

Name: Key
Blk: _____ Date: _____

**Chemistry 11
Stoichiometry Unit Review**

Your Unit Test is scheduled for _____

The format:

30 Multiple Choice Questions (with flashbacks)

20 Short Answer

50 Marks TOTAL

MOLE to MOLE:

1. Water decomposes into its two elements: H_2 (g) and O_2 (g)

a. Write the balanced equation:



b. How many moles of hydrogen gas are produced if 0.500 mol of water are decomposed?

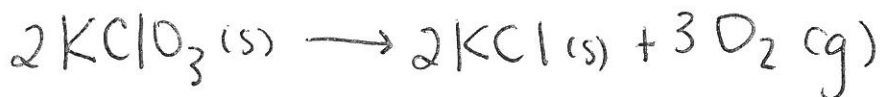
$$0.500 \text{ mol } H_2O \times \frac{2 \text{ mol } H_2}{2 \text{ mol } H_2O} = \boxed{0.500 \text{ mol } H_2}$$

c. How many moles of oxygen gas are produced if 0.250 mol of water decompose?

$$0.250 \text{ mol } H_2O \times \frac{1 \text{ mol } O_2}{2 \text{ mol } H_2O} = \boxed{0.125 \text{ mol } O_2}$$

MOLE to QUANTITY:

2. When 6.5 mol of potassium chlorate solid breaks down to the simpler compound of potassium chloride and oxygen gas, what mass of KCl (s) would be formed?



$$6.5 \text{ mol } KClO_3 \times \frac{2 \text{ mol } KCl}{2 \text{ mol } KClO_3} \times \frac{74.6 \text{ g}}{1 \text{ mol } KCl}$$

$$= \boxed{4.8 \times 10^2 \text{ g } KCl}$$

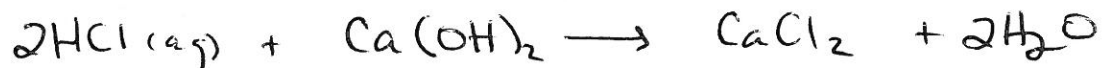
$$\begin{array}{r} 1 K = 39.1 \\ 1 Cl = 35.5 \\ \hline 74.6 \\ 3 O = 48.0 \\ \hline 122.6 \end{array}$$

3. When 5.00 mol of methane gas (CH₄) burns in the presence of excess oxygen gas, what volume of carbon dioxide gas (at STP) will be produced?



$$5.00 \text{ mol CH}_4 \times \frac{1 \text{ mol CO}_2}{1 \text{ mol CH}_4} \times \frac{22.4 \text{ L}}{1 \text{ mol CO}_2} = \boxed{112 \text{ L CO}_2}$$

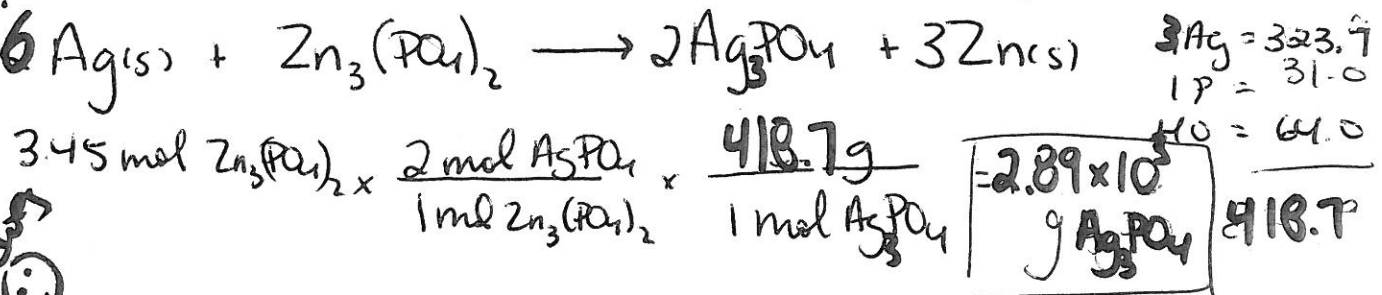
4. What volume of 1.00M HCl (aq) is needed to **neutralize** 2.50 mol of calcium hydroxide? The reaction produces calcium chloride and water.



$$2.50 \text{ mol Ca}(\text{OH})_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ca}(\text{OH})_2} \times \frac{5.00 \text{ mol HCl}}{1.00 \text{ M}} = \boxed{5.00 \text{ L HCl}}$$

$$L = \frac{\text{mol}}{M}$$

5. When an excess of silver reacts with 3.45 moles of zinc phosphate, what mass of silver phosphate would be produced? Note: Zinc metal will also be produced.



Just Miss rxn
 Clogs not occur!
 That's preferred
 that it does 😊

QUANTITY to QUANTITY:

6. Zinc metal reacts with HCl to produce zinc chloride and hydrogen gas. What mass of zinc chloride can be produced by reacting 50.0 mL of 2.00 M HCl with sufficient Zn?



$$1\text{Zn} = 65.4$$

$$2\text{Cl} = 71.0$$

$$\hline 136.4$$

$$0.0500 \text{ L} \times \frac{2.00 \text{ mol HCl}}{1 \text{ L}} \times \frac{1 \text{ mol ZnCl}_2}{2 \text{ mol HCl}} \times \frac{136.4 \text{ g ZnCl}_2}{1 \text{ mol ZnCl}_2} =$$

$$\boxed{6.82 \text{ g ZnCl}_2}$$



7. What volume of methane gas (CH₄) must be burned to produce 56.0 L of CO₂ at STP?

$$56.0 \text{ L CO}_2 \times \frac{1 \text{ mol CO}_2}{22.4 \text{ L}} \times \frac{1 \text{ mol CH}_4}{1 \text{ mol CO}_2} \times \frac{22.4 \text{ L}}{1 \text{ mol CH}_4} = \boxed{56.0 \text{ L CH}_4}$$

8. Nitric acid reacts with Sodium hydroxide to produce sodium nitrate and water. If 25.0 mL of the Nitric acid reacts with 0.750 g of solid NaOH, what is the concentration of the nitric acid?



$$0.750 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.0 \text{ g NaOH}} \times \frac{1 \text{ mol HNO}_3}{1 \text{ mol NaOH}} = \frac{1.88 \times 10^{-2} \text{ mol HNO}_3}{0.0250 \text{ L}} = \boxed{0.750 \text{ M HNO}_3}$$

Limiting Reactants:

For each of the following questions identify:

a. the amount of product(s) that will form

b. the Limiting Reactant

c. the Excess reactant(s) and how much is (are) left over

$$1 \text{ K} = 39.1$$

$$1 \text{ Cl} = \frac{35.5}{74.6}$$

$$74.6$$

9. For the reaction: $\text{HCl}(aq) + \text{KOH}(aq) \rightarrow \text{KCl}(aq) + \text{H}_2\text{O}(l)$

If 50.0 mL of 1.25 M HCl reacts with 75.0 mL of 1.00 M KOH

$$\text{a. } 0.0500 \text{ L} \times \frac{1.25 \text{ mol HCl}}{1 \text{ L}} \times \frac{1 \text{ mol KCl}}{1 \text{ mol HCl}} \times \frac{74.6 \text{ g}}{1 \text{ mol KCl}} = \boxed{4.66 \text{ g KCl}}$$

$$0.0750 \text{ L} \times \frac{1.00 \text{ mol KOH}}{1 \text{ L}} \times \frac{1 \text{ mol KCl}}{1 \text{ mol KOH}} \times \frac{74.6 \text{ g}}{1 \text{ mol KCl}} = 5.60 \text{ g KCl}$$

10. For the reaction: $6 \text{ClO}_2(g) + 3 \text{H}_2\text{O}(l) \rightarrow 5 \text{HClO}_3(aq) + \text{HCl}(aq)$

If 71.0 g of ClO₂ is mixed with 19.0 g of water.

$$1 \text{ Cl} = 35.5$$

$$2 \text{ O} = \frac{32.0}{67.5}$$

$$71.0 \text{ g ClO}_2 \times \frac{1 \text{ mol ClO}_2}{67.5 \text{ g}} \times \frac{5 \text{ mol HClO}_3}{6 \text{ mol ClO}_2} \times \frac{84.5 \text{ g}}{1 \text{ mol HClO}_3} = \boxed{74.1 \text{ g HClO}_3}$$

$$19.0 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.0 \text{ g H}_2\text{O}} \times \frac{5 \text{ mol HClO}_3}{3 \text{ mol H}_2\text{O}} \times \frac{84.5 \text{ g}}{1 \text{ mol HClO}_3} = 148.7 \text{ g HClO}_3$$

$$1 \text{ H} = 1.0$$

$$1 \text{ Cl} = 35.5$$

$$3 \text{ O} = \frac{48.0}{84.5}$$

11. For the reaction: $2 \text{MnI}_2(s) + 13 \text{F}_2(g) \rightarrow 2 \text{MnF}_3(s) + 4 \text{IF}_5(l)$

If 1.23 g of MnI₂ reacts with 25.0 g of F₂.

$$1.23 \text{ g} \times \frac{1 \text{ mol MnI}_2}{308.7 \text{ g}} \times \frac{2 \text{ mol MnF}_3}{2 \text{ mol MnI}_2} \times \frac{111.9 \text{ g}}{1 \text{ mol MnF}_3} = \boxed{0.446 \text{ g MnF}_3}$$

$$1 \text{ Mn} = 54.9$$

$$3 \text{ F} = \frac{57.0}{111.9}$$

$$25.0 \text{ g F}_2 \times \frac{1 \text{ mol F}_2}{38.0 \text{ g F}_2} \times \frac{2 \text{ mol MnF}_3}{13 \text{ mol F}_2} \times \frac{111.9 \text{ g}}{1 \text{ mol MnF}_3} = 1.05 \text{ g MnF}_3$$

9. a.

$$0.0500 \text{ L} \times \frac{1.25 \text{ mol HCl}}{1 \text{ L}} \times \frac{1 \text{ mol H}_2\text{O}}{1 \text{ mol HCl}} \times \frac{18.0 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{1.13 \text{ g H}_2\text{O}}$$

b. HCl is the limiting Reactant.

c.

used

Omit!

10. a.

$$71.0 \text{ g ClO}_2 \times \frac{1 \text{ mol ClO}_2}{67.5 \text{ g}} \times \frac{1 \text{ mol HCl}}{6 \text{ mol ClO}_2} \times \frac{36.5 \text{ g}}{1 \text{ mol HCl}} = \boxed{6.40 \text{ g HCl}}$$

b.

The limiting Reactant is ClO_2 .

c.

$$71.0 \text{ g ClO}_2 \times \frac{1 \text{ mol ClO}_2}{67.5 \text{ g}} \times \frac{3 \text{ mol H}_2\text{O}}{6 \text{ mol ClO}_2} \times \frac{18.0 \text{ g}}{1 \text{ mol H}_2\text{O}} = 9.47 \text{ g H}_2\text{O}$$

$1 \text{ I} = 126.9$
 $5 \text{ F} = 95.0$

$$19.0 \text{ g} - 9.47 \Rightarrow \boxed{9.5 \text{ g H}_2\text{O left}}$$

11. (a) $1.23 \text{ g MnI}_2 \times \frac{1 \text{ mol MnI}_2}{308.7 \text{ g}} \times \frac{4 \text{ mol IF}_5}{2 \text{ mol MnI}_2} \times \frac{221.9 \text{ g}}{1 \text{ mol IF}_5} = \boxed{1.77 \text{ g IF}_5}$

(b) The limiting reactant is MnI_2 .

(c)

$$1.23 \text{ g MnI}_2 \times \frac{1 \text{ mol MnI}_2}{308.7 \text{ g}} \times \frac{13 \text{ mol F}_2}{2 \text{ mol MnI}_2} \times \frac{38.0 \text{ g}}{1 \text{ mol F}_2} = 0.984 \text{ g F}_2$$

$$\therefore 25.0 \text{ g} - 0.984 \text{ g} = \boxed{24.0 \text{ g F}_2 \text{ remains}}$$

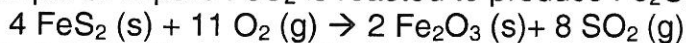
$$1 \text{ Fe} = 55.8$$

$$2 \text{ S} = \underline{64.2}$$

$$120.$$

Percent Yield:

12. A 100.0 g sample of impure FeS_2 is roasted to produce Fe_2O_3 and SO_2 :



and 4.50 L of SO_2 (g) is collected at STP:

a. What is the THEORETICAL YIELD of SO_2 ?

$$100.0 \text{ g} \times \frac{1 \text{ mol FeS}_2}{120.0 \text{ g}} \times \frac{8 \text{ mol SO}_2}{4 \text{ mol FeS}_2} \times \frac{22.4 \text{ L}}{1 \text{ mol SO}_2} = \boxed{37.3 \text{ L SO}_2}$$

b. What is the PERCENT YIELD?

$$\text{P.Y} = \frac{\text{actual}}{\text{expected}} \times 100 \rightarrow \frac{4.50 \text{ L}}{37.3 \text{ L}} \times 100 = \boxed{12.1\%}$$

13. The reaction $\text{SiO}_2 (\text{s}) + 4 \text{ HF} (\text{g}) \rightarrow \text{SiF}_4 (\text{g}) + 2 \text{ H}_2\text{O} (\text{g})$ produces 2.50 g of H_2O when 12.2 g of SiO_2 is treated with an excess of HF.

a. What is the Theoretical Yield of H_2O ?

$$12.2 \text{ g SiO}_2 \times \frac{1 \text{ mol SiO}_2}{60.1 \text{ g SiO}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol SiO}_2} \times \frac{18.0 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{7.31 \text{ g H}_2\text{O}}$$

b. What is the Percent Yield?

$$\text{P.Y} = \frac{\text{actual}}{\text{expected}} \times 100 \Rightarrow \frac{2.50 \text{ g H}_2\text{O}}{7.31} \times 100 = \boxed{34.2\%}$$

c. How much SiF_4 would form?

$$12.2 \text{ g SiO}_2 \times \frac{1 \text{ mol SiO}_2}{60.1 \text{ g}} \times \frac{1 \text{ mol SiF}_4}{1 \text{ mol SiO}_2} \times \frac{104.1 \text{ g SiF}_4}{1 \text{ mol SiF}_4} = \boxed{21.2 \text{ g SiF}_4}$$

$$\text{P.Y} = \frac{x}{21.2 \text{ g}} \times 100 = 34.2 \div 100$$

$$21.2 \left(\frac{x}{21.2} \right) = (0.342) 21.2 \rightarrow x = \boxed{7.25 \text{ g SiF}_4}$$