Name: _____ Date: _____ Period: _____

Lab: Types of Chemical Reactions

ESSENTIAL QUESTION: How do we represent chemical reactions as a chemical equation?

BACKGROUND- See class handout.

PRELAB:

1. What is a chemical reaction (in your own words)?

2. Where are the reactants and products in a chemical equation?

3. → means "_____" when reading a chemical equation.

4. What does the abbreviation (aq) mean in a chemical equation?

5. Restate the 5 signs or evidence that a chemical reaction has taken place.

6. From the reading:
   a. Describe how $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ is an example of a synthesis reaction.

   b. Describe how $2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$ is an example of a decomposition reaction.

   c. Describe how $Cl_2(g) + 2KBr(aq) \rightarrow 2KCl(g) + Br_2(l)$ is an example of a single replacement reaction.

   d. Describe how $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$ is an example of a double replacement reaction.

PROCEDURE:

Part A: Copper and magnesium

1. Use the steel wool to clean a piece of copper wire until the wire is shiny. Record the appearance of the wire.
2. Light the Bunsen burner.
3. Using the tongs, hold the wire in the hottest part of the flame for 1-2 minutes. Record what happens during the reaction.
4. After the reaction, record the appearance of the wire, noting any changes.
5. Place an evaporating dish near the base of the burner. Record the appearance of a piece of magnesium ribbon.
6. Using the tongs, hold the magnesium in the hottest part of the flame. DO NOT LOOK DIRECTLY AT THE BURNING MAGNESIUM. HOLD THE BURNING MAGNESIUM OVER THE EVAPORATING DISH AND AWAY FROM YOU. Record what happens during the reaction.
7. After the reaction, record the appearance of the magnesium, noting any changes.
8. Put the copper wire back in the lab bin and put the magnesium remains in the trash.

Part B: Copper(II) carbonate

1. Place a heaping scoop of copper(II) carbonate in a clean, dry test tube. Record the appearance of the solid.

2. Using a test tube holder, hold the tube over a Bunsen burner flame to heat the solid. Record what happens during the reaction. POINT THE TUBE AWAY FROM YOURSELF AND OTHERS!
3. Turn off the burner. Light a wood splint and insert it into the test tube. If CO_2 gas is present, it will put the flame out.
4. Record any change in appearance of the solid in the test tube.
5. Dispose of the solid in the Part B waste container in the fume hood.

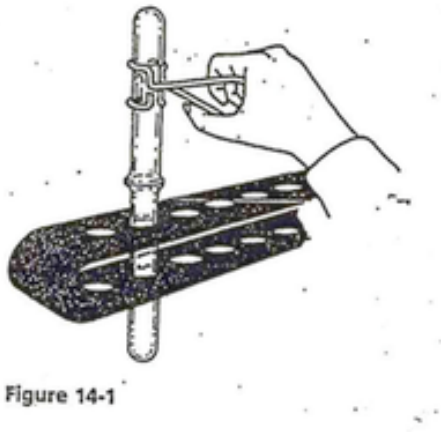
Figure 14-1

Part C: Hydrochloric acid and zinc, copper(II) sulfate and zinc

1. Add about 5 mL of 3 M hydrochloric acid to a clean, dry test tube. HANDLE ACID WITH CARE- IT CAN CAUSE PAINFUL BURNS!
2. Carefully add a small piece of zinc to the acid. Quickly hold the other test tube (of the same size) over the top to collect the gas that forms. Record observations of the reaction. KEEP THE TEST TUBES TOGETHER- DON'T LET THE GAS OUT!
3. One partner should light a wood splint while the other partner holds the two test tubes. Hold the burning splint to the mouth of the test tubes. Open the test tubes toward the burning splint. A "pop" indicates the presence and burning of hydrogen gas.
4. Record the appearance of the substances in the reaction tube. Feel the outside of the test tube that holds the substances- record any observations.
5. Pour the contents in the test tube into the HCl/Zn waste container in the fume hood.
6. Add about 5 mL of 1 M copper(II) sulfate solution to another clean, dry test tube. Place a small amount of zinc in the tube.
7. Go on the part D and come back later to record observations of the substances.
8. After recording observations, dispose of materials in the $CuSO_4$ waste container.

Part D: Potassium iodide and lead(II) nitrate, sodium carbonate and hydrochloric acid

1. Get out the reaction sheet for small-scale labs.
2. Make observations of the potassium iodide and of the lead(II) nitrate solutions (found in the tiny pipettes).
3. In one square of the sheet protector, add a few drops of the KI from the dropper and then add a few drops of the $Pb(NO_3)_2$. Record your observations.
4. In another square, make a small pile of sodium carbonate. Use your scoop to make a small dent in the top of the pile.
5. Make observations of the sodium carbonate and hydrochloric acid in the bottle.
6. Using the pipette, add about 1 mL of the 3 M HCl onto the pile. Record what happens during the reaction and what the substances look like after the reaction.
7. Use a paper towel to wipe the sheet protector clean and put it in the trash.
8. Rinse off the sheet protector and any other lab supplies that still need cleaning
9. WASH YOUR HANDS and wipe down your lab station.

DATA: Observations of chemical reactions.

Reaction	Before	During reaction	After
$Cu + O_2$			
$Mg + O_2$			
$CuCO_3$			
$Zn + HCl$			
$H_2 + O_2$			
$Zn + CuSO_4$			
$KI + Pb(NO_3)_2$			
$Na_2CO_3 + HCl$			

INTERPRETATIONS/ANALYSIS:

*Balance each of the equations by inserting the proper coefficients where needed.
For a few reactions, you need to determine what the products will be BEFORE balancing!
*Write the names of the reactant(s) and product(s) below the molecular equation for each reaction.

PART A:

1. Solid copper and oxygen gas react to form solid copper(II) oxide.
(Hint! Before you balance, you must write the formulas with states of matter!)

2. $Mg\ (s) + O_2\ (g) \rightarrow$ _____ (s)

PART B:

3. $CuCO_3\ (s) \rightarrow CuO\ (s) + CO_2\ (g)$

PART C:

4. $Zn\ (s) + HCl\ (aq) \rightarrow$ _____$(aq) +$ _____ (g)
*(** Hint: Zn will have a +2 charge!)*

5. Hydrogen gas and oxygen gas react to form dihydrogen monoxide gas.
(Hint! Before you balance, you must write the formulas with states of matter!)

6. $Zn\ (s) + CuSO_4\ (aq) \rightarrow ZnSO_4\ (aq) + Cu\ (s)$

PART D:

7. $Pb(NO_3)_2\ (aq) + KI\ (aq) \rightarrow$ _____ $(aq) +$ _____ (s)

8. $Na_2CO_3\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l) + CO_2\ (g)$

CONCLUSIONS AND POST LAB QUESTIONS-

1. Identify each type of reaction as either single replacement, double replacement, synthesis or decomposition
   a. Part A reactions are:

   b. Part B reactions are:

   c. Part C reactions (#4 and #5) are:

   d. Part D reaction #7 is:

2. What evidence indicated that a chemical reaction took place? Name at least 2 specific examples and their reaction from the lab. *Use complete sentences and restate the question in your answer.*

3. In this experiment, what method was used to test for the presence of CO_2 gas? What test was used to identify hydrogen gas? For each, explain what the result should be to indicate the gas is present. *Use complete sentences and restate the question in your answer.*

4. Looking at chemical equation #1 in Part A above, the formula of the product is CuO. What does this mean about the charge on the copper ion in this compound? *Use complete sentences and restate the question in your answer.*

5. Looking at chemical equation #2 in Part A above, why is the formula of the product MgO, not MgO_2? *Use complete sentences and restate the question in your answer.*

6. Looking at chemical equations #4 and #5 in Part C above, why is the product hydrogen written as H_2 (subscript 2)? *Use complete sentences and restate the question in your answer.*

7. Which of the reactions were exothermic (you may need to look up this definition)? List all that apply. For each reaction, state what evidence did you see that let you know the reaction was exothermic. *Use complete sentences and restate the question in your answer.*

8. Extra Practice: Balance the equations below and identify the type of reaction represented by each equation.

a) $AgNO_3$ (*aq*) + Cu (*s*) → $Cu(NO_3)_2$ (*aq*) + Ag (*s*) _____

b) $BaCl_2$ (*aq*) + Na_2SO_4 (*aq*) → $BaSO_4$ (*s*) + NaCl (*aq*) _____

c) Cl_2 (*g*) + NaBr (*aq*) → NaCl (*aq*) + Br_2 (*l*) _____

d) $KClO_3$ (*s*) → KCl (*s*) + O_2 (*g*) _____

e) $AlCl_3$ (*aq*) + NH_4OH (*aq*) → NH_4Cl (*aq*) + $Al(OH)_3$ (*s*) _____

f) H_2 (*g*) + O_2 (*g*) → H_2O (*g*) _____

g) CH_4 (g) + O_2 (g) → CO_2 (g) + H_2O (g) _____