

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.

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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