Chapter 9
Practice Test

Name: _____

Date: _____ Per: _____

Directions: Answer the following questions in the spaces provided. Show as much work as possible. Maintain 3 decimal places throughout your calculations. Box your answers & include units!

Balance the following:

1. _____Al + _____Fe_2O_3 → _____Fe + _____Al_2O_3

2. _____$PbCl_2$ + _____Li_2SO_4 → _____$PbSO_4$ + _____$LiCl$

3. _____Cl_2 + _____KBr → _____KCl + _____Br_2

Sample: Convert 60.0g NaOH to formula units NaOH

$$\frac{60.0\text{g NaOH}}{} \left| \frac{1\text{ mol NaOH}}{39.997\text{g NaOH}} \right| \frac{6.022 \times 10^{23}\text{ units NaOH}}{1\text{ mol NaOH}} = \boxed{9.03 \times 10^{23}\text{ units NaOH}}$$

4. Convert 44.1g $NaHCO_3$ to formula units $NaHCO_3$

$$\frac{}{} \left| \frac{}{} \right| \frac{}{} = \_\_\_\_\_$$

Sample: Given the unbalanced reaction, $TiCl_4$ + H_2O → TiO_2 + HCl

a. Write the balanced equation: ***$TiCl_4 + 2H_2O \rightarrow TiO_2 + 4HCl$***

How many moles of HCl would be produced from:

b. 2 moles of $TiCl_4$ ***8 moles HCl*** ***c. 0.5 moles of H_2O*** ***1 mole HCl***

b. since the mole ratio of $TiCl_4$: HCl is 1:4, the number of moles of HCl must always be 4 times the moles of $TiCl_4$

c. since the mole ratio of H_2O : HCl is 2:4, the number of moles of HCl must always be 2 times the moles of H_2O

5. Given the unbalanced equation, Fe + H_2O → Fe_3O_4 + H_2

a. Write the balanced equation: _____

How many moles of Fe_3O_4 would be produced from:

b. 2.5 moles of Fe _____ c. 1.5 moles of H_2O _____

Sample: Given the equation $Zn + CrCl_3 \rightarrow CrCl_2 + ZnCl_2$, find the mass of $ZnCl_2$ formed if 1.20×10^{24} formula units of $CrCl_3$ reacts with an excess of Zn.

Analyze, rewrite, balance equation $1Zn + 2CrCl_3 \rightarrow 2CrCl_2 + 1ZnCl_2$

1.20×10^{24} part. ?g

Solve for only reactant $\frac{1.20 \times 10^{24}\text{ part. } CrCl_3}{} \times \frac{1\text{ mol } CrCl_3}{6.022 \times 10^{23}\text{ part. } CrCl_3} \times \frac{1\text{ mol } ZnCl_2}{2\text{ mol } CrCl_3} \times \frac{136.286\text{g } ZnCl_2}{1\text{ mol } ZnCl_2} = \boxed{136\text{g } ZnCl_2}$

6. Given the equation $WO_3 + H_2 \rightarrow W + H_2O$, find the mass of W formed if 3.00×10^{22} formula units of WO_3 reacts with an excess of H_2.

Answers: 1) 2,1,2,1 2) 1,1,1,2 3) 1,2,2,1 4) 3.16×10^{23} p. $NaHCO_3$ 5) a: 3,4,1,4 b: 0.83 mol Fe_3O_4 c: 0.38 mol Fe_3O_4 6) 9.16 g W 7) 62.7 g CO_2 8) a: 12.1 g $NaNO_3$ b: 86.8%

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Sample: Given the equation $RbCl + O_2 \rightarrow RbClO_4$, find the mass of $RbClO_4$ formed if 2.70g of O_2 reacts with 135g RbCl.

Analyze, rewrite, balance equation

$$\underset{135g}{1RbCl} + \underset{2.7g}{2O_2} \rightarrow \underset{?g}{1RbClO_4}$$

Solve for 1st reactant

$$\frac{135g\ RbCl}{} \times \frac{1\ mol\ RbCl}{120.921g\ RbCl} \times \frac{1\ mol\ RbClO_4}{1\ mol\ RbCl} \times \frac{184.917g\ RbClO_4}{1\ mol\ RbClO_4} = 206.45g\ RbClO_4$$

Solve for 2nd reactant

$$\frac{2.70g\ O_2}{} \times \frac{1\ mol\ O_2}{31.998g\ O_2} \times \frac{1\ mol\ RbClO_4}{2\ mol\ O_2} \times \frac{184.917g\ RbClO_4}{1\ mol\ RbClO_4} = \boxed{7.80g\ RbClO_4}$$

In a limiting reactant problem the correct answer will be the lower of the two calculated values.

7. Given the unbalanced equation $CH_4 + O_2 \rightarrow CO_2 + H_2O$, find the mass of CO_2 produced from the reaction of 56.1g of CH_4 with 91.2g of O_2.

Sample: Using the equation $Al + CuSO_4 \rightarrow Cu + Al_2(SO_4)_3$, calculate the percent yield if you experimentally produce 3.65 grams of copper when 1.87 grams of aluminum reacts with 9.65 grams of copper (II) sulfate.

Analyze, rewrite, balance equation

$$\underset{1.87g}{2Al} + \underset{9.65g}{3CuSO_4} \rightarrow \underset{?g}{3Cu} + Al_2(SO_4)_3$$

Solve for 1st reactant

$$\frac{1.87g\ Al}{} \times \frac{1\ mol\ Al}{26.982g\ Al} \times \frac{3\ mol\ Cu}{2\ mol\ Al} \times \frac{63.546g\ Cu}{1\ mol\ Cu} = 6.61g\ Cu$$

Solve for 2nd reactant

$$\frac{9.65g\ CuSO_4}{} \times \frac{1\ mol\ CuSO_4}{159.608g\ CuSO_4} \times \frac{3\ mol\ Cu}{3\ mol\ CuSO_4} \times \frac{63.546g\ Cu}{1\ mol\ Cu} = \boxed{3.84g\ Cu}$$

Calculate % yield =

$$\frac{\text{actual yield (from question)}}{\text{theoretical yield (calculated above)}} \times 100 \rightarrow \rightarrow \frac{3.65g\ Cu}{3.84g\ Cu} \times 100 = \boxed{95.1\%}$$

8. Given the <u>unbalanced</u> equation $Ba(NO_3)_2 + Na_2CrO_4 \rightarrow BaCrO_4 + NaNO_3$, find the mass of $NaNO_3$ formed if 18.6g $Ba(NO_3)_2$ reacts with 46.1g Na_2CrO_4.

When the reaction is carried out, 10.5 g of $NaNO_3$ is formed. Calculate the percent yield.

Answers: 1) 2,1,2,1 2) 1,1,1,2 3) 1,2,2,1 4) 3.16 x 10^{23} p. $NaHCO_3$ 5) a: 3,4,1,4 b: 0.83 mol Fe_3O_4 c: 0.38 mol Fe_3O_4 6) 9.16 g W 7) 62.7 g CO_2 8) a: 12.1 g $NaNO_3$ b: 86.8%