting of parts of another. Of primary interest among experimental topics revised or presented for the first time are osmotic pressure, chromatographic adsorption, and differential thermal analysis.

The section on the treatment of experimental data dealing with errors has been rewritten to include several problems on the calculation of error. The rewritten section represents an improvement over previous efforts in that the goal of a relatively clear presentation of the subject of experimental

error to the third-year college student has been accomplished.

An entirely new chapter devoted to the experimental techniques of electronics, high vacuum, and glass manipulation has been added to the book. High-vacuum technology is discussed through consideration of types of vacuum pumps and gauges, the detection of leaks, and the basic theory of viscous, slip, and molecular flow. The section on electronics contains an experiment on the determination of characteristic curves of various vacuum tubes, triode amplification, and rectification.

As the authors point out, space for new experiments can be obtained only by the elimination of those from previous editions which have become part of first- or second-year laboratory courses or which, for various reasons, have become less important to the student of physical chemistry. Such casualties from the previous edition of this book include experiments on photoelectric colorimetry, on partial miscibility, on clock reactions, and on unimolecular films and discussions of dimensions and colorimetry.

The second section of the book, dealing with the apparatus and techniques generally encountered in experimental work, has been left unchanged for the most part other than the section on errors mentioned previously. The few new topics cover principally separate discussions of gamma radiation, high-vacuum distillation, and time measurements.

JOHN B. BUTT

Elements of Gasdynamics. H. W. Liepmann and A. Roshko. John Wiley & Sons, New York (1957). 439 pages. $11.00.

Elements of Gasdynamics is an excellent book. The material covered may be ascertained from the chapter headings, which read: (1) "Concepts from Thermodynamics"; (2) "One Dimensional Gasdynamics"; (3) "One Dimensional Wave Motion"; (4) "Waves in Supersonic Flow"; (5) "Flow in Ducts and Wind Tunnels"; (6) "Methods of Measurement"; (7) "The Equations of Frictionless Flow"; (8) "Small-Perturbation Theory"; (9) "Bodies of Revolution: Slender Body Theory"; (10) "The Similarity Rules of High Speed Flow"; (11) "Transonic Flow"; (12) "The Method of Characteristics"; (13) "Effects of Viscosity and Conductivity"; (14) "Concepts from Gas Kinetics." There are very few criticisms which need to be made. It is unfortunate that the authors chose to use the symbols F and G for the Helmholtz and Gibbs free energy rather than A and G. The use of F for the Helmholtz free energy will cause much confusion since most Americans use F for the Gibbs free energy and the majority of the tables of thermodynamic data adhere to this convention. This reviewer would like to have seen a somewhat more extended discussion of the second law of thermodynamics and of the principles of irreversible thermodynamics, especially since the latter is used in one form or another extensively throughout the text. The treatment of the Clausius-Clapeyron equation is very poor and unconvincing. The usual thermodynamic derivations are superior to the quasimolecular one given by the authors. Also, the treatment of imperfect gases is superficial and the relationship