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?

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

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?

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

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

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

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

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?

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

$$5.00 \text{ mol } CH_4 \times \frac{1 \text{ mol } CO_2}{1 \text{ mol } CH_4} \times \frac{22.4 \text{ L}}{1 \text{ mol } CO_2} = \boxed{112 \text{ L } CO_2}$$

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.

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

mol / M | L

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

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

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

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

QUANITITY 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?

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

1Zn = 65.4
2Cl = 71.0
136.4

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

$$\boxed{6.82 \text{ g } ZnCl_2}$$

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

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

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

mol / M | L

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?

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

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

$$= \boxed{0.750 \text{ M } HNO_3}$$

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

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

1 Cl = 35.5
2 O = 32.0
67.5

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.

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

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

Mn = 54.9
2 I = 253.8
308.7

1 Mn = 54.9
3 F = 57.0
111.9

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 .

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

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

9. a.

$$0.0500\,L \times \frac{1.25\,mol\ HCl}{1\,L} \times \frac{1\,mol\ H_2O}{1\,mol\ HCl} \times \frac{18.0\,g\ H_2O}{1\,mol\ H_2O} = \boxed{1.13\,g\ H_2O}$$

b. HCl is the limiting Reactant.

c. (used)

Omit !

10. (a.)

$$71.0\,g\ ClO_2 \times \frac{1\,mol\ ClO_2}{67.5\,g} \times \frac{1\,mol\ HCl}{6\,mol\ ClO_2} \times \frac{36.5\,g}{1\,mol\ HCl} = \boxed{6.40\,g\ HCl}$$

(b.)

The limiting Reactant is ClO_2.

(c.)

$$71.0\,g\ ClO_2 \times \frac{1\,mol\ ClO_2}{67.5\,g} \times \frac{3\,mol\ H_2O}{6\,mol\ ClO_2} \times \frac{18.0\,g}{1\,mol\ H_2O} = 9.47\,g\ H_2O$$

1 I = 126.9
5F = 95.0

$\therefore$ 19.0 g − 9.47 ⇒ $\boxed{9.5\,g\ H_2O\ \text{left}}$

11. (a) $1.23\,g\ MnI_2 \times \frac{1\,mol\ MnI_2}{308.7\,g} \times \frac{4\,mol\ IF_5}{2\,mol\ MnI_2} \times \frac{221.9\,g}{1\,mol\ IF_5} = \boxed{1.77\,g\ IF_5}$

(b) The limiting Reactant is MnI_2.

(c)

$1.23\,g\ MnI_2 \times \frac{1\,mol\ MnI_2}{308.7\,g} \times \frac{13\,mol\ F_2}{2\,mol\ MnI_2} \times \frac{38.0\,g}{1\,mol\ F_2} = 0.984\,g\ F_2$.

$\therefore 25.0\,g - 0.984\,g = \boxed{24.0\,g\ F_2 \text{ remains}}$

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?

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

b. What is the PERCENT YIELD?

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

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?

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

b. What is the Percent Yield?

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

1 Si = 28.1
4 F = 76.0
104.1

C. How much SiF_4 would form?

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

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

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