GRAM FORMULA MASS

Name _____

Determine the gram formula mass (the mass of one mole) of each compound below.

1. $KMnO_4$ _____

2. KCl _____

3. Na_2SO_4 _____

4. $Ca(NO_3)_2$ _____

5. $Al_2(SO_4)_3$ _____

6. $(NH_4)_3PO_4$ _____

7. $CuSO_4 \cdot 5H_2O$ _____

8. $Mg_3(PO_4)_2$ _____

9. $Zn(C_2H_3O_2)_2 \cdot 2H_2O$ _____

10. $Zn_3(PO_4)_2 \cdot 4H_2O$ _____

11. H_2CO_3 _____

12. $Hg_2Cr_2O_7$ _____

13. $Ba(ClO_3)_2$ _____

14. $Fe_2(SO_3)_3$ _____

15. $NH_4C_2H_3O_2$ _____

MOLES AND MASS

Determine the number of moles in each of the quantities below.

1. 25 g of NaCl

    _____

2. 125 g of H_2SO_4

    _____

3. 100. g of $KMnO_4$

    _____

4. 74 g of KCl

    _____

5. 35 g of $CuSO_4 \bullet 5H_2O$

    _____

Determine the number of grams in each of the quantities below.

1. 2.5 moles of NaCl

    _____

2. 0.50 moles of H_2SO_4

    _____

3. 1.70 moles of $KMnO_4$

    _____

4. 0.25 moles of KCl

    _____

5. 3.2 moles of $CuSO_4 \bullet 5H_2O$

    _____

THE MOLE AND VOLUME

For gases at STP (273 K and 1 atm pressure), one mole occupies a volume of 22.4 L. What volume will the following quantities of gases occupy at STP?

1. 1.00 mole of H_2

2. 3.20 moles of O_2

3. 0.750 mole of N_2

4. 1.75 moles of CO_2

5. 0.50 mole of NH_3

6. 5.0 g of H_2

7. 100. g of O_2

8. 28.0 g of N_2

9. 60. g of CO_2

10. 10. g of NH_3

THE MOLE AND AVOGADRO'S NUMBER

Name _____

One mole of a substance contains Avogadro's Number (6.02×10^{23}) of molecules.

How many molecules are in the quantities below?

1. 2.0 moles

2. 1.5 moles

3. 0.75 mole

4. 15 moles

5. 0.35 mole

How many moles are in the number of molecules below?

1. 6.02×10^{23}

2. 1.204×10^{24}

3. 1.5×10^{20}

4. 3.4×10^{26}

5. 7.5×10^{19}

MIXED MOLE PROBLEMS

Name _____

Solve the following problems.

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

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

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

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

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

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

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

PERCENTAGE COMPOSITION

Name _____

Determine the percentage composition of each of the compounds below.

1. $KMnO_4$

   K = _____

   Mn = _____

   O = _____

2. HCl

   H = _____

   Cl = _____

3. $Mg(NO_3)_2$

   Mg = _____

   N = _____

   O = _____

4. $(NH_4)_3PO_4$

   N = _____

   H = _____

   P = _____

   O = _____

5. $Al_2(SO_4)_3$

   Al = _____

   S = _____

   O = _____

Solve the following problems.

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

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

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

DETERMINING EMPIRICAL FORMULAS

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

1. 75% carbon, 25% hydrogen

_____

2. 52.7% potassium, 47.3% chlorine

_____

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

_____

4. 13% magnesium, 87% bromine

_____

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

_____

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

_____

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?

   _____

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

   _____

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?

   _____

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?

   _____

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?

   _____

COMPOSITION OF HYDRATES

Name _____

A hydrate is an ionic compound with water molecules loosely bonded to its crystal structure. The water is in a specific ratio to each formula unit of the salt. For example, the formula $CuSO_4 \cdot 5H_2O$ indicates that there are five water molecules for every one formula unit of $CuSO_4$. Answer the questions below.

1. What percentage of water is found in $CuSO_4 \cdot 5H_2O$?

   _____

2. What percentage of water is found in $Na_2S \cdot 9H_2O$?

   _____

3. A 5.0 g sample of a hydrate of $BaCl_2$ was heated, and only 4.3 g of the anhydrous salt remained. What percentage of water was in the hydrate?

   _____

4. A 2.5 g sample of a hydrate of $Ca(NO_3)_2$ was heated, and only 1.7 g of the anhydrous salt remained. What percentage of water was in the hydrate?

   _____

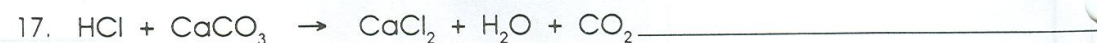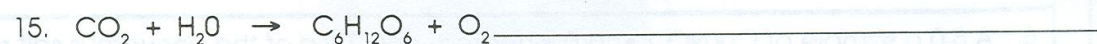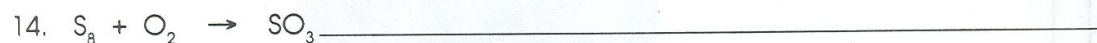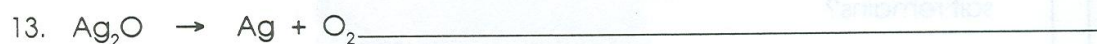5. A 3.0 g sample of $Na_2CO_3 \cdot H_2O$ is heated to constant mass. How much anhydrous salt remains?

   _____

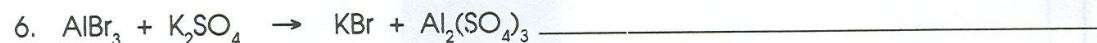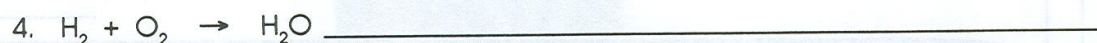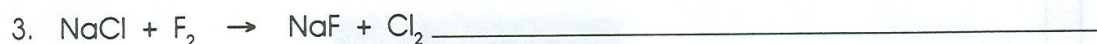6. A 5.0 g sample of $Cu(NO_3)_2 \cdot nH_2O$ is heated, and 3.9 g of the anhydrous salt remains. What is the value of n?

   _____

BALANCING CHEMICAL EQUATIONS

Name _____

Rewrite and balance the equations below.

1. $N_2 + H_2 \rightarrow NH_3$ _____

2. $KClO_3 \rightarrow KCl + O_2$ _____

3. $NaCl + F_2 \rightarrow NaF + Cl_2$ _____

4. $H_2 + O_2 \rightarrow H_2O$ _____

5. $AgNO_3 + MgCl_2 \rightarrow AgCl + Mg(NO_3)_2$ _____

6. $AlBr_3 + K_2SO_4 \rightarrow KBr + Al_2(SO_4)_3$ _____

7. $CH_4 + O_2 \rightarrow CO_2 + H_2O$ _____

8. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ _____

9. $C_8H_{18} + O_2 \rightarrow 1O_2 + H_2O$ _____

10. $FeCl_3 + NaOH \rightarrow Fe(OH)_3 + NaCl$ _____

11. $P + O_2 \rightarrow P_2O_5$ _____

12. $Na + H_2O \rightarrow NaOH + H_2$ _____

13. $Ag_2O \rightarrow Ag + O_2$ _____

14. $S_8 + O_2 \rightarrow SO_3$ _____

15. $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$ _____

16. $K + MgBr_2 \rightarrow KBr + Mg$ _____

17. $HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$ _____
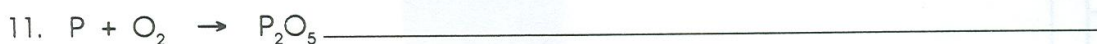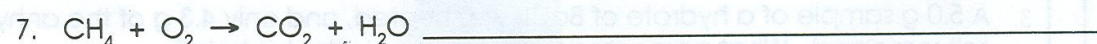
WORD EQUATIONS

Name _____

Write the word equations below as chemical equations and balance.

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

2. aluminum bromide + chlorine yield aluminum chloride + bromine

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

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

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

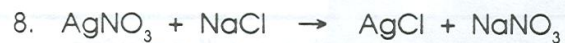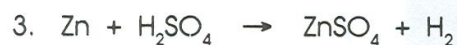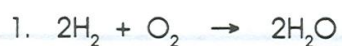6. calcium hydroxide + phosphoric acid yield calcium phosphate + water

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

8. hydrogen + nitrogen monoxide yield water + nitrogen

CLASSIFICATION OF CHEMICAL REACTIONS

Name _____

Classify the reactions below as synthesis, decomposition, single replacement (cationic or anionic) or double replacement.

1. $2H_2 + O_2 \rightarrow 2H_2O$ _____

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

3. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ _____

4. $2CO + O_2 \rightarrow 2CO_2$ _____

5. $2HgO \rightarrow 2Hg + O_2$ _____

6. $2KBr + Cl_2 \rightarrow 2KCl + Br_2$ _____

7. $CaO + H_2O \rightarrow Ca(OH)_2$ _____

8. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ _____

9. $2H_2O_2 \rightarrow 2H_2O + O_2$ _____

10. $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$ _____

PREDICTING PRODUCTS
OF CHEMICAL REACTIONS

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

1. magnesium bromide + chlorine

2. aluminum + iron (III) oxide

3. silver nitrate + zinc chloride

4. hydrogen peroxide (catalyzed by manganese dioxide)

5. zinc + hydrochloric acid

6. sulfuric acid + sodium hydroxide

7. sodium + hydrogen

8. acetic acid + copper