Name: _____ Date: _____

AP Chemistry Summer Assignment

Worksheet #1 - Math Skills

Significant Figures (Sig Figs)

1. How many sig figs are in the following numbers?

   a) 0.0450 3

   b) 790 2

   c) 32.10 4

2. Solve the following problems. Round your answer to the correct number of sig figs (and use the correct unit on your answer).

   a) 825 cm x 32 cm x 0.248 cm 6500 cm^3

   b) $\frac{15.68\ g}{2.885\ mL}$ 5.435 g/mL

Density (round your answers to correct number of sig figs and show all work with units)

3. A cube of ruthenium metal 1.5 cm on a side has a mass of 42.0 g. What is the density in g/cm^3? Will ruthenium metal float on water?

$V = (1.5\ cm)^3 = 3.375\ cm^3$

$D = \frac{m}{V} = \frac{42.0\ g}{3.375\ cm^3} = \boxed{12.4\ g/cm^3}$ ruthenium will not float on water

4. The density of bismuth metal is 9.8 g/cm^3. What is the mass of a sample of bismuth that displaces 65.8 mL of water?

65.8 mL H_2O = 65.8 cm^3

$9.8\ g/cm^3 = \frac{m}{65.8\ cm^3}$

$m = 644.84 = \boxed{640\ g}$

Conversions (round answers correctly and show work with units)

5. Make the following conversions:

a) 16.2 m to km

$$\frac{16.2\ m \mid 1\ km}{\mid 1000\ m} = 0.0162\ km = \boxed{1.62 \times 10^{-2}\ km}$$

b) 5.44 nL to mL

$$\frac{5.44\ nL \mid 1\ L \mid 10^{3}\ mL}{\mid 10^{9}\ nL \mid 1\ L} = \boxed{5.44 \times 10^{-6}\ mL}$$

c) 45.7 mL/s to kL/hr

$$\frac{45.7\ mL \mid 1\ L \mid 1\ kL \mid 60\ s \mid 60\ min}{1\ s \mid 1000\ mL \mid 1000\ L \mid 1\ min \mid 1\ hr} = \boxed{0.165\ kL/hr}$$

Reactions

6. Balance the following and equations and tell what type of reaction it is (synthesis, decomposition, single replacement, double replacement, or combustion)

a) 2 KNO_3 → 2 KNO_2 + ___ O_2 Type: decomp

b) 2 $AgNO_3$ + ___ K_2SO_4 → ___ Ag_2SO_4 + 2 KNO_3 Type: DR

c) 4 CH_3NH_2 + 9 O_2 → 4 CO_2 + 10 H_2O + 2 N_2 Type: combust

d) ___ N_2O_5 + ___ H_2O → 2 HNO_3 Type: synthesis

e) 2 Na + ___ $Zn(NO_3)_2$ → ___ Zn + 2 $NaNO_3$ Type: SR

7. What are diatomic molecules? List the 7.

Average Atomic Mass

8. Magnesium consists of 3 naturally occurring isotopes with the masses 23.98504, 24.98584, and 25.98259 amu. The relative abundances of these three isotopes are 78.70%, 10.13 %, and 11.17% respectively. Calculate the average atomic mass.

$$[(23.98504)(0.7870) + (24.98584)(0.1013) + (25.98259)(0.1117)]$$

$$= \boxed{24.30955 \text{ amu}}$$

Percent Composition

9. Calculate the percent composition of $C_{12}H_{22}O_{11}$ (sugar). (Give Percent of each element.) Show all work.

$$\%C = \frac{144.12 \text{ g C}}{342.34 \text{ g } C_{12}H_{22}O_{11}} \times 100 = \boxed{42.098 \% \text{ C}}$$

$$\%H = \frac{22.22 \text{ g H}}{342.34 \text{ g}} \times 100 = \boxed{6.491 \% \text{ H}}$$

$$\%O = \frac{176 \text{ g O}}{342.34 \text{ g}} \times 100 = \boxed{51.411 \% \text{ O}}$$

Moles

10. Calculate the number of moles of the following: (SHOW WORK)

a) 42.8 g of KNO_3

$$\frac{42.8 \text{ g } KNO_3 \mid 1 \text{ mol } KNO_3}{\mid 101.11 \text{ g } KNO_3} = \boxed{0.423 \text{ mol } KNO_3}$$

b) 155.7 L of CO_2 at STP

$$\frac{155.7 \text{ L } CO_2 \mid 1 \text{ mol } CO_2}{\mid 22.4 \text{ L } CO_2} = \boxed{6.951 \text{ mol } CO_2}$$

c) 9.25×10^{26} molecules of $CaCl_2$

$$\frac{9.25 \times 10^{26} \text{ molec } CaCl_2 \mid 1 \text{ mol } CaCl_2}{\mid 6.02 \times 10^{23} \text{ molec } CaCl_2} = \boxed{1.54 \times 10^{3} \text{ molec } CaCl_2}$$

Stoichiometry

11. Using the following equation:

$$2\ NaOH + H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$$

How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

$$\frac{200\text{ g NaOH}}{} \left| \frac{1\text{ mol NaOH}}{40\text{ g NaOH}} \right| \frac{1\text{ mol } Na_2SO_4}{2\text{ mol NaOH}} \left| \frac{142.04\text{ g } Na_2SO_4}{1\text{ mol } Na_2SO_4} \right. = 355.1$$

$= \boxed{400\text{ g } Na_2SO_4}$

12. Using the following equation:

$$Pb(SO_4)_2 + 4\ LiNO_3 \rightarrow Pb(NO_3)_4 + 2\ Li_2SO_4$$

How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

$$\frac{250\text{ g } Li_2SO_4}{} \left| \frac{1\text{ mol } Li_2SO_4}{109.94\text{ g } Li_2SO_4} \right| \frac{4\text{ mol } LiNO_3}{2\text{ mol } Li_2SO_4} \left| \frac{68.95\text{ g } LiNO_3}{1\text{ mol } LiNO_3} \right.$$

$= 313.58 = \boxed{310\text{ g } LiNO_3}$

13. Using the following equation: $Fe_2O_3 + 3\ H_2 \rightarrow 2\ Fe + 3\ H_2O$

- Calculate how many grams of iron can be made from 16.5 grams of Fe_2O_3.

$$\frac{16.5\text{ g } Fe_2O_3}{} \left| \frac{1\text{ mol } Fe_2O_3}{159.7\text{ g } Fe_2O_3} \right| \frac{2\text{ mol Fe}}{1\text{ mol } Fe_2O_3} \left| \frac{55.85\text{ g Fe}}{1\text{ mol Fe}} \right.$$

$= 11.5407 = \boxed{11.5\text{ g Fe}}$

Limiting Reactant & Percent Yield

1. Determine the grams of sodium chloride produced when 10.0 g of sodium react with 10.0 g of chlorine gas according to the equation: $2\ Na + Cl_2 \rightarrow 2\ NaCl$

$$\frac{10.0\text{ g Na}}{} \cdot \frac{1\text{ mol Na}}{22.99\text{ g Na}} \cdot \frac{2\text{ mol NaCl}}{2\text{ mol Na}} \cdot \frac{58.44\text{ g NaCl}}{1\text{ mol NaCl}} = 25.4\text{ g NaCl}$$

$$\frac{10.0\text{ g Cl}_2}{} \cdot \frac{1\text{ mol Cl}_2}{70.9\text{ g Cl}_2} \cdot \frac{2\text{ mol NaCl}}{1\text{ mol Cl}_2} \cdot \frac{58.44\text{ g NaCl}}{1\text{ mol NaCl}} = \boxed{8.24\text{ g NaCl}}$$

2. Determine the mass of lithium hydroxide produced when 50.0g of lithium are reacted with 45.0g of water according to the equation: $2\ Li + 2\ H_2O \rightarrow 2\ LiOH + H_2$

$$\frac{50.0\text{ g Li}}{} \cdot \frac{1\text{ mol Li}}{6.94\text{ g Li}} \cdot \frac{2\text{ mol LiOH}}{2\text{ mol Li}} \cdot \frac{23.95\text{ g LiOH}}{1\text{ mol LiOH}} = 173\text{ g LiOH}$$

$$\frac{45.0\text{ g H}_2\text{O}}{} \cdot \frac{1\text{ mol H}_2\text{O}}{18.02\text{ g H}_2\text{O}} \cdot \frac{2\text{ mol LiOH}}{2\text{ mol H}_2\text{O}} \cdot \frac{23.95\text{ g LiOH}}{1\text{ mol LiOH}} = \boxed{59.8\text{ g LiOH}}$$

3. Determine the percent yield of water produced when 68.3 g of hydrogen reacts with 85.4g of oxygen and 86.4g of water are collected. $2\ H_2 + O_2 \rightarrow 2\ H_2O$

$$\frac{68.3\text{ g H}_2}{} \cdot \frac{1\text{ mol H}_2}{2.02\text{ g H}_2} \cdot \frac{2\text{ mol H}_2\text{O}}{2\text{ mol H}_2} \cdot \frac{18.02\text{ g H}_2\text{O}}{1\text{ mol H}_2\text{O}} = 609\text{ g H}_2\text{O}$$

$$\frac{85.4\text{ g O}_2}{} \cdot \frac{1\text{ mol O}_2}{32\text{ g O}_2} \cdot \frac{2\text{ mol H}_2\text{O}}{1\text{ mol O}_2} \cdot \frac{18.02\text{ g H}_2\text{O}}{1\text{ mol H}_2\text{O}} = \underline{\underline{96.2\text{ g H}_2\text{O}}}$$

Theoretical yield

$$\%\text{ yield} = \frac{86.4\text{ g H}_2\text{O}}{96.2\text{ g H}_2\text{O}} \times 100 = \boxed{89.8\%\text{ yield}}$$

Worksheet #2: Practice Naming Compounds

1. Provide names for the following ionic compounds:
   a. AlF_3 Aluminum fluoride
   b. $Fe(OH)_2$ Iron(II) hydroxide
   c. $Cu(NO_3)_2$ Copper(II) nitrate
   d. $Ba(ClO_4)_2$ Barium perchlorate
   e. Li_3PO_4 Lithium phosphate
   f. Hg_2S Mercury(I) sulfide
   g. $Cr_2(CO_3)_3$ Chromium(III) carbonate
   h. $(NH_4)_2SO_4$ Ammonium sulfate
2. Write the chemical formulas for the following compounds:
   a. Copper(I) oxide Cu_2O
   b. Potassium peroxide K_2O_2
   c. Iron(III) carbonate $Fe_2(CO_3)_3$
   d. Zinc nitrate $Zn(NO_3)_2$
   e. Sodium hypobromite $NaBrO$
   f. Aluminum hydroxide $Al(OH)_3$
3. Give the name or chemical formula for each of the following molecular substances:
   a. SF_6 Sulfur hexafluoride
   b. XeO_3 Xenon trioxide
   c. Dinitrogen tetroxide N_2O_4
   d. Hydrogen cyanide HCN
   e. IF_5 Iodine pentafluoride
   f. Dihydrogen monoxide H_2O
   g. Tetraphosphorous hexasulfide P_4S_6
4. Give the name or chemical formula for the following compounds:
   a. Ammonium oxalate $(NH_4)_2C_2O_4$
   b. Manganese(III) dichromate $Mn_2(Cr_2O_7)_3$
   c. $Ti(OH)_4$ Titanium(IV) hydroxide
   d. $Ni(ClO_2)_3$ Nickel(III) chlorite
   e. Dinitrogen pentoxide N_2O_5
   f. Aluminum oxide Al_2O_3
   g. Fe_2S_3 Iron(III) sulfide

5. Name the following acids

a. $H_2C_2O_4$ Oxalic acid

b. $HBrO_3$ Bromic acid

c. HBr Hydrobromic acid

d. HNO_2 Nitrous acid

e. H_2SO_4 Sulfuric acid

f. HClO Hypochlorous acid

6. Write formulas for the following acids.

a. hydrochloric acid HCl

b. sulfuric acid H_2SO_4

c. nitric acid HNO_3

d. phosphoric acid H_3PO_4

e. carbonic acid H_2CO_3

f. acetic acid $HC_2H_3O_2$