**Day 1-3: Stoichiometry**

3. Interpret the equation for the formation of water from its elements in terms of numbers of molecules, moles, and volumes of gases at STP.

$$2H\_{2}\_{(g)}+O\_{2}\_{(g)}\rightarrow 2H\_{2}O\_{(g)}$$

11. This equation shows the formation of aluminum oxide, which is found on the surface of aluminum objects exposed to the air.

$$4 Al\_{(s)}+3O\_{2}\_{(g)}\rightarrow 2Al\_{2}O\_{3}\_{(s)}$$

1. Write the six mole ratios that can be derived from this equation.
2. How many moles of aluminum are needed to form 3.7 mol Al2O3?

13. Acetylene gas (C2H2) is produced by adding water to calcium carbide (CaC2).

$$CaC\_{2}\_{(s)}+2H\_{2}O\_{(l)}\rightarrow C\_{2}H\_{2}\_{(g)}+Ca(OH)\_{2}\_{(aq)}$$

How many grams of acetylene are produced by adding water to 5.00 g CaC2?

14. Use the equation in Question 13 to determine how many moles of CaC2 are needed to react completely with 49.0 g H2O.

1. In the decomposition of sodium chlorate, 31.7 grams of oxygen are produced. How many grams of sodium chloride are formed?



1. Ethyne was first prepared by sparking carbon rods in the presence of hydrogen gas. How many grams of carbon electrodes will be consumed when 59.8 grams of ethyne are produced?

2C + H2 → C2H2

1. How many grams of hydrogen are produced when 4.72 grams of aluminum react with excess hydrochloric acid?
2. How many grams of hydrochloric acid are required to react with 61.8 grams of calcium hydroxide?

**Day 4: Stoichiometry with gases**

15. How many molecules of oxygen are produced by the decomposition of 6.54 g of potassium chlorate (KClO3)?

$$2KClO\_{3}\_{(s)}\rightarrow 2KCl\_{(s)}+3O\_{2}\_{(g)}$$

16. The last step in the production of nitric acid is the reaction of nitrogen dioxide with water.

$$3NO\_{2}\_{(g)}+H\_{2}O\_{(l)}\rightarrow 2HNO\_{3}\_{(aq)}+NO\_{(g)}$$

How many grams of nitrogen dioxide must react with water to produce 5.00x1022 molecules of nitrogen monoxide?

17. The equation for the combustion of carbon monoxide is:

$$2CO\_{(g)}+O\_{2}\_{(g)}\rightarrow 2CO\_{2}\_{(g)}$$

How many liters of oxygen are required to burn 3.86 L of carbon monoxide?

19. Calculate the volume of sulfur dioxide, in milliliters, produced when 27.9 mL O2 reacts with carbon disulfide.

$$CS\_{2}\_{(l)}+3O\_{2}\_{(g)}\rightarrow CO\_{2}\_{(g)}+ 2SO\_{2}\_{(g)}$$

**Day 4: Limiting Reagents**

26. The equation for the complete combustion of ethane (C2H4) is:

$$C\_{2}H\_{4}\_{(g)}+3O\_{2}\_{(g)}\rightarrow 2CO\_{2}\_{(g)}+2H\_{2}O\_{(g)}$$

If 2.70 mol C2H4 reacts with 6.30 mol O2, identify the limiting reagent.

28. The equation below shows the incomplete combustion of ethane:

$$C\_{2}H\_{4}\_{(g)}+2O\_{2}\_{(g)}\rightarrow 2CO\_{(g)}+2H\_{2}O\_{(g)}$$

If 2.70 mol C2H4 is reacted with 6.30 mol O2,

1. Identify the limiting reagent.
2. Calculate the moles of water actually produced.

29. The heat from an acetylene torch is produced by burning acetylene (C2H2) in oxygen:

$$2C\_{2}H\_{2}\_{(g)}+5O\_{2}\_{(g)}\rightarrow 4CO\_{2}\_{(g)}+2H\_{2}O\_{(g)}$$

How many grams of water can be produced by the reaction of 2.40 mol C2H2 with 7.40 mol O2?

**Day 5: Percent Yields**

30. When 84.8 g of iron (III) oxide reacts with an excess of carbon monoxide, iron is produced.

$$Fe\_{2}O\_{3}\_{(s)}+3CO\_{(g)}\rightarrow 2Fe\_{(s)}+3CO\_{2}\_{(g)}$$

What is the theoretical yield of iron?

31. When 5.00 g of copper reacts with excess silver nitrate, silver metal and copper (II) nitrate are produced. What is the theoretical yield of silver in this reaction?

33. If 15.0 g of nitrogen reacts with 15.0 g of hydrogen, 10.5 g of ammonia is produced. What is the percent yield of this reaction?

38. What is the percent yield if 4.65 g of copper is produced when 1.87 g of aluminum reacts with an excess of copper (II) sulfate?

$$2 Al\_{(s)}+3CuSO\_{4}\_{(aq)}\rightarrow 2Al\_{2}(SO\_{4})\_{3}\_{(aq)}+3Cu\_{(s)}$$

**More Practice for an additional 2 % including Questions:** 45, 53, 54, 55, 57, 59, 65

AP1.) Zinc reacts with hydrochloric acid (hydrogen chloride) to produce two products in a single displacement reaction. How many moles of hydrochloric acid are required to produce 7.5 moles of zinc chloride?

(*ans*: 0.07 moles HCl)

AP2.) What mass of hydrogen gas will be produced when 105.5 g of zinc react with excess hydrochloric acid? (*ans*: 3.227 moles H2)

AP3.) Copper metal reacts with silver nitrate to form silver and copper (II) nitrate. How many grams of copper are required to form 250.0 g of silver? (*ans*: 42.35 grams Cu)

AP4.) How many grams of iron (II) chloride are produced when 15.3 g of iron react with excess chlorine gas? (*ans*: 44.4 grams Fe)

AP5.) In the reaction below, 80.0 g of copper react with 380.0 g of silver nitrate. Based on this reaction, answer the following questions.

**\_\_\_\_\_ Cu (s) + \_\_\_\_\_ AgNO3 (aq) 🡪 \_\_\_\_\_ Cu(NO3)2 (aq) + \_\_\_\_\_ Ag (s)**

a.) Which reactant is the limiting reactant? (show ALL work) (*ans*: AgNO3)

b.) How much of the excess reagent will be left unreacted? (*ans*: 8.9 grams Cu)

c.) What is the percent yield if 195.5 g of silver are produced? (*ans*: 81%)

d.) What type of reaction did you write? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e.) What type of chemical bonds do the reactants/products have? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Write out the balanced chemical equation below including state symbols for 6 & 7**

AP6.) Aluminum sulfate reacts with calcium hydroxide to yield…

 **equation**:

 type of reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AP7.) Ethane, C2H6, undergoes a combustion reaction to yield ...

 **equation**: