Acumen Tutoring™

Chemistry Memorize Me™

Gas Laws

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

$$PV = nRT$$

Density and Molar Mass

$$d = \frac{P(MM)}{RT}$$

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

Ideal Gas Constant, R

The value of the ideal gas constant, *R*, depends on your units for pressure and volume:

- R = 0.08206 L•atm/mole•K
- R = 62.36 L•torr/mole•K
- R = 8.314 L•kPa/mole•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

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

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.

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

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