Gas Laws

The Basics

Combined Gas Law

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

P_1, P_2 - Pressure, any units; V_1, V_2 - Volume, any units; n_1, n_2 - moles; T_1, T_2 - Temp, °K

Ideal Gas Law

$$PV = nRT$$

P - Pressure; V - Volume; n - number of moles;
R - Ideal gas constant, see sidebar; T - Temp, °K

Ideal Gas Constant, *R*

The value of the ideal gas constant, *R*, varies according to your units for pressure and volume:

- R = 0.0821 L•atm/mole•K
- R = 62.36 L•torr/mole•K
- R = 8.314 L•kPa/mole•K

Less Basic

Graham's Law

$$\frac{v_1}{v_2} = \sqrt{\frac{m_2}{m_1}}$$

v_1, v_2 - Diffusion rate; m_1, m_2 - molar mass

Molecular RMS Velocity

$$v_{rms} = \sqrt{\frac{3RT}{m}}$$

You need to use this value for R so that the velocity will come out in m/s.

Note the unusual units here. This will be 1,000 times what we usually think of as molar mass.

v_{rms} - velocity, m/s; R - Ideal gas constant, 8.3145 J/mole•K; T - Temp, °K; m - molecular mass in kg/mole