Name: Key
Blk:____Date:____________

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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:

$2H_2O \rightarrow 2H_2 + O_2$.

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

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

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

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

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?

1 K = 39.1
1 Cl = 35.5
74.6
3 O = 48.0
122.6

$2KClO_3 (s) \rightarrow 2KCl (s) + 3O_2 (g)$

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

$= 4.8 \times 10^4 \text{ g } KCl$

3.When 5.00 mol of methane gas (CH_4)burns in the presence of excess oxygen gas, what volume of carbon dioxide gas (at STP) will be produced?

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

$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} = $ **112 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.

$2HCl(aq) + Ca(OH)_2 \longrightarrow CaCl_2 + 2H_2O$

mol / M | L

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

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

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.

This rxn does not occur... Just pretend that it does :)

$6Ag(s) + Zn_3(PO_4)_2 \longrightarrow 2Ag_3PO_4 + 3Zn(s)$

3Ag = 323.7
1P = 31.0
4O = 64.0
418.7

$3.45 \text{ mol } Zn_3(PO_4)_2 \times \frac{2 \text{ mol } Ag_3PO_4}{1 \text{ mol } Zn_3(PO_4)_2} \times \frac{418.7 \text{ g}}{1 \text{ mol } Ag_3PO_4} = $ **2.89×10^3 g Ag_3PO_4**

QUANITITY to QUANTITY:

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

1Zn = 65.4
2Cl = 71.0
136.4

$Zn(s) + 2HCl \longrightarrow ZnCl_2 + H_2$

$0.0500 \text{ L} \times \frac{2.00 \text{ mol HCl}}{1 \text{ L}} \times \frac{1 \text{ mol } ZnCl_2}{2 \text{ mol HCl}} \times \frac{136.4 \text{ g } ZnCl_2}{1 \text{ mol } ZnCl_2} =$

6.82 g $ZnCl_2$

$CH_4(g) + 2O_2(g) \rightarrow CO_2 + 2H_2O$

7.What volume of methane gas (CH_4) must be burned to produce 56.0 L of CO_2 at STP?

$56.0\ L\ CO_2 \times \frac{1\ mol\ CO_2}{22.4\ L} \times \frac{1\ mol\ CH_4}{1\ mol\ CO_2} \times \frac{22.4\ L}{1\ mol\ CH_4} = 56.0\ L\ CH_4$

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?

(mol / M | L)

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

$0.750\ g\ NaOH \times \frac{1\ mol\ NaOH}{40.0\ g\ NaOH} \times \frac{1\ mol\ HNO_3}{1\ mol\ NaOH} = \frac{1.88 \times 10^{-2}\ mol\ HNO_3}{0.0250\ L}$

$= 0.750\ M\ HNO_3$

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 K = 39.1
1 Cl = 35.5
74.6

9.For the reaction: HCl (aq)+ KOH (aq) → KCl (aq)+ H_2O (l)
If 50.0 mL of 1.25 M HCl reacts with 75.0 mL of 1.00 M KOH

(a) $0.0500\ L \times \frac{1.25\ mol\ HCl}{1\ L} \times \frac{1\ mol\ KCl}{1\ mol\ HCl} \times \frac{74.6\ g}{1\ mol\ KCl} = 4.66\ g\ KCl$ →

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

1 H = 1.0
1 Cl = 35.5
3 O = 48.0
84.5

10.For the reaction: 6 ClO_2 (g) + 3 H_2O (l) → 5 $HClO_3$ (aq) + HCl (aq)
If 71.0 g of ClO_2 is mixed with 19.0 g of water.

1 Cl = 35.5
2O = 32.0
67.5

$71.0\ g\ ClO_2 \times \frac{1\ mol\ ClO_2}{67.5\ g} \times \frac{5\ mol\ HClO_3}{6\ mol\ ClO_2} \times \frac{84.5\ g}{1\ mol\ HClO_3} = 74.1\ g\ HClO_3$ →

$19.0\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.0\ g\ H_2O} \times \frac{5\ mol\ HClO_3}{3\ mol\ H_2O} \times \frac{84.5\ g}{1\ mol\ HClO_3} = 148.7\ g\ HClO_3$

1 Mn = 54.9
2 I = 253.8
308.7

11.For the reaction: 2 MnI_2 (s)+ 13 F_2 (g)→ 2 MnF_3 (s) + 4 IF_5 (l)
If 1.23 g of MnI_2 reacts with 25.0 g of F_2 .

1 Mn = 54.9
3 F = 57.0
111.9

$1.23\ g \times \frac{1\ mol\ MnI_2}{308.7\ g} \times \frac{2\ mol\ MnF_3}{2\ mol\ MnI_2} \times \frac{111.9\ g}{1\ mol\ MnF_3} = 0.446\ g\ MnF_3$ →

$2.50\ g\ F_2 \times \frac{1\ mol\ F_2}{38.0\ g\ F_2} \times \frac{2\ mol\ MnF_3}{13\ mol\ F_2} \times \frac{111.9\ g}{1\ mol\ MnF_3} = 1.05\ g\ MnF_3$

1 Fe = 55.8
2 S = 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 :

$$4\ FeS_2\ (s) + 11\ O_2\ (g) \rightarrow 2\ Fe_2O_3\ (s) + 8\ SO_2\ (g)$$

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

a. What is the THEORETICAL YEILD of SO_2?

$$100.0\ g \times \frac{1\ mol\ FeS_2}{120.0\ g} \times \frac{8\ mol\ SO_2}{4\ mol\ FeS_2} \times \frac{22.4\ L}{1\ mol\ SO_2} = \boxed{37.3\ L\ SO_2}$$

b. What is the PERCENT YIELD?

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

1 Si = 28.1
2 O = 32.0
60.1

13. The reaction SiO_2 (s) + 4 HF (g) → SiF_4 (g) + 2 H_2O (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?

$$12.2\ g\ SiO_2 \times \frac{1\ mol\ SiO_2}{60.1\ g\ SiO_2} \times \frac{2\ mol\ H_2O}{1\ mol\ SiO_2} \times \frac{18.0\ g\ H_2O}{1\ mol\ H_2O} = \boxed{7.31\ g\ H_2O}$$

b. What is the Percent Yield?

$$P.Y = \frac{actual}{expected} \times 100 \rightarrow \frac{2.50\ g\ H_2O}{7.31} \times 100 = \boxed{34.2\%}$$

1 Si = 28.1
4 F = 76.0
104.1

C. How much SiF_4 would form?

$$12.2\ g\ SiO_2 \times \frac{1\ mol\ SiO_2}{60.1\ g} \times \frac{1\ mol\ SiF_4}{1\ mol\ SiO_2} \times \frac{104.1\ g\ SiF_4}{1\ mol\ SiF_4} = \boxed{21.2\ g\ SiF_2}$$

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

$$21.2 \left(\frac{x}{21.2}\right) = (0.342)\,21.2 \rightarrow x = \boxed{7.25\ g\ SiF_4}$$