Unit 6 Study Guide

Name KEY

1. List 5 observations that indicate a chemical reaction has taken place.

permanent color change, gas/bubbles form, precipitate forms, heat/light produced, odor produced

2. Decide if each is a physical or chemical change:
   a. a state change (melting, freezing, boiling) P
   b. tearing something in half P
   c. breaking something into smaller pieces P
   d. a piece of fruit rotting in the sun C – odor, color change

3. Classify the REACTION TYPE, then BALANCE each of the following equations.

a. $1\ CH_4 + 2\ O_2 \rightarrow 2\ H_2O + 1\ CO_2$ — combustion

b. $2\ AgNO_3 + 1\ Na_2SO_4 \rightarrow 2\ NaNO_3 + 1\ Ag_2SO_4$ — double dis.

c. $2\ CaO + 2\ H_2O \rightarrow 2\ Ca(OH)_2$ — synthesis

d. $2\ Na + 2\ HOH \rightarrow 2\ NaOH + 1\ H_2$ ← diatomic! — single dis.

4. Write a balanced chemical equation for: potassium hydroxide reacts with hydrogen sulfate to create potassium sulfate and water.

$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$

5. Translate this reaction into a sentence: $2AgNO_3 + Na_2S \rightarrow Ag_2S + NaNO_3$

Silver nitrate reacts with sodium sulfide to create silver sulfide and sodium nitrate

6. 1) Name the reaction type, 2) Predict the products [use subscripts!], 3) then balance the reaction [use coefficients!]

a. $2\overset{+2\ -2}{MgO} \rightarrow 2Mg + O_2$ ← diatomic! — decomp.

b. $2Li(s) + Cl_2(g) \rightarrow 2\overset{+1\ -1}{LiCl}$ — synthesis

c. $3\overset{+2\ -1}{MgBr_2} + \overset{-3}{N_2} \rightarrow \overset{+2\ -3}{Mg_3N_2} + 3Br_2$ ← diatomic! — single dis.

d. $\overset{+2\ -2}{FeS} + 2HCl \rightarrow \overset{+2\ -1}{FeCl_2} + \overset{+1\ -2}{H_2S}$ — double dis.

7. Write out all of the possible mole ratios for: $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$

$\frac{2\ mol\ C_4H_{10}}{13\ mol\ O_2}$ $\frac{2\ mol\ C_4H_{10}}{8\ mol\ CO_2}$ $\frac{2\ mol\ C_4H_{10}}{10\ mol\ H_2O}$ $\frac{13\ mol\ O_2}{8\ mol\ CO_2}$ $\frac{13\ mol\ O_2}{10\ mol\ H_2O}$ $\frac{8\ mol\ CO_2}{10\ mol\ H_2O}$ [and flip all]

8. How many moles of O_2 can be produced by letting 20.0 moles of $KClO_3$ react? $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

$20.0\ mol\ KClO_3 \times \frac{3\ mol\ O_2}{2\ mol\ KClO_3} = 30\ mol\ O_2$

30 mol O_2

9. How many grams of NaOH are produced from 120 g of Na_2O? $Na_2O + H_2O \rightarrow 2\ NaOH$

$120\ g\ Na_2O \times \frac{1\ mol\ Na_2O}{62\ g\ Na_2O} \times \frac{2\ mol\ NaOH}{1\ mol\ Na_2O} \times \frac{40\ g\ NaOH}{1\ mol\ NaOH} =$

154.8 g NaOH

10. Sulfur dioxide (SO_2) reacts with marble ($CaCO_3$) to produce $CaSO_4$ and CO2 according to the following equation:

$2\,CaCO_3\,(s) + 2\,SO_2\,(g) + O_2\,(g) \rightarrow 2\,CaSO_4\,(s) + 2\,CO_2\,(g)$

a) How many moles of CO_2 can be produced when 4 moles of SO_2 react?

4 mol CO_2

$$4\text{ mol } SO_2 \times \frac{2\text{ mol } CO_2}{2\text{ mol } SO_2} = 4\text{ mol } CO_2$$

b) How many moles of O_2 can are needed to react to produce 5.8 grams of CO_2?

0.065 mol O_2

$$5.8\text{ g } CO_2 \times \frac{1\text{ mol } CO_2}{44\text{ g } CO_2} \times \frac{1\text{ mol } O_2}{2\text{ mol } CO_2} = 0.065\text{ mol } O_2$$

c) How many grams of $CaSO_4$ can be produced when 6.5 moles of SO_2 react?

884 g $CaSO_4$

$$6.5\text{ mol } SO_2 \times \frac{2\text{ mol } CaSO_4}{2\text{ mol } SO_2} \times \frac{136\text{g } CaSO_4}{1\text{ mol } CaSO_4} = 884\text{g } CaSO_4$$

d) How many grams of calcium carbonate are used per 25.0 g of O_2?

156.25 g $CaCO_3$

$$25.0\text{g } O_2 \times \frac{1\text{mol } O_2}{32\text{g } O_2} \times \frac{2\text{ mol } CaCO_3}{1\text{mol } O_2} \times \frac{100\text{g } CaCO_3}{1\text{mol } CaCO_3} = 156.25\text{g } CaCO_3$$

11. Nickel reacts with Carbon Monoxide to produce **$Ni(CO)_4$** (a poisonous compound).

a) Translate this into a **balanced** chemical equation:

$$Ni + 4CO \rightarrow Ni(CO)_4$$

b) How many moles of CO would react with 109.4 g of Ni ?

$$109.4\text{g } Ni \times \frac{1\text{mol } Ni}{59\text{g } Ni} \times \frac{4\text{mol } CO}{1\text{mol } Ni} = 7.42\text{ mol } CO$$

7.42 moles CO

12. **$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$**

a. What is your **theoretical yield** (in grams NO) if you start with 75.8 g NH_3?

b. If your **actual yield** is 125.3 g NO, what is your **percent yield**?

$$75.8\text{g } NH_3 \times \frac{1\text{ mol } NH_3}{17\text{g } NH_3} \times \frac{4\text{ mol } NO}{4\text{ mol } NH_3} \times \frac{30\text{g } NO}{1\text{mol } NO} = 133.76\text{g } NO$$

$$\frac{125.3\text{g}}{133.76\text{g}} \times 100 = 93.6\%\text{ yield}$$

133.76 g NO
93.6%

13. **$2NaI + Cl_2 \rightarrow 2NaCl + I_2$**

a. What is your **theoretical yield** (in grams NaCl) if you start with 106.8 g Cl_2?

b. If your **actual yield** is 80.6 g NaCl, what is your **percent yield**?

$$106.8\text{g } Cl_2 \times \frac{1\text{mol } Cl_2}{70\text{g } Cl_2} \times \frac{2\text{ mol } NaCl}{1\text{mol } Cl_2} \times \frac{58\text{g } NaCl}{1\text{mol } NaCl} = 176.98\text{g } NaCl$$

176.98 g NaCl
45.5%

$$\frac{80.6\text{g}}{176.98\text{g}} \times 100 = 45.5\%\text{ yield}$$