STOICHIOMETRY: MOLE-MOLE PROBLEMS

Name _____

6. $N_2 + H_2 \rightarrow NH_3$

How many moles of hydrogen are needed to completely react with two moles of nitrogen?

_____

7. $KClO_3 \rightarrow KCl + O_2$

How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate?

_____

8. $Zn + HCl \rightarrow ZnCl_2 + H_2$

How many moles of hydrogen are produced from the reaction of three moles of zinc with an excess of hydrochloric acid?

_____

9. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

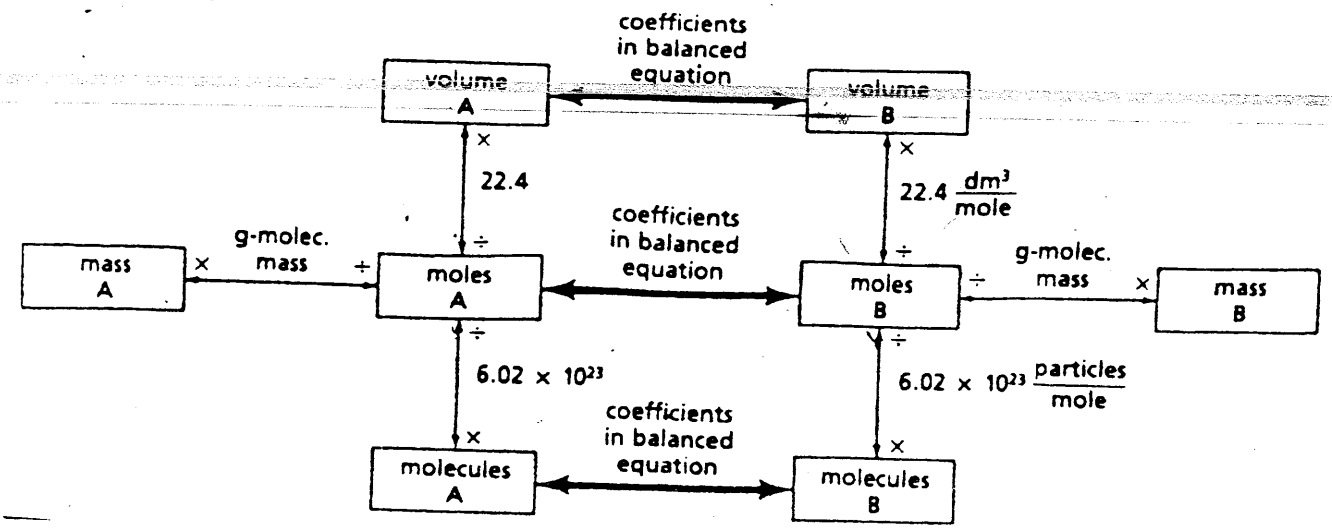
How many moles of oxygen are necessary to react completely with four moles of propane (C_3H_8)?

_____

10. $K_3PO_4 + Al(NO_3)_3 \rightarrow KNO_3 + AlPO_4$

How many moles of potassium nitrate are produced when two moles of potassium phosphate react with two moles of aluminum nitrate?

_____



STOICHIOMETRY: II
MASS-MASS PROBLEMS

Name _____

Balance; solve for answer. significant figures

1. $KClO_3 \rightarrow KCl + O_2$

How many grams of potassium chloride are produced if 25 g of potassium chlorate decompose?

2. $N_2 + H_2 \rightarrow NH_3$

How many grams of hydrogen are necessary to react completely with 50.0 g of nitrogen in the above reaction?

3. How many grams of ammonia are produced in the reaction in Problem 2?

4. $AgNO_3 + BaCl_2 \rightarrow AgCl + Ba(NO_3)_2$

How many grams of silver chloride are produced from 5.0 g of silver nitrate reacting with an excess of barium chloride?

STOICHIOMETRY: VOLUME-VOLUME PROBLEMS

Name _____

1. $N_2 + 3H_2 \rightarrow 2NH_3$

   What volume of hydrogen is necessary to react with five liters of nitrogen to produce ammonia? (Assume constant temperature and pressure.)

   _____

2. What volume of ammonia is produced in the reaction in Problem 1?

   _____

3. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

   If 20 liters of oxygen are consumed in the above reaction, how many liters of carbon dioxide are produced?

   _____

4. $2H_2O \rightarrow 2H_2 + O_2$

   If 30 mL of hydrogen are produced in the above reaction, how many milliliters of oxygen are produced?

   _____

5. $2CO + O_2 \rightarrow 2CO_2$

   How many liters of carbon dioxide are produced if 75 liters of carbon monoxide are burned in oxygen? How many liters of oxygen are necessary?

   _____

   _____

STOICHIOMETRY: MASS-MASS PROBLEMS

Name _____

1. $2KClO_3 \rightarrow 2KCl + 3O_2$

   How many grams of potassium chloride are produced if 25 g of potassium chlorate decompose?

   _____

2. $N_2 + 3H_2 \rightarrow 2NH_3$

   How many grams of hydrogen are necessary to react completely with 50.0 g of nitrogen in the above reaction?

   _____

3. How many grams of ammonia are produced in the reaction in Problem 2?

   _____

4. $2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$

   How many grams of silver chloride are produced from 5.0 g of silver nitrate reacting with an excess of barium chloride?

   _____

5. How much barium chloride is necessary to react with the silver nitrate in Problem 4?

   _____

STOICHIOMETRY: MIXED PROBLEMS

Name _____

1. $N_2 + 3H_2 \rightarrow 2NH_3$

   What volume of NH_3 at STP is produced if 25.0 g of N_2 is reacted with an excess of H_2?

   _____

2. $2KClO_3 \rightarrow 2KCl + 3O_2$

   If 5.0 g of $KClO_3$ is decomposed, what volume of O_2 is produced at STP?

   _____

3. How many grams of KCl are produced in Problem 2?

   _____

4. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

   What volume of hydrogen at STP is produced when 2.5 g of zinc react with an excess of hydrochloric acid?

   _____

5. $H_2SO_4 + 2NaOH \rightarrow H_2O + Na_2SO_4$

   How many molecules of water are produced if 2.0 g of sodium sulfate are produced in the above reaction?

   _____

6. $2AlCl_3 \rightarrow 2Al + 3Cl_2$

   If 10.0 g of aluminum chloride are decomposed, how many molecules of Cl_2 are produced?

   _____

Name _____

STOICHIOMETRY PROBLEMS

Mass-Volume Problems (continued)

Exercises

Sugar cane plants convert carbon dioxide (CO_2) and water (H_2O) to sucrose ($C_{12}H_{22}O_{11}$) and oxygen (O_2) in the presence of sunlight according to the following reaction:

$$12CO_2(g) + 11H_2O(l) \rightarrow C_{12}H_{22}O_{11}(s) + 12O_2(g)$$

1. How many grams of sucrose ($C_{12}H_{22}O_{11}$) is produced from 224 cubic decimeters of carbon dioxide (CO_2) at STP? 1. _____

2. How many cubic decimeters of carbon dioxide (CO_2) at STP is needed to produce 5.00 pounds of sugar? (1 kg = 2.20 lbs.) 2. _____

3. What mass of water would be needed to combine with 200 cubic decimeters of CO_2 at STP? 3. _____

One of the steps in the production of iron utilizes the following chemical reaction:

$$3CO(g) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3CO_2(g)$$

4. What mass of Fe_2O_3 would react with 50 cubic decimeters of CO at STP? 4. _____

5. What volume of carbon dioxide (CO_2) at STP is produced from 1000 grams of Fe_2O_3? 5. _____

6. What mass of iron (Fe) is produced when 300 cubic centimeters of CO_2 is produced at STP? 6. _____

How many moles of calcium oxide are produced when 36.5 g of calcium react completely with oxygen gas?

Molecule-Mass-Volume Problems

Exercises

Begin each problem by sketching a diagram that outlines the steps in the solution to the problem.

Baking soda ($NaHCO_3$) reacts with sulfuric acid (H_2SO_4) to produce sodium sulfate (Na_2SO_4), water (H_2O), and carbon dioxide (CO_2). The reaction is represented by the following balanced equation:

$$2NaHCO_3(s) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l) + 2CO_2(g)$$

7. How many grams of sodium sulfate (Na_2SO_4) is produced from 24.0×10^{23} formula units of sodium bicarbonate ($NaHCO_3$) and sufficient sulfuric acid (H_2SO_4)? 7. _____

8. How many cubic decimeters of carbon dioxide (CO_2) at STP would be produced from 24.0×10^{23} formula units of sodium bicarbonate ($NaHCO_3$) and sufficient sulfuric acid (H_2SO_4)? 8. _____

9. How many formula units of sulfuric acid (H_2SO_4) would be used when 250 liters of carbon dioxide (CO_2) at STP is produced? 9. _____

Name _____

STOICHIOMETRY: LIMITING REAGENT

1. $N_2 + 3H_2 \rightarrow 2NH_3$

   How many grams of NH_3 can be produced from the reaction of 28 g of N_2 and 25 g of H_2?

   _____

2. How much of the excess reagent in Problem 1 is left over?

   _____

3. $Mg + 2HCl \rightarrow MgCl_2 + H_2$

   What volume of hydrogen at STP is produced from the reaction of 50.0 g of Mg and the equivalent of 75 g of HCl?

   _____

4. How much of the excess reagent in Problem 3 is left over?

   _____

5. $3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3$

   Silver nitrate and sodium phosphate are reacted in equal amounts of 200. g each. How many grams of silver phosphate are produced?

   _____

6. How much of the excess reagent in Problem 5 is left?

   _____

Percent Yield Calculations

1) Balance this equation and state which of the six types of reaction is taking place:

$$\_\_\_\_ Mg + \_\_\_\_ HNO_3 \rightarrow \_\_\_\_ Mg(NO_3)_2 + \_\_\_\_ H_2$$

Type of reaction: _____

2) If I start this reaction with 40 grams of magnesium and an excess of nitric acid, how many grams of hydrogen gas will I produce?

3) If 1.7 grams of hydrogen is actually produced, what was my percent yield of hydrogen?

---

4) Balance this equation and state what type of reaction is taking place:

$$\_\_\_\_ NaHCO_3 \rightarrow \_\_\_\_ NaOH + \_\_\_\_ CO_2$$

Type of reaction: _____

5) If 25 grams of carbon dioxide gas is produced in this reaction, how many grams of sodium hydroxide should be produced?

6) If 50 grams of sodium hydroxide are actually produced, what was my percent yield?

Percent & Theoretical Yield Worksheet
Honors Chemistry

Name _____
Period _____

1. Sulfur dioxide is produced from zinc sulfide when it reacts with oxygen. If the typical yield is 86.78%, what mass of SO_2 should be expected if 4897 g of ZnS is used?

2. Aluminum reacts with excess copper II sulfate. If 1.85 g of Al reacts and the percent yield of Cu is 56.6%, what mass of copper is produced?

3. A 15 g sample of magnesium reacts with hydrochloric acid (HCl). 46.6 g of magnesium chloride was formed during the reaction. What was the percent yield?

4. Titanium IV oxide is used as a pigment in paints and as a whitener for paper. It is made by reacting titanium chloride with oxygen gas.

$$TiCl_{4(g)} + O_{2(g)} \longrightarrow TiO_{2(s)} + 2\ Cl_{2(g)}$$

   a. If 3.5 mol of $TiCl_4$ reacts with 4.5 mol of O_2, what mass of TiO_2 should be produced?

   b. If 250.0 g of TiO_2 was produced, what was the percent yield?

5. Sodium chloride is produced by the reaction between sodium metal and chlorine gas. Suppose that 6.70 mol Na reacts with 3.20 mol Cl_2.
   a. What is the theoretical yield of sodium chloride? (in moles)

   b. If 321.42 g of NaCl was actually produced, what is the percent yield of the reaction?

6. Calcium carbonate decomposes when heated to produce calcium oxide and carbon dioxide.
   a. What is the theoretical yield of each product if 24.8 g $CaCO_3$ is heated?

   b. What is the percent yield if 13.1 g CaO is produced?