Chemistry Module 6 Homework

Assignment #1 **SHOW ALL MATH CALCULATIONS** **Module 6**

OR NO CREDIT

Read pages 163 – 185.

1. Calculate the ratios of the chemicals using the following equation to fill in the table:

$$3Hg + 2P + 4O_2 \rightarrow Hg_3(PO_4)_2$$

Moles of Hg	Moles of P	Moles of O2	Moles of $Hg_3(PO_4)_2$
12 moles			
	10 moles		
		12 moles	
	7 moles		

2. Write Gay-Lussac's Law. What has to be true for you to use Gay-Lussac's Law in stoichiometry?

3. In welding, acetylene gas, C_2H_2, is burned with oxygen gas to produce a hot flame and melt the metal. The reaction is: (Math)

$$2\ C_2H_2\ (g) + 5\ O_2\ (g) \rightarrow 4\ CO_2\ (g) + 2\ H_2O\ (g)$$

   a. When 7.50 liters of C_2H_2 are burned with excess oxygen, how many liters of carbon dioxide will be formed?

   b. When 18.0 liters of oxygen are burned with excess C_2H_2, how many liters of water vapor (H_2O) are produced?

4. What is a limiting reactant? Why do you need to know which substance is the limiting reactant when you do stoichiometry?

5. For the following reaction, if a chemist adds 3.0 moles of Zn to 4.0 moles of HNO_3, what is the limiting reactant? (Math)

$$4\ Zn\ (s) + 10\ HNO_3\ (aq) \rightarrow 4\ Zn(NO_3)_2\ (aq) + NH_4NO_3\ (aq) + 3\ H_2O\ (l)$$

6. When iron sulfide is mixed with oxygen, the following reaction occurs:

$$4\ FeS\ (aq) + 7\ O_2\ (g) \rightarrow 2\ Fe_2O_3\ (s) + 4\ SO_2\ (aq)$$

   If 15.0 moles of iron sulfide are reacted with 25.0 moles of oxygen, what is the limiting reactant? (Math)

7. For the reaction: $2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (g)$ How many liters of water vapor can be produced by reacting 6.3 liters of H_2 with 4.7 liters of O_2?

   a. Find the limiting reactant first. Which reactant runs out first?

   b. Use the limiting reactant to determine the amount of water produced.

Stoichiometry Steps

Set-Up:	Determine which two chemicals are used in the problem.
	Calculate the molar mass of each chemical. (Look up the weight on the chart.)
Calculate:	A. Change grams to moles.
	B. Trade moles
	C. Change moles to grams

8. Use this reaction to answer the questions: $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + 2\ H_2O$ A chemist reacts 50.0 grams of sulfuric acid (H_2SO_4) with excess NaOH. How many grams of water will be produced?
    a. What are the two chemicals you are going to use?
    b. What is the molar mass of each chemical?
    c. Convert grams of sulfuric acid to moles. (Grams to moles, divide.)
    d. Trade moles of sulfuric acid for moles of water. (Use the numbers in the equation.)
    e. Convert moles of water to grams. (Moles to grams, multiply.)

9. A phosphorous fertilizer, $CaH_2P_2O_8$, can be made using this reaction:

$$Ca_3P_2O_8 + 2H_2SO_4 + 4\ H_2O \rightarrow CaH_2P_2O_8 + 2\ CaH_4SO_6$$

    If 150.0 grams of H_2SO_4 are reacted with excess $Ca_3P_2O_8$ and water, how many moles of $CaH_2P_2O_8$ (fertilizer) are produced?
    a. What are the two chemicals you are using?
    b. What is the molar mass of each chemical?
    c. Change grams of H_2SO_4 to moles.
    d. Trade moles of H_2SO_4 for moles of fertilizer ($CaH_2P_2O_8$). How many moles of fertilizer are produced?
    e. Convert moles of fertilizer to grams.

10. Methanol, CH_3OH, is made by reacting carbon monoxide with hydrogen gas at high temperature and pressure. (Math)
    a. Write the balanced equation for the reaction.
    b. How many grams of carbon monoxide are needed to make 600.0 g of CH_3OH? (Do all the steps.)

Assignment #2 **Show Your Work** **Module 6**

Read pages 185 – 190.

11. Gas welding is done with acetylene gas, C_2H_2. The formula for the combustion of acetylene is shown below:

$$2\ C_2H_2 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$$

If you burn 250.0 grams of acetylene in the presence of excess oxygen, how many grams of carbon dioxide will be produced?

a. Calculate moles of acetylene.
b. Trade moles of acetylene for moles of carbon dioxide.
c. Calculate grams of carbon dioxide.

12. When you heat nickel carbonate, $NiCO_3$, it decomposes. The reaction for the decomposition is:

$$2\ NiCO_3 \rightarrow 2\ Ni + 3\ O_2 + 2\ C$$

If you start with 500.0 grams of nickel carbonate, how many grams of oxygen will be produced?

a. Calculate moles of nickel carbonate.
b. Trade moles of nickel carbonate for moles of oxygen.
c. Calculate grams of oxygen.

13. When sodium hydroxide (NaOH) is poured in a solution of aluminum oxide (Al_2O_3), it makes aluminum hydroxide ($Al(OH)_3$)and sodium oxide (Na_2O).

$$Al_2O_3\ (aq) + 6NaOH\ (aq) \rightarrow 2Al(OH)_3\ (s) + 3Na_2O\ (aq)$$

If you pour 180.0 grams of sodium hydroxide in an excess amount of aluminum oxide, how many grams of sodium oxide will be produced?

a. Calculate moles of sodium hydroxide.
b. Trade moles of sodium hydroxide for moles of sodium oxide.
c. Calculate grams of sodium oxide.

14. Calcium can be reacted with nitric acid (HNO_3) to produce calcium nitrate ($Ca(NO_3)_2$) and hydrogen gas. Calcium nitrate is used in cold packs and in some types of concrete mixes. The balanced chemical equation for this reaction is: $Ca + 2\ HNO3 \rightarrow Ca(NO_3)_2 + H_2$

a. If a chemist reacts 80.0 grams of calcium with 50.0 grams of nitric acid, which is the limiting reactant?
b. Use the limiting reactant to determine the number of grams of calcium nitrate produced.

15. Copper reacts with sulfur to form copper (II) sulfide. $2\ Cu\ (s) + S\ (s) \rightarrow Cu_2S\ (s)$ (Math)

    a. How many grams of Cu_2S will be produced when 100.0 g of Cu are reacted with excess S?

    b. What is the maximum number of grams of Cu_2S that can be formed when 80.0 g of Cu reacts with 25.0 g of S? (Find the limiting reactant.)

16. Honors – Explain the difference between theoretical yield and actual yield?

17. Honors - When 84.8 g of iron (III) oxide reacts with an excess of carbon monoxide, then 57.8 g of iron is produced. What is the percent yield for this reaction?

    $Fe_2O_3\ (s) + 3CO\ (g) \rightarrow 2\ Fe\ (s) + 3\ CO_2\ (g)$

18. Honors – A student reacts benzene, C_6H_6, with bromine, Br_2, to prepare bromobenzene, C_6H_5Br.

    $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

    a. What is the theoretical yield of bromobenzene in this reaction when 30.0 g of benzene reacts with 65.0 g of bromine?

    b. If the actual yield of bromobenzene was 56.7 g, what was the percentage yield?