MIXED MOLE PROBLEMS

/42

Name Key

...e the following problems.

1. How many grams are there in 1.5×10^{25} molecules of CO_2?

1.1×10^3 g CO_2

2. What volume would the CO_2 in Problem 1 occupy at STP?

5.6×10^2 L CO_2

3. A sample of NH_3 gas occupies 75.0 liters at STP. How many molecules is this?

2.02×10^{24} m.c NH_3

4. What is the mass of the sample of NH_3 in Problem 3?

56.9 g NH_3

5. How many atoms are there in 1.3×10^{22} molecules of NO_2?

3.9×10^{22} atoms

6. A 5.0 g sample of O_2 is in a container at STP. What volume is the container?

3.5 L O_2

7. How many molecules of O_2 are in the container in Problem 6? How many atoms of oxygen?

1.9×10^{23} atoms

9.4×10^{22} molecules

/6

PERCENTAGE COMPOSITION

Name _____

Determine the percentage composition of each of the compounds below.

1. $KMnO_4$

   K = 24.7%
   Mn = 34.8%
   O = 40.5%

2. HCl

   H = 2.8%
   Cl = 97.2%

3. $Mg(NO_3)_2$

   Mg = 16.2%
   N = 18.9%
   O = 64.9%

4. $(NH_4)_3PO_4$

   N = 28.2%
   H = 8.1%
   P = 20.8%
   O = 42.9%

5. $Al_2(SO_4)_3$

   Al = 15.8%
   S = 28.1%
   O = 56.1%

Solve the following problems.

6. How many grams of oxygen can be produced from the decomposition of 100. g of $KClO_3$? 39.3 g

7. How much iron can be recovered from 25.0 g of Fe_2O_3? 17.5 g

8. How much silver can be produced from 125 g of Ag_2S? 109 g Ag.

DETERMINING EMPIRICAL FORMULAS

Name _____

What is the empirical formula (lowest whole number ratio) of the compounds below?

1. 75% carbon, 25% hydrogen

CH_4

2. 52.7% potassium, 47.3% chlorine

KCl

3. 22.1% aluminum, 25.4% phosphorus, 52.5% oxygen

$AlPO_4$

4. 13% magnesium, 87% bromine

$MgBr_2$

5. 32.4% sodium, 22.5% sulfur, 45.1% oxygen

Na_2SO_4

6. 25.3% copper, 12.9% sulfur, 25.7% oxygen, 36.1% water

$CuSO_4 \cdot 5H_2O$

/6

DETERMINING MOLECULAR FORMULAS (TRUE FORMULAS)

Name _____

Solve the problems below.

1. The empirical formula of a compound is NO_2. Its molecular mass is 92 g/mol. What is its molecular formula?

N_2O_4

2. The empirical formula of a compound is CH_2. Its molecular mass is 70 g/mol. What is its molecular formula?

C_5H_{10}

3. A compound is found to be 40.0% carbon, 6.7% hydrogen and 53.5% oxygen. Its molecular mass is 60. g/mol. What is its molecular formula?

$C_2H_4O_2$

4. A compound is 64.9% carbon, 13.5% hydrogen and 21.6% oxygen. Its molecular mass is 74 g/mol. What is its molecular formula?

$C_4H_{10}O$

5. A compound is 54.5% carbon, 9.1% hydrogen and 36.4% oxygen. Its molecular mass is 88 g/mol. What is its molecular formula?

$C_4H_8O_2$

15

WORD EQUATIONS

Name _____

Write the word equations below as chemical equations and balance.

1. zinc + lead (II) nitrate yield zinc nitrate + lead

$Zn + Pb(NO_3)_2 \longrightarrow Zn(NO_3)_2 + Pb$ ✓

2. aluminum bromide + chlorine yield aluminum chloride + bromine

$2\,AlBr_3 + 3Cl_2 \longrightarrow 2\,AlCl_3 + 3Br_2$

3. sodium phosphate + calcium chloride yield calcium phosphate + sodium chloride

$2Na_3PO_4 + 3CaCl_2 \longrightarrow Ca_3(PO_4)_2 + 6NaCl$

4. potassium chlorate when heated yields potassium chloride + oxygen gas

$2KClO_3 + 2KCl + 3O_2(g)$

5. aluminum + hydrochloric acid yield aluminum chloride + hydrogen gas

$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2(g)$

6. calcium hydroxide + phosphoric acid yield calcium phosphate + water

$3Ca(OH)_2 + 2H_3PO_4 \longrightarrow Ca_3(PO_4)_2 + 6H_2O$

7. copper + sulfuric acid yield copper (II) sulfate + water + sulfur dioxide

$Cu + 2H_2SO_4 \longrightarrow CuSO_4 + 2H_2O + SO_2$

8. hydrogen + nitrogen monoxide yield water + nitrogen

$2H_2 + 2NO \longrightarrow 2H_2O + N_2$

/8

PREDICTING PRODUCTS OF CHEMICAL REACTIONS

Name _____

Predict the products of the reactions below. Then, write the balanced equation and classify the reaction.

1. magnesium bromide + chlorine

$MgBr_2 + Cl_2 \longrightarrow MgCl_2 + Br_2$ single replacement

2. aluminum + iron (III) oxide

$Al + Fe_2O_3 \longrightarrow Fe + Al_2O_3$ single replacement

3. silver nitrate + zinc chloride

$2\,AgNO_3 + ZnCl_2 \longrightarrow 2\,AgCl + Zn(NO_3)_2$ double replacement

4. hydrogen peroxide (catalyzed by manganese dioxide)

$H_2O_2 \xrightarrow{MnO_2} 2\,H_2O + O_2$ decomposition

5. zinc + hydrochloric acid

$Zn + 2\,HCl \longrightarrow ZnCl + H_2$ single replacement

6. sulfuric acid + sodium hydroxide

$H_2SO_4 + NaOH \longrightarrow Na_2SO_4 + 2H_2O$ neutralization

7. sodium + hydrogen

$Na + H_2 \longrightarrow 2\,NaH$ synthesis

8. acetic acid + copper

$CH_3COOH + Cu \longrightarrow$ No rxn ! (single

