Mole-Volume Relationship (added from CH 8)

- Volume of 1 mole of a liquid or solid vary greatly with the substance
- Volume of gases under same physical conditions are more predictable.
- Avogadro's hypothesis: states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles.
  - Not all gas particles are the same size but large particles do not require much more space than small number of relatively small particles. (b/c particles so far apart in gases)

Volume

- Volume of gas change with pressure & temperature (ex. helium balloon, water bottle in airplane)
- Volume of gas usually measured at standard temperature and pressure. (STP)
  - Temp $0^{o}C$, pressure of 101.3 Pa or 1 atmospohere (atm)
- At STP 1 mol or 6.022×10^{23} representative particles of any gas occupies a volume of 22.4L
  - Called molar volume

Calculating Volume at STP

- Molar volume used to convert known number of moles of gas to volume of gas at STP
  - 22.4 L = 1 mol @ STP
  - Suppose you have 0.375 mol of oxygen gas and want to know what volume gas will occupy at STP

Practice

- 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 SO_2 gas at STP

- Suppose you collect 0.200L of hydrogen gas at STP in an experiment. Calculate the number of moles of hydrogen.

Calculating molar Mass from Denisty

- The density of a gas at STP and the molar volume at STP (22.4 L/mol) can be used to calculate the molar mass of the gas
- Molar mass = density at STP x molar volume at STP

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

Mole Road Map

- To convert from one unit to another, you MUST USE MOLES as intermediate step!