**Stoichiometry Packet  
Instructor:  M. Walker-Waugh  
  
LATEST EDITION modified on 10/23/02**

**Directions:**  Write the balanced equation for each of the following situations.  **SHOW ALL OF YOUR WORK ON ATTACHED PAGES, OR IT WILL NOT BE ACCEPTED.**   In addition, list the reaction type.

***NEW RULE FALL 2014: YOU MUST TELL THE AMOUNTS OF EVERY SUBSTANCE THAT REMAINS IN THE CONTAINER AT THE END OF THE REACTION. ASSUME THAT ALL REACTIONS GO TO COMPLETION.***

**Reaction Type   
a.        Combination Reaction  
b.        Decomposition Reaction  
c.        Single Displacement / THIS IS ONE TYPE OF Oxidation Reduction Reaction   
d.        Precipitation Reaction  
e.        Gaseous Reaction   
f.         Neutralization Reaction  
g.        Combustion Reaction**

1.  5.00  x 1015 ng of potassium chlorate is heated to form potassium chloride and oxygen

2.  61.802 cg of nitrogen gas is reacted with 61.802 cg of hydrogen gas to form ammonia

3.  1.839 g of calcium hydroxide is reacted with a 25.0 mL of a 0.200 M sulfuric acid solution

4.  3.59 x 102 g strip of zinc is dropped into a test tube of containing excess hydrochloric acid

5.  2.11 mg of hydrogen peroxide decomposes in the presence of manganese dioxide to form water and oxygen

6.  8.924 g of copper(II) sulfate, pentahydrate is heated to drive off the water of hydration

7.  A 4.32 ng sample of methane burns in excess oxygen

8.  5.92 g of sodium oxalate is reacted with 5.92 of calcium chloride

9.  13.33 cg of barium chloride is reacted with 135.2 mL of a 0.250 M sulfuric acid

10. 1.29 dag of sodium chloride is reacted with 25.0 dag of silver nitrate

11.  3.512 g of barium nitrate is reacted with EXCESS of sodium sulfate

12.  1.325 cg strip lithium reacts with 13.25 mg of magnesium nitrate

13.  6.9 g sodium nitride forms sodium and nitrogen gas

14.  3.577 Gg silver nitrate reacts with EXCESS of aluminum

15.  1.95 g iron(III) chloride and 25.00 mL of a 0.250 M sodium hydroxide solution

**ANSWER SHEET**

Part I:  Balancing Equations

1. **2 KClO3 → 2 KCl (s) + 3 O2(g)**   *(This is just stoichiometry.)*

Grams of Product (List the Product and the Amount): **3.04 x 106 g KCl   and     1.92 x 106 g O2**

Reaction Type: **\_\_\_Decomposition\_\_\_\_\_\_**

? g KClO3 = 5.00 x 1015 ng KClO3 x 1 g KClO3 x 1 mol KClO3      x 2 mol KCl     x 74.55 g KCl = 3.04 x 106 g KCl                                    
 1 x 109 KClO3  122.55 g KClO3  2 mol KClO3 1 mol KCl

? g KClO3 = 5.00 x 1015 ng KClO3 x 1 g KClO3 \_\_ x 1 mol KClO3 x \_\_3 mol O2 x 32.00 g O2 = 1.92 x 106 g O2   
 1 x 109 ng KClO3 122.55 g KClO3 2 mol KClO3 1 mol O2

1. **N2 (g) + 3 H2 (g)** **→ 2 NH3 (g)** *(This is LIMITING REACTANT: N2 is the Limiting Reactant)*

Grams of Product (List the Product and the Amount): **0.75168 g NH3**

Reaction Type: **Combination or Single Displacement (which is also called Oxidation-Reduction)**

? g NH3 = 61.802 cg N2 x 1 g N2 x 1 mol N2 x 2 mol NH3 x 17.04 g NH3 = 0.75168 g NH3  \*\*\*\*\*\*\* Limiting Reactant is N2  
 1 x 102 cg N2 28.02 g N2 1 mol N2 1 mol NH3

? g NH3 = 61.802 cg H2 x 1 g H2 x 1 mol H2 x 2 mol NH3 x 17.04 g NH3 = 3.3756 g NH3  
 1 x 102 g H2 2.02 g H2 3 mol H2 1 mol NH3

How much N2 remains in the vessel?

You will use the LIMITING REACTANT and determine how much H2 was USED in the RXN.

? g NH3 = 61.802 cg N2 x 1 g N2 x 1 mol N2 x 3 mol H2 x 2.02 g H2 = 0.13366 g H2  
 1 x 102 cg N2 28.02 g N2 1 mol N2 1 mol H2

Amount of H2 Remaining in the Container = H2 amount given - H2 amount used = 0.61802 g H2 GIVEN - 0.13366 g H2 USED = 0.48436 g of H2 LEFT OVER

1. **Ca(OH)2 (aq) + H2SO4 (aq) → + 2 H2O (l) + CaSO4 (aq)** *(This is LIMITING REACTANT: H2SO4 is the Limiting Reactant)*

Reaction Type: **Neutralization**  
Grams of Product (List the Product and the Amount): **0.180 g H2O and 0.681 g CaSO4**

? g H2O = 1.839 g Ca(OH)2 x 1 mol Ca(OH)2 x 2 mol H2O x 18.02 g H2O = 0.8944 g H2O  
 74.10 g Ca(OH)2  1 mol Ca(OH)2 1 mol H2O

? g H2O = 25.0 mL H2SO4 x \_\_1 L H2SO4\_\_ x 0.200 mol H2SO4  x 2 mol H2O x 18.02 g H2O = 0.180 g H2O  
 1000 mL H2SO4 1 L H2SO4 1 mol H2SO4 1 mol H2O

ONLY USE THE *Limiting Reactant* TO DETERMINE THE AMOUNT OF THE REMAINING PRODUCT(S).

? g H2O = 25.0 mL H2SO4 x \_\_1 L H2SO4\_\_ x 0.200 mol H2SO4  x 1 mol CaSO4 x 136.14 g CaSO4 = 0.681 g CaSO4  
 1000 mL H2SO4 1 L H2SO4 1 mol H2SO4 1 mol CaSO4

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

4**.  Zn (s) + 2 HCl (aq) → ZnCl2 (aq) + H2 (g)***(This is just stoichiometry.)*

 Reaction Type: **Single Displacement**  
Grams of Product (List the Product and the Amount): **7.48 x 102 g ZnCl2  and 1.11 x 101 g H2**  
  
? g ZnCl2 = 3.59 x 102 g Zn x \_\_1 mol Zn x 1 mol ZnCl2 x 136.27 g ZnCl2 = 7.48 x 102 g ZnCl2  
 65.37 g Zn 1 mol Zn 1 mol ZnCl2  
  
? g H2 = 3.59 x 102 g Zn x \_\_1 mol Zn x 1 mol H2 x 2.02 g H2 = 1.11 x 101 g H2  
 65.37 g Zn 1 mol Zn 1 mol H2

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

5**.  2 H2O2 (aq) → 2 H2O (l) + O2 (g)**     *(This is just stoichiometry.)*

Reaction Type: **Decomposition**  
Grams of Product (List the Product and the Amount): **1.12 x 10-3 g H2O and 9.92 x 10-4 g O2**   
  
? g H2O = 2.11 mg H2O2 x \_\_1 g H2O2  x \_1 mol H2O2 x 2 mol H2O x 18.02 g H2O = 1.12 x 10-3 g H2O  
 1000 mg H2O2 34.02 g H2O2 2 mol H2O2 1 mol H2O

? g O2 = 2.11 mg H2O2 x \_\_1 g H2O2  x \_1 mol H2O2 x 1 mol O2 x 32.00 g O2 = 9.92 x 10-4 g O2  
 1000 mg H2O2 34.02 g H2O2 2 mol H2O2 1 mol O2

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

6**.  CuSO4 . 5 H2O (s) → CuSO4 (s) + 5 H2O (g)**  *(This is just stoichiometry.)*

Reaction Type: **Decomposition**  
Grams of Product (List the Product and the Amount): **5.704 g CuSO4 and 3.220 g H2O**  
  
? g CuSO4 = 8.924 g CuSO4 . 5 H2O x \_\_\_1 mol CuSO4 . H2O x \_\_1 mol CuSO4  x 159.60 g CuSO4 = 5.704 g CuSO4  
 249.70 g CuSO4 . 5 H2O 1 mol CuSO4 . H2O 1 mol CuSO4

? g CuSO4 = 8.924 g CuSO4 . 5 H2O x \_\_\_1 mol CuSO4 . H2O x \_\_5 mol H2O x 18.02 g H2O = 3.220 g H2O  
 249.70 g CuSO4 . 5 H2O 1 mol CuSO4 . H2O 1 mol H2O

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

7. **CH4 (g) + 2 O2 (g) → CO2 (g) + 2 H2O (g)** *(This is just stoichiometry.)*

Reaction Type; **Combustion**   
  
 Grams of Product (List the Product and the Amount): **1.18 x 10¯8 g CH4 and 9.70 x 10¯9 g H2O**  
   
 ? g CO2 = 4.32 ng CH4 x \_\_1 g CH4  x 1 mol CH4 x 1 mol CO2 x 44.01 g CO2  = 1.18 x 10¯8 g CH4  
 1 x 109 ng CH4 16.05 g CH4 1 mol CH4 1 mol CO2

? g H2O = 4.32 ng CH4 x \_\_1 g CH4  x 1 mol CH4 x 2 mol H2O x 18.02 g H2O = 9.70 x 10¯9 g H2O  
 1 x 109 ng CH4 16.05 g CH4 1 mol CH4 1 mol H2O

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

8. **Na2C2O4 (aq) + CaCl2 (aq)** **→ 2 NaCl (aq) + CaC2O4 (s)** *(This is LIMITING REACTANT: Na2C2O4 is the Limiting Reactant)*

**Reaction Type: Precipitation**

Grams of Product (List the Product and the Amount): **7.481 x 10¯2 g NaCl and 8.200 x 10¯2 g CaC2O4**

? g NaCl = 5.92 g Na2C2O4 x \_\_1 mol Na2C2O4 x \_2 mol NaCl x 58.44 g NaCl = 7.481 x 10¯2 g NaCl  
 208.24 g Na2C2O4  1 mol Na2C2O4 1 mol NaCl

? g NaCl = 13.33 g CaCl2 x \_\_1 mol CaCl2 x \_2 mol NaCl x 58.44 g NaCl = 1.404 x 10¯1 g NaCl  
 110.98 g CaCl2 1 mol CaCl2 1 mol NaCl

ONLY USE THE *Limiting Reactant* TO DETERMINE THE AMOUNT OF THE REMAINING PRODUCT(S).

? g CaC2O4 = 13.33 cg Na2C2O4 x \_\_1 mol Na2C2O4 x \_1 mol CaC2O4 x 128.10 g CaC2O4 = 8.200 x 10¯2 g CaC2O4  
 208.24 g Na2C2O4  1 mol Na2C2O4 1 mol CaC2O4

**YOU MUST CALCULATE THE AMOUNT OF EXCESS REACTANT LEFT OVER AT THE END OF THE REACTION!!!!!!!**

9.  Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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10. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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11. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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12. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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13. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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14. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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15. Balanced Equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                                                                                                   Reaction Type\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                                                 
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