REVIEWS

The Perfect Gas. By J. S. Rowlinson. Pergamon Press, 1963. 136 pp. 30*s*.

The *International Encyclopedia of Physical Chemistry and Chemical Physics* is planned by the publishers to consist of about 100 volumes distributed over 22 topics. The book under review is Volume 5 of Topic 10, *The Fluid State.*

A book entitled *Real Gases* was recently reviewed by Dr Griffith (*J. Fluid Mech.* **17**, 1963, 631), and the terminological confusion in the field is well illustrated by the fact that the two books *Real Gases* and *The Perfect Gas* to a large extent cover the same material. To a physical chemist a perfect gas obeys the simple equation of state and its specific heats are in general functions of temperature. To him a partly dissociated or ionized gas is a mixture of perfect gases and still obeys the equation of state provided the gas constant is referred to the number of moles. The aerodynamicist often loosely refers to any departures from the 'ideal gas with constant specific heats' of classical compressible flow theory as 'real gas effects', although he would probably agree that variations of the specific heats with temperature do not necessarily make the gas imperfect. The main difference in approach appears in the treatment of dissociation and ionization where it has become the practice in aerodynamics to retain the gas constant in the equation of state at the value for the undissociated or un-ionized gas and allow for changes in composition and in the equation of state by the introduction of a 'compressibility factor'.

It is therefore to be expected that the aerodynamicist will find Professor Rowlinson's small book of much greater interest than a cursory glance at the title might suggest. The first two chapters survey the general thermodynamic relations for a perfect gas and the experimental methods used for measuring heat capacities. The main chapter deals with the calculation of thermodynamic properties of a perfect gas using the partition function and a knowledge of the available quantal states. This is followed by a chapter on mixed gases and reactions, including dissociation and ionization. Both these chapters contain a wealth of up-to-date information with detailed reference to published papers and tabulations. The account is admirably readable and should be easily accessible to the fluid mechanicist with a basic knowledge of statistical and quantum mechanics.

A chapter on molecular collisions puts the emphasis on energy transfer with particular reference to non-equilibrium effects in sound waves. Viscosity, diffusion and thermal conduction are to be discussed in another volume in the encyclopedia. The final chapter on gas flows is an introduction to fluid mechanics intended for the physical chemist and includes the properties of shock waves and their uses in physical chemistry.

The book will be useful to graduate students and research workers in fluid mechanics by giving them a brief but authoritative introduction to the methods of calculating the properties of gases without drawing too heavily on background knowledge. The many references to the literature are particularly valuable.

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