

The Basics

Boyle's Law

$$P_1 V_1 = P_2 V_2$$

Charles' Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Avogadro's Law

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

Combined Gas Law

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

Combined Gas Law (alt.)

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

This version of the Combined Gas Law incorporates Avogadro's Law.

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 , depends on your units for pressure and volume:

- $R = 0.08206 \text{ L}\cdot\text{atm}/\text{mole}\cdot\text{K}$
- $R = 62.36 \text{ L}\cdot\text{torr}/\text{mole}\cdot\text{K}$
- $R = 8.314 \text{ L}\cdot\text{kPa}/\text{mole}\cdot\text{K}$

The Less Basic

Graham's Law of Diffusion

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

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

Standard Temp & Pressure (STP)

STP is 1 atm pressure and 0°C.

1 mole of *any* gas at STP has a volume of 22.4 L

Molecular RMS Velocity

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

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

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

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