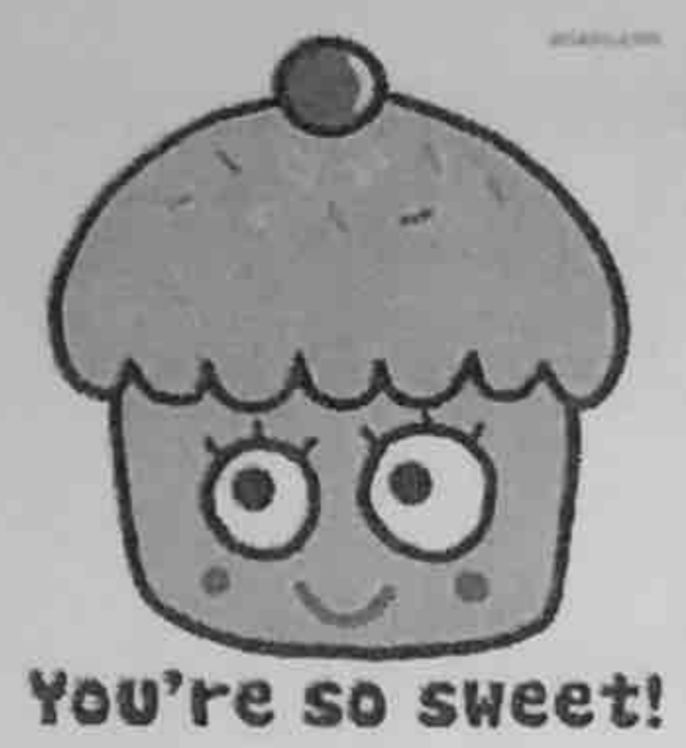
Name Key Date 2019 Period______



Super Chemists' Unit 6 Sweet Sheet

Part A: Writing and Balancing Chemical Equations

Directions: Write and balance the following chemical equations. State what type of equation it is; ***synthesis, decomposition, combustion, single displacement or double displacement***.

1. Sodium phosphate and calcium chloride yield calcium phosphate and sodium chloride

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

double displacement

2. Aluminum and hydrochloric acid yield aluminum chloride and hydrogen gas

$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

Single displacement

3. Zinc carbonate is heated to produce zinc oxide and carbon dioxide.

$ZnCO_3 \rightarrow ZnO + CO_2$

Decomposition

4. Potassium and chlorine gas are combined to make potassium chloride.

$2K + Cl_2 \rightarrow 2KCl$

Synthesis

5. Propane (C_3H_8) is burned completely to form carbon dioxide and water.

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

Combustion

Part B: Predicting Products of Chemical Reactions

Directions: Write the chemical reaction and predict the products produced. Then balance the equation and state what type of reaction it is. Be sure to use your Activity Series and Solubility Charts.

1. Magnesium bromide and chlorine

$MgBr_2 + Cl_2 \rightarrow MgCl_2 + Br_2$

Single displacement

2. Aluminum and iron (III) oxide

$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$

Single displacement

3. Silver nitrate and zinc chloride

$2AgNO_3 + ZnCl_2 \rightarrow 2AgCl + Zn(NO_3)_2$

Double displacement

4. Calcium carbonate is decomposed.

$CaCO_3 \rightarrow CaO + O_2$

Decomposition

5. C_7H_{16} burns to completion.

$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$

Combustion

6. Lead and Aluminum chloride No rxn.

7. Copper and silver nitrate

$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

Single Displacement

8. Potassium sulfate and magnesium fluoride

$K_2SO_4 + MgF_2 \rightarrow MgSO_4 + 2KF$ (SIS) (SIS)

No rxn.

9. Zinc nitrate and barium hydroxide

$Zn(NO_3)_2 + Ba(OH)_2 \rightarrow Zn(OH)_2 + Ba(NO_3)_2$ (P.O.) (SIS)

Double Displacement

10. Lithium hydroxide and barium chloride

$2LiOH + BaCl_2 \rightarrow 2LiCl + Ba(OH)_2$

No rxn.

Part C: Percent Composition

Directions: Determine the percent composition of each element in the following compounds.

1. Na_2CO_3

$2\,Na = 46$ $\quad Na = \frac{46}{106} = 43.4\%$

$C = 12$

$3O = +48$ $\quad C = \frac{12}{106} = 11.3\%$

106

$O = \frac{48}{106} = 45.3\%$

Part D: Empirical and Molecular Formulas

Directions: Determine the empirical formula and molecular formula for the following compounds.

1. The analysis of a compound shows that it is 50.1% S and 49.9% O. Find the empirical formula.

$\frac{50.1\,g\,S \mid 1\,mol\,S}{\mid 32\,g\,S} = \frac{1.5656}{1.5656} = 1\,S$ $\quad \frac{49.9\,g\,O \mid 1\,mol\,O}{\mid 16\,g\,O} = \frac{3.119}{1.5656} = 2 \quad O_2$

Empirical Formula:

SO_2

2. If the molar mass of the compound is 192 g/mol, find the molecular formula.

$32 + 32 = 64$ $\quad \frac{192}{64} = 3$

Molecular Formula:

S_3O_6

Part E: Stoichiometry, Limiting Reactant and Percent Yield

Directions: Given the following reaction answer the questions.

1. Sodium bromide reacts with hydrogen phosphate to produce sodium phosphate and hydrogen bromide.

A. Write the balanced chemical equation for this reaction.

SIS SIS

$3\,NaBr + H_3PO_4 \rightarrow Na_3PO_4 + 3HBr$ (no rxn.)

B. If 100 grams of each reactant are available to react, which would be the limiting reactant?

$$\frac{100g\ NaBr}{} \left| \frac{1\ mol\ NaBr}{103g\ NaBr} \right| \frac{1\ mol\ H_3PO_4}{3\ mol\ NaBr} \left| \frac{98g\ H_3PO_4}{1\ mol\ H_3PO_4} \right. = 31.7g\ H_3PO_4$$

NaBr is the Limiting Reactant

C. How many grams of each product should theoretically be produced?

$$\frac{100g\ NaBr}{} \left| \frac{1\ mol\ NaBr}{103g\ NaBr} \right| \frac{1\ mol\ Na_3PO_4}{3\ mol\ NaBr} \left| \frac{164g\ Na_3PO_4}{1\ mol\ Na_3PO_4} \right. = 53.1g\ Na_3PO_4$$

$$\frac{100g\ NaBr}{} \left| \frac{1\ mol\ NaBr}{103g\ NaBr} \right| \frac{3\ mol\ HBr}{3\ mol\ NaBr} \left| \frac{81g\ HBr}{1\ mol\ HBr} \right. = 78.6g\ HBr$$

D. If 50 grams of sodium phosphate were actually produced, what is the percent yield?

$$\frac{50g}{53.1g} \times 100 = 94\%$$

2. The dissociation of ammonia, NH_3, into its elements is an endothermic reaction.

a. Write a balanced equation for this reaction.

$2NH_3 \rightarrow N_2 + 3H_2$

b. What type of reaction is this, why?

Decomposition one reactant to two or more products

c. Is there a limiting reactant in this reaction? Why or why not?

Yes + no
there is only one reactant so it is the limiting reactant

d. If 123 grams of ammonia react, how many grams of each product should theoretically be produced?

$\frac{123\,g\,NH_3}{} \times \frac{1\,mol\,NH_3}{17\,g\,NH_3} \times \frac{1\,mol\,N_2}{2\,mol\,NH_3} \times \frac{28\,g\,N_2}{1\,mol\,N_2} = 101.3\,g\,N_2$

$\frac{123\,g\,NH_3}{} \times \frac{1\,mol\,NH_3}{17\,g\,NH_3} \times \frac{3\,mol\,H_2}{2\,mol\,NH_3} \times \frac{2\,g\,H_2}{1\,mol\,H_2} = 21.7\,g\,H_2$

e. If 75 grams of nitrogen are actually produced, what is the percent yield?

$\frac{75\,g}{101.3\,g} \times 100 = 74\%$

3. Molten iron and carbon monoxide are produced in a blast furnace by the reaction of iron (III) oxide and carbon.

a. What type of reaction is this? Why?

$Fe_2O_3 + C \rightarrow Fe + CO$

Single Displacement Carbon kicks out Fe

b. Write a balanced equation for the reaction.

$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$

c. If 180 grams of carbon are available to react with 640 grams of iron (III) oxide, what is the limiting reactant? Show work!

$$\frac{180g\ C}{} \cdot \frac{1\ mol\ C}{12g\ C} \cdot \frac{1\ mol\ Fe_2O_3}{3\ mol\ C} \cdot \frac{160g\ Fe_2O_3}{1\ mol\ Fe_2O_3} = 800g\ Fe_2O_3$$

We only have 640g of Fe_2O_3 so Fe_2O_3 is Limiting Reactant

d. Using your results from part c, how many grams of each product should be theoretically produced?

$$\frac{640g\ Fe_2O_3}{} \cdot \frac{1\ mol\ Fe_2O_3}{160g\ Fe_2O_3} \cdot \frac{2\ mol\ Fe}{1\ mol\ Fe_2O_3} \cdot \frac{56g\ Fe}{1\ mol\ Fe} = 448g\ Fe$$

$$\frac{640g\ Fe_2O_3}{} \cdot \frac{1\ mol\ Fe_2O_3}{160g\ Fe_2O_3} \cdot \frac{3\ mol\ CO}{1\ mol\ Fe_2O_3} \cdot \frac{28g\ CO}{1\ mol\ CO} = 336g\ CO$$

e. If 350 grams of iron are actually produced as a result of this reaction, what is the percent yield?

$$\frac{350g}{448g} \times 100 = 78\%$$

Part F: Net Ionic Equations

Directions: For the following reactions write the balanced double displacement reaction (molecular equation), the complete ionic equation, and the net ionic equation.

1. Barium bromide and sodium sulfate

P.O. SIS

$BaBr_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2NaBr$

P.O.

$Ba^{2+} + 2Br^- + 2Na^+ + SO_4^{2-} \longrightarrow BaSO_{4(s)} + 2Na^+ + 2Br^-$

SI = $Br^- + Na^+$

Net Ionic Eqn. $Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_{4(s)}$

2. Magnesium nitrate and sodium chromate

P.O. SIS

$Mg(NO_3)_2 + Na_2CrO_4 \longrightarrow MgCrO_4 + 2NaNO_3$

$Mg^{2+} + 2NO_3^- + 2Na^+ + CrO_4^{2-} \longrightarrow MgCrO_{4(s)} + 2Na^+ + 2NO_3^-$

SI = $NO_3^- + Na^+$

Net Ionic Eqn. $Mg^{2+} + CrO_4^{2-} \longrightarrow MgCrO_{4(s)}$

3. Copper (II) chloride and silver acetate

SIS P.O.

$CuCl_2 + 2Ag\,CH_3COO \longrightarrow Cu(CH_3COO)_2 + 2AgCl$

$Cu^{2+} + 2Cl^- + 2Ag^+ + 2CH_3COO \rightarrow Cu^{2+} + 2CH_3COO + 2AgCl_{(s)}$

SI = $Cu^{2+} + CH_3COO$

Net Ionic Eqn. $Cl^- + Ag^+ \rightarrow AgCl_{(s)}$