Chemistry 11 Stoichiometry Review Assignment

Name: ________________________________ Date: ___________ Block: ____

Answer the following practice questions on a separate page

Define the following terms:
1. Stoichiometry
2. Stoichiometric ratio
3. Limiting reactant
4. Excess reactant
5. Percent yield

(Mole-Mole Conversions)
6. The combustion of the organic fuel, decane, is outlined in the chemical equation below. You must balance the equation in order to answer the subsequent questions a-c.

\[ \text{C}_{10}\text{H}_{22} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \]

a. How many moles of CO$_2$ are produced if 5.0 moles of C$_{10}$H$_{22}$ react with an excess of O$_2$?
b. How many moles of O$_2$ react with 0.75 moles of C$_{10}$H$_{22}$?
c. How many moles of O$_2$ would be required to produce 4.0 moles of H$_2$O?

7. Use the following equation to solve the problems below:

\[ 3\text{SiO}_2 + 4\text{Al} \rightarrow 3\text{Si} + 2\text{Al}_2\text{O}_3 \]

a. If 6.0 moles of SiO$_2$ react, how many moles of:
   i. Al react?
   ii. Si are produced?
   iii. Al$_2$O$_3$ are produced?

b. If 2.5 moles of Al$_2$O$_3$ are produced, how many moles of:
   i. Al react?
   ii. SiO$_2$ react?
b) If $4.0 \times 10^{-3}$ moles of oxygen reacted, how many grams of $N_2$ were needed?

9. $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$ How many moles of $Cu$ are needed to react with 3.50g of AgNO$_3$?

10. Mercury (II) oxide decomposes into mercury and oxygen gas.

   a) Write and balance the equation.
   
   b) How many moles of mercury (II) oxide are needed to produce 125g of oxygen?
   
   c) How many grams of mercury are produced if 24.5 moles of mercury (II) oxide decomposes?

11. $Li_3N(s) + 3H_2O(l) \rightarrow NH_3(g) + 3LiOH(aq)$

   a. What mass of lithium hydroxide are produced when 0.38g of lithium nitride react?
   
   b. How many grams of lithium nitride would react with 4.05g of $H_2O$?

12. In the combustion of 54.50g of butane ($C_4H_6$), how many grams of $CO_2$ are produced? Write and balance the equation before solving.

13. In the following unbalanced equation,

   $$\underline{\_\_\_}FeS_2 + \_\_\_O_2 \rightarrow \_\_\_Fe_2O_3 + \_\_\_SO_2$$

   a. How many grams of iron (IV) sulphide are used when 9.0g of $O_2$ react?
   
   b. What is the mass of iron (III) oxide produced when 25.0g of iron (IV) sulphide are used?

14. $Cu + 2AgNO_3 \rightarrow 2Ag + Cu(NO_3)_2$

   How many grams of silver are produced when 36.92g of copper react?

15. $\underline{\_\_\_}Al_2(SO_4)_3 + \underline{\_\_\_}Ca(OH)_2 \rightarrow \underline{\_\_\_}Al(OH)_3 + \underline{\_\_\_}CaSO_4$

   Balance and answer the following questions.

   a. What mass of aluminum (III) hydroxide are produced if 165.7g of aluminum (III) sulfate react?
   
   b. How many grams of calcium hydroxide are needed to form 6.35g of calcium sulphate?
16. Given the following equation:

\[ 3 \text{ NO}_2 (g) + \text{ H}_2\text{O}(l) \rightarrow 2 \text{ HNO}_3 (aq) + \text{ NO}_2 (g) \] Assume STP

a. What mass of water is required to react with 15.5 L of Nitrogen dioxide?
b. What volume of Nitrogen monoxide would be produced from 100.0 g of water?
c. If 42.0 L of \( \text{NO}_2 \) is produced, what volume of \( \text{NO}_2 \) reacted?

17. When Magnesium reacts with Nitric Acid, Hydrogen gas and aqueous Magnesium nitrate are formed. What volume of Hydrogen gas will be produced if 40.0 g of Magnesium is reacted with an excess of Nitric Acid?

18. The corrosion (rusting) of iron is represented as follows: (at STP)

\[ 3 \text{ O}_2 (g) + 4 \text{ Fe(s)} \rightarrow 2 \text{ Fe}_2\text{O}_3 (s) \]

a. What volume of Oxygen gas would be required to produce 16.0 g of \( \text{Fe}_2\text{O}_3 \)?
b. What mass of Iron would be required to react with 10.0 L of \( \text{O}_2 \) gas?

19. Mercury (II) oxide decomposes when heated to produce liquid Mercury and Oxygen gas. What mass of Mercury (II) oxide would be required to produce 30.5 L of Oxygen gas? (Assume STP)

20. How many mL of 2.00M HNO3 is needed to consume 5.4g of aluminum?

\[ 2\text{Al} + 6\text{HNO}_3 \rightarrow 2\text{Al(NO}_3)_3 + 3\text{H}_2 \]

21. 20mL of HCl is needed to consume 2.8g Fe. What is the concentration of HCl?

\[ \_\text{Fe} + \_\text{HCl} \rightarrow \_\text{FeCl}_3 + \_\text{H}_2 \]

22. What mass of copper will react with 10.0mL of 12.0M nitric acid?

\[ \text{Cu} + \_\text{HNO}_3 \rightarrow \_\text{Cu(NO}_3)_2 + \_\text{NO}_2 + \_\text{H}_2\text{O} \]
REVIEW: Limiting Reagents and Percent Yield

Answer all questions on separate paper and report all answers to the correct number of significant figures.

1. Identify the limiting reactant when 1.22g of O$_2$ reacts with 1.05g of H$_2$ to produce water.

2. Identify the limiting reactant when 5.87g of Mg(OH)$_2$ reacts with 12.84g of HCl to form MgCl$_2$ and water.

3. Identify the limiting reactant when 6.33g of sulphuric acid reacts with 5.92g of sodium hydroxide to produce sodium sulphate and water.

4. Identify the reactant in excess if 6.25g of silver nitrate reacts with 4.12g of sodium chloride to form sodium nitrate and silver chloride.

5. If 4.1g of Cr is heated with 9.3g of Cl$_2$ what mass of CrCl$_3$ will be produced?

6. What mass of sulphur trioxide is produced when 12.4g of sulphur dioxide is reacted with 3.45g of oxygen gas?

7. If 21.4g of aluminum is reacted with 91.3g of iron (III) oxide, the products will be aluminum oxide and iron. What mass of iron will be produced?

8. If 41.6g of N$_2$O$_4$ reacts with 20.8g of N$_2$H$_4$, the products will be nitrogen gas and water. What mass of nitrogen will be produced?

9. What mass of NaCl will be produced by the reaction of 58.7g of NaI with 29.4g of Cl$_2$?

10. a. Write the balanced equation for the reaction of lead (II) nitrate with sodium iodide to form sodium nitrate and lead (II) iodide:

b. If I start with 25.0 grams of lead (II) nitrate and 15.0 grams of sodium iodide, how many grams of sodium nitrate can be formed?

c. What is the limiting reagent in the reaction?

d. How much of the excess reagent will be left over from the reaction?

11. You calculate that using a certain amount of beryllium and hydrochloric acid you can produce 10.7g of beryllium chloride. You perform the experiment and only collect 4.5g. What was the percent yield for the reaction?
12. Determine the percent yield for the reaction between 45.9 g of NaBr and excess chlorine gas to produce 12.8 g of NaCl and an unknown quantity of bromine gas.

13. Determine the percent yield for the reaction between 44.5 g of zinc sulphide and 13.3 g of oxygen, if 18.4 g of zinc oxide is recovered with an unknown amount of sulphur dioxide.

14. A reaction was carried out according to the following equation:
   \[ \text{FeBr}_2 + 2 \text{KCl} \rightarrow \text{FeCl}_2 + 2 \text{KBr} \]
   a. What is the theoretical yield of iron (II) chloride if 34.00 grams of iron (II) bromide was used in the reaction with excess potassium chloride?
   
   b. What is the percent yield of iron (II) chloride if the actual yield is 4.00 grams?

15. a. What mass of \( \text{CS}_2(s) \) is produced when 17.5 g of \( \text{C(s)} \) are reacted with 39.5 g of \( \text{SO}_2(g) \) according to the equation: \( 5 \text{C(s)} + 2 \text{SO}_2(g) \rightarrow \text{CS}_2(s) + 4 \text{CO}(g) \)?
   
   b. What mass of the excess reactant will be left over?

16. If 0.250 g of \( \text{Ba(OH)}_2(aq) \) is mixed with 15.0 mL of 0.125 M \( \text{HBr}(aq) \), what mass of \( \text{BaBr}_2(aq) \) can be formed?
   
   \[ \text{Ba(OH)}_2(aq) + 2 \text{HBr}(aq) \rightarrow \text{BaBr}_2(aq) + 2 \text{H}_2\text{O}(l) \]

17. The reaction \( \text{SiO}_2(s) + 4 \text{HF}(g) \rightarrow \text{SiF}_4(g) + 2 \text{H}_2\text{O}(g) \) produces 2.50 g of \( \text{H}_2\text{O}(g) \) when 12.20 g of \( \text{SiO}_2(s) \) is treated with a small excess of \( \text{HF}(g) \).
   a. What mass of \( \text{SiF}_4(g) \) is formed?
   
   b. What mass of \( \text{SiO}_2(s) \) is left unreacted if only 2.50 g of \( \text{H}_2\text{O}(g) \) is formed?
   
   c. What is the percent yield of the \( \text{H}_2\text{O}(g) \)?