**Chemistry IA—Chemical Quantities**

- The Mole:

- MOLE—SI unit of an amount in chemistry

- the mole is a COUNTING unit (just like a dozen)

- 1 dozen = 12 eggs

- 1 MOLE = 6.02 x 1023 particles (Avogadro’s number!!)

- particles can be atoms, ions, molecules or formula units

- use the FACTOR LABEL METHOD to convert between moles and

atoms

**1 mole 6.02 x 1023 atoms**

**---------------------------- or ------------------------------**

**6.02 x 1023 atoms 1 mole**

*How many atoms are in 2.5 moles of C??*

- Molar Mass:

- molar mass—the mass of 1 mole of a substance (expressed in

grams)

- the molar mass is EQUAL in number to the atomic mass in amu

- it is much more convenient to measure the mass of MOLES of a

substance because we can measure in grams!!

- 1 atom H = 1.0079 amu

- 1 mole H = 6.02 x 1023 atoms H = 1.0079 grams H

- 1 atom O = 15.9994 amu

- 1 mole O = 6.02 x 1023 atoms O = 15.9994 grams O

- FORMULA MASS—the mass of a compound

- you calculate the formula mass by the ALGEBRAIC SUM of all of

the atoms making up the compound

*What is the formula mass of Al2(SO4)3 ??*

Al 🡪 2 x 27.0g = 54.0 g

S 🡪 3 x 32.1g = 96.3 g

O 🡪 12 x 16.0g = 192.0 g

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342.3 g

- use the FACTOR LABEL METHOD to convert from moles to mass

*How many grams are in 2.7 moles of O2?*

*How many moles are there in 15.5 grams NaCl?*

- the mole is the CENTRAL UNIT of chemistry!!!!!!

- all conversions usually involve the mole!!!

**MOLES**

**Molar**

**Mass**

**(grams)**

**Number**

**of**

**particles**

**(atoms)**

- when converting from grams to atoms or atoms to grams you

MUST convert to moles first!!

*How many molecules are in 12.5 grams H2O?*

*How many grams do 5.3 x 1030 molecules of CO2 weigh?*

- Percent Composition and Chemical Formulas

- percent composition—the percent by mass of each element in a

compound

mass of element

% comp = ---------------------------- x 100

mass of compound

- can use numbers from given data or use the MOLAR MASSES for

a known compound

*Calculate the percent composition of each element in NaHCO3*

**FORMULA MASS = 84.0 g**

*9.03 g Mg completely combines with 3.48 g N to form a compound. What is the percent composition of this compound??*

***Mg + N2 🡪 MgxNy***

**9.03g 3.48g 12.51g**

- Calculating Empirical Formulas:

- empirical formula—gives the LOWEST WHOLE NUMBER

RATIO of atoms in the compound

- used for formulas of IONIC compounds

- may or may not be the same as the molecular formula!!

- Solving for the empirical formula from % composition data:

STEP 1: Assume 100 g

STEP 2: Convert % 🡪 g

STEP 3: Calculate the number of MOLES of each atom

STEP 4: Divide each number of MOLES by the smallest

number of MOLES

STEP 5: Make sure that this mole ratio is a WHOLE

NUMBER RATIO (multiply by different factors until

it is)

STEP 6: Use the whole number ratio as SUBSCRIPTS in the

empirical formula

*A compound is 67.6% Hg, 10.8% S, and 21.6 % O. What is it’s empirical formula??*

**Assume 100 g**

**So… HgSO4**

- Calculating the molecular formula:

- molecular formula—shows the actual number of atoms in a

molecule

- may not be the smallest whole number ratio

- Calculating the molecular formula:

STEP 1: Calculate the empirical formula

STEP 2: Divide the MOLAR MASS / empirical formula mass

STEP 3: Multiply the subscripts in the empirical formula by

the answer to step 2

STEP 4: Write the molecular formula using these new

subscripts

*A compound is 58.8 % C, 9.8 % H, and 31.4% O. It has a molar mass of 102 g/mol. What is the molecular formula???*

**Assume 100 g**

**So… C5H10O2 is the EMPIRICAL**

**=**

**So … {C5H10O2} x 1 🡪 C5H10O2**