Ideal Gas Law

The relationship between pressure and temperature for most gases can be approximated by the ideal gas law,

$$pV = mRT$$

where p is the absolute pressure, V is the volume, m is the mass, T is the absolute temperature (units in Kelvins or Rankines) and R is the gas constant. This equation is also referred to as the perfect gas law or the equation of state for an ideal gas. The gas constant R for some common gases is given in the table. Note that the density ρ is given by m/V, hence the ideal gas law can be written in terms of the density as

$$p = \rho RT$$

The ideal gas law can also be written in per mole basis as follows:

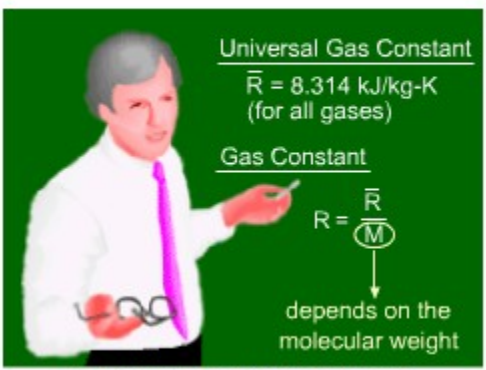
$$pV = n\bar{R}T$$

where n is the number of moles and $\bar{R}$ is the universal gas constant. The number of moles is given by n = m/M where M is the molecular weight of the gas. The universal gas constant $\bar{R}$ is 8.314 kJ/kmol-K for all gases, and it is related to the gas constant by:

$$R = \bar{R}/M$$

Table: Gas Constant for Common Gases*

	Gas Constant, R (kJ/kg-K)
Air	0.2870
Ammonia	0.4882
Carbon Dioxide	0.1889
Helium	2.0771
Hydrogen	4.1243
Nitrogen	0.2968
Oxygen	0.2598
R-12	0.06876
R-134a	0.08149



Universal Gas Constant Versus Gas Constant