Ideal Gas Law

$PV = nRT$

R ← universal gas const.

$.08206 \frac{L \cdot atm}{K \cdot mol}$

What is the volume of a container if 56.9 g of oxygen at 45.9^{o}C can be put in the container at a pressure of 643 Torr?

$PV = nRT$

$V = \frac{nRT}{P} = \frac{\left(\frac{56.9}{31.9988}\right)\left(.08206 \frac{L\,atm}{K\,m}\right)\left(319.1\ K\right)}{\left(\frac{643}{760}\ atm\right)}$

$45.9 + 273.15 = 319.1$

$= 55.0\ L$

$643\ mmHg \times \frac{1\ atm}{760\ mmHg}$

Gas Density

$PV = nRT$

$\frac{P}{RT} = \frac{n}{V} \leftarrow \frac{g}{MM}$

$\frac{P}{RT} = \frac{g}{MM\,V}$

$\frac{P \cdot MM}{RT} = \frac{g}{V} = \text{density}$

If a gas has a density of 3.62 g/L at 2.00 atm and 23°C, what is the molar mass of the gas?

$\frac{(2.00\,atm)(x)}{(.08206\,\frac{L\,atm}{K\,mol})(296\,K)} = 3.62\,\frac{g}{L}$

$23 + 273.15 =$

Graham's Law

$T \propto KE$

2 gases @ same T ... same KE

$\frac{1}{2} m_1 v_1^2 = \frac{1}{2} m_2 v_2^2$

$\frac{m_1}{m_2} = \frac{v_2^2}{v_1^2}$

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

diffusion

effusion

$\frac{\sqrt{MM_1}}{\sqrt{MM_2}} = \frac{rate_2}{rate_1} = \frac{\left(\frac{d_2}{t_2}\right)}{\left(\frac{d_1}{t_1}\right)} = \frac{d_2}{t_2} \cdot \frac{t_1}{d_1}$

If it takes 3 minutes and 18 seconds for hydrogen to escape from a container through a small opening, and it takes another gas 18 minutes and 3 seconds to escape under the same conditions, what is the molar mass of the second gas?

$$\frac{\sqrt{MM_1}}{\sqrt{MM_2}} = \frac{\left(\frac{d_2}{t_2}\right)}{\left(\frac{d_1}{t_1}\right)} = \frac{d_2}{t_2} \cdot \frac{t_1}{d_1}$$

The Peterson problem