★ Know your polyatomic ions.

★ Be able to name compounds.

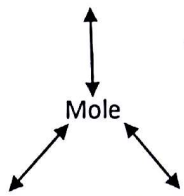
★ Diatomics: $H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2$

Unit 6 Test Review

$$\%\ composition = \frac{part}{whole} \times 100$$

$$n = \frac{molecular\ formula\ mass}{empirical\ formula\ mass}\ or\ n = \frac{MFM}{EFM}$$

1 mol = (P.T)g ← molar mass
1 mol = 22.4 L
1 mol = 6.02 x 10^{23} Particles



covalent

1. Determine the molecular mass for disulfur tetroxide.

↳ S_2O_4 ⇒ MM: $2(32.07)+4(16) = 128.14\ g/mol$

ionic

2. Determine the formula mass for nickel (III) chloride.

$Ni^{+3}\ Cl^{-1}$ ⇒ $NiCl_3$ ⇒ MM: $58.69+3(35.45) = 165.04\ g/mol$

3. What is the percent composition of carbon tetrachloride, CCl_4?

whole: CCl_4

$12.01+4(35.45) = 153.81\ g/mol$

$\%C = \frac{12.01}{153.81} \cdot 100 = 7.81\%\ C$

$\%Cl = \frac{141.8}{153.81} \cdot 100 = 92.19\%\ Cl$

4. How many grams of sulfur are in 5.82 g of Iron (III) sulfate?

$Fe^{+3}\ SO_4^{-2}$

$Fe_2(SO_4)_3$ ⇒ MM: $2(55.85)+3(32.07)+12(16.00) = 399.91\ g/mol$

$\frac{96.21}{399.91} \cdot 100 = 24.06\%\ S$

part of sulfur / total / % sulfur

$(0.2406)(5.82) = 1.40\ g\ S$

5. Calculate the mass of CO_2 gas if there are 12.2 L present.

volume → mass

$12.2\ L\ CO_2 \cdot \frac{1\ mol\ CO_2}{22.4\ L\ CO_2} \cdot \frac{44.01\ g\ CO_2}{1\ mol\ CO_2} = 23.97\ g\ CO_2$

6. How many molecules of H_2O are present in 4.77 g of H_2O? (Molar mass = 18.02 g/mol)

g → molecule (particle)

$4.77\ g\ H_2O \cdot \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \cdot \frac{6.02 \times 10^{23}\ molecule\ H_2O}{1\ mol\ H_2O} = 1.59 \times 10^{23}\ molecule\ H_2O$

7. What is the empirical formula of laughing gas, which is 63.6 % N and 36.4 % O?

$63.6\ g\ N \cdot \frac{1\ mol\ N}{14.01\ g\ N} = 4.54\ mol\ N/2.28 = (2)$

$36.4\ g\ O \cdot \frac{1\ mol\ O}{16.00\ g\ O} = 2.28\ mol\ O/2.28 = (1)$

N_2O

8. A compound was found to contain 49.98 g carbon and 10.47 g hydrogen. If the molecular mass of the compound is 58.00 g/mol, what is the molecular formula?

$49.98\ g\ C \cdot \frac{1\ mol\ C}{12.01\ g\ C} = 4.16\ mol\ C/4.16 = 1 \times 2 = (2)$

$10.47\ g\ H \cdot \frac{1\ mol\ H}{1.01\ g\ H} = 10.37\ mol\ H/4.16 = 2.5 \times 2 = (5)$

EF = C_2H_5

$n = \frac{MFM}{EFM}$

$n = \frac{58.00}{29.07}$

$n = 2$

n / EF

$(2)(C_2H_5)$

C_4H_{10} : MF

9. Answer the following for **iron (II) phosphate**:

a. How would you write the formula for the above: $Fe^{+2}\ PO_4^{-3}$ ⇒ $Fe_3(PO_4)_2$

b. How many total atoms are in one formula unit for the compound above?

13 atoms

c. How many total ions are in one formula unit for the compound above?

5 ions: 3 Fe^{+2}, 2 PO_4^{-3}

d. What is the formula mass for the compound above?

$Fe_3(PO_4)_2 = 3(55.85)+2(30.97)+8(16.00) = 357.49\ g/mol$

10. Answer both A and B:

a. Calculate the percent composition of glucose ($C_6H_{12}O_6$)

Find all % elements → MM = 180.18 g/mol (whole)

$\%C = \frac{72.06}{180.18} \cdot 100 = 39.99\%C$

$\%H = \frac{12.12}{180.18} \cdot 100 = 6.73\%H$

$\%O = \frac{96}{180.18} \cdot 100 = 53.28\%O$

b. If there are 125 grams of glucose in a sample, how many grams of oxygen are there?

$53.28\%O \rightarrow (0.5328)(125) = 66.60\text{ g O}$

(0.5328: decimal form; 125: total mass; 66.60 g O: part of oxygen in mass)

11. Convert the following using dimensional analysis:

5.86 grams CO_2 to molecule of CO_2 $5.86\text{ g } CO_2 \cdot \frac{1\text{ mol } CO_2}{44.01\text{ g } CO_2} \cdot \frac{6.02\times10^{23}\text{ molecule } CO_2}{1\text{ mol } CO_2} = 8.02\times10^{22}\text{ molecule } CO_2$

Name the three types of particles and tell when they are used.

atoms = element formula unit = ionic molecule = covalent (include diatomics)

12. Convert the following using dimensional analysis:

64.2 liters He to atoms of He $64.2\text{ L He} \cdot \frac{1\text{ mol He}}{22.4\text{ L He}} \cdot \frac{6.02\times10^{23}\text{ atoms He}}{1\text{ mol He}} = 1.72\times10^{24}\text{ atoms He}$

What temperature and pressure conditions are required to use the molar volume conversion? 0°C & 1 atm

What state of matter is required to use the molar volume conversion? gases ONLY

13. Convert the following using dimensional analysis:

84.5 liters Cl_2 to grams Cl_2 $84.5\text{ L } Cl_2 \cdot \frac{1\text{ mol } Cl_2}{22.4\text{ L } Cl_2} \cdot \frac{70.9\text{ g } Cl_2}{1\text{ mol } Cl_2} = 267.46\text{ g } Cl_2$

14. Which of the following are empirical formulas and which are molecular formulas?

$C_{14}H_{18}N_2O_5$	C_6H_{14}	$C_6H_{12}O_6$	CH_2O	H_2O_2
EF	MF	MF	EF	MF

15. . Ascorbic acid (vitamin C) contains 40.92% carbon, 4.58% hydrogen, and 54.50% oxygen by mass. What is the empirical formula of ascorbic acid?

$40.92\text{ g C} \cdot \frac{1\text{ mol C}}{12.01\text{ g C}} = 3.41\text{ mol C} / 3.41 = 1 \times 3 = (3)$

$4.58\text{ g H} \cdot \frac{1\text{ mol H}}{1.01\text{ g H}} = 4.53\text{ mol H} / 3.41 = 1.33 \times 3 = (4)$

$54.5\text{ g O} \cdot \frac{1\text{ mol}}{16\text{ g O}} = 3.41\text{ mol O} / 3.41 = 1 \times 3 = (3)$

$C_3H_4O_3$

16. A hydrocarbon has the empirical formula CH_2 and a molar mass of 84 g/mol. Determine the molecular formula.

EFM = 14.03 g/mol

$n = \frac{MFM}{EFM} \rightarrow n = \frac{84}{14.03} = (6)$

n ↓ EF ↓

$6(CH_2) = C_6H_{12}$