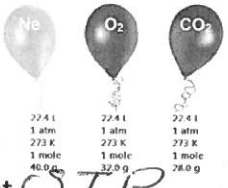
Chemical Quantities Outline

(The Mole to Volume)

Mole to Volume Relationship

- Avogadros Law: equal volumes of gases at the same temperature and pressure, contain equal numbers of particles.



- Volume of a gas can change with a change in temperature and pressure so it is usually measured at STP (standard temperature and pressure)
  - 0°C and 1 atm
- At STP: 1 mol = 6.022×10^{23} particles = 22.4 L
- 22.4L is called the molar volume of a gas
- Molar volume is used to convert between number of moles of a gas and the volume of the gas at STP
- Conversion Factors for mol and volume ratio: $1\ mol = 22.4\ L$

$$\frac{22.4\ L}{1\ mol} \quad OR \quad \frac{1\ mol}{22.4\ L}$$

Sulfur dioxide (SO_2) is a gas produced by burning coal. It is an air pollutant and one of the causes of acid rain. Determine the volume, in liters, of 0.60 mol of SO_2 gas at STP.

$$0.60\ mol\ SO_2 \left(\frac{22.4\ L}{1\ mol}\right) = 13\ L\ SO_2$$

What is the volume of 0.960 mol CH_4 at STP?

$$0.960\ mol \left(\frac{22.4\ L}{mol}\right) = 21.5\ L\ CH_4$$

At STP, how many moles are in 1.00×10^3L of C_2H_6?

$$1.00 \times 10^3\ L\ C_2H_6 \left(\frac{1\ mol}{22.4\ L}\right) = 44.6\ mol\ C_2H_6$$

The density of a gaseous compound containing carbon and oxygen is found to be 1.964 g/L at STP. What is the molar mass?

$$\frac{1.964\ g}{1\ L}\left(\frac{22.4\ L}{mol}\right) = \frac{43.99\ g}{mol}$$

What is the density of krypton gas at STP?

$D = \frac{g}{L}$

$$\frac{83.8\ g}{\cancel{mol}}\left(\frac{1\ \cancel{mol}}{22.4\ L}\right) = 3.74\ L$$

Summary of mole conversions