NOTES: 10.2 – Molar Volume, Density; and the Mole "Road Map"; NOTES: 10.3 - Percent Composition

Volume ↔ Mole Conversion:

• Conversion Factor:

-1 mole of any gas at STP = _____

-this is known as _____

-"STP" = standard temperature (0°C) and standard pressure (1 atm)

Volume Example #1: Determine the volume, in liters, of 0.600 mol of SO₂ gas at STP.

Volume Example #2: Determine the number of moles in 33.6 L of He gas at STP.

DENSITY:

Density = _____

When given the density of an unknown gas, one can multiply by the molar volume to find the molar mass. The molar mass can then allow for identification of the gas from a list of possibilities.

Density Example: The density of an unknown gas is 2.054 g/L.

(a) What is the molar mass?

(b) Identify the gas as either:	nitrogen (N ₂), fluorine	(F ₂), nitrogen diox	xide (NO ₂), carbon	dioxide (CO ₂), or
ammonia (NH ₃).				

Density Example #2:

The density of a gaseous compound containing carbon and oxygen is 1.964 g/L at STP. How many moles are in a 47.0 g sample of this gaseous mixture?

The MOLE "Road Map"...all roads lead to the mole!

Mixed Mole Conversions:

1 mole = _____

particles.

<u>Mixed Mole Example #1:</u> How many carbon atoms are in a 50.0-carat diamond that is pure carbon? Fifty carats is the same as 10.0 g.

Mixed Mole Example #2: How many individual atoms are in 22.0 g of water?

Mixed Mole Example #3: What is the volume of a sample of nitrogen dioxide gas measured at STP that has a mass of 29.3 g?

Mixed Mole Example #4: What is the mass in grams of in 3.41 x 10²² molecules of CBr₄?

NOTES: 10.3 - Percent Composition

The chemical composition of a compound can be expressed as the mass percent of each element in the compound.

Example: Determine the percent composition of C_3H_8 .

Example: Determine the percent composition of iron (III) sulfate.

Hydrated Compounds:

Some compounds exist in a "hydrated" state. Some specific number of water molecules are present for each molecule of the compound.

Example: oxalic acid (COOH)₂ can be obtained in the laboratory as (COOH)₂•2H₂O.
Note: the dot in (COOH)₂•2H₂O shows that the crystals of oxalic acid contain 2 water molecules per (COOH)₂
molecule.
• The molar mass of (COOH)₂ = _____% anhydrous = _____%

• The molar mass of $(COOH)_2 = _____%$ annydrous = _____%

• The molar mass of (COOH)₂•2H₂O = _____ % water = _____

• Water can be driven out of a hydrated compound by heating it to leave an "anhydrous" (without water) compound.

Example: A 7.0 g sample of calcium nitrate, Ca(NO₃)₂•4H₂O, is heated to constant mass (which means all the water has evaporated!). How much anhydrous (without water) salt remains?