ECE 309 M.M. Yovanovich

Ideal Gas Law - Equation of State

The relation between pressure P, volume V, absolute temperature T, total mass M and the gas constant R for an ideal gas is

$$PV = MRT$$

The units of the product PV are joules, therefore the units of the gas constant:

$$R = \frac{PV}{MT}$$

are $J/kg \cdot K$. This equation of state predicts the behavior of gases quite accurately within certain ranges of pressure and temperature.

Values of Gas Constant

Some values of the gas constant are

Substance	R, $kJ/kg \cdot K$
Air	0.2870
Argon	0.2081
Helium	2.0770
Oxygen	0.2598
Nitrogen	0.2968
Water Vapor	0.4615

Alternate Forms

Alternate forms are obtained by the introduction of the specific volume v and the specific mass density ρ:

$$Pv = RT \qquad \text{or} \qquad P = \rho RT$$

where

$$v = \frac{1}{\rho} = \frac{V}{M}$$