Describing Chemical Reactions

Introduction and Purpose

Procedure

Carry out the reactions using the approximate quantities of reagents suggested. Unless otherwise stated, use test tubes. When heating reagents in test tubes, slant the test tube so that the opening is pointed *away* from people. Heat the test tube at the surface of the material and work down towards the bottom of the tube. Discard solutions down the drain, wash and rinse your glassware. Discard solid waste in the waste cans on the lab tables. In the data section you will balance the equation, write the word equation and record your observations.

A. Combination (Synthesis) reactions:

1. Grasp a strip of magnesium ribbon in crucible tongs and ignite it in the burner flame. Hold it over a watch glass. Do not look directly at the flame! Add a few drops of distilled H_2O to the ash. Stir with a stirring rod and place a drop of the solution on red litmus paper. Red litmus turning blue is evidence for the presence of a base.

2. Heat a piece of copper metal strongly in the Bunsen burner flame for about 30 s. Remove the copper from the flame and note the change in appearance. Discard the product in the solid waste can.

B. Decomposition reactions:

1. Place about 1 scoopful of solid sodium hydrogen carbonate $NaHCO_3$ into a dry test tube. Mass the test tube with the powder. Heat the sodium hydrogen carbonate in the test tube strongly for 2 minutes. Observe any changes that occur during the heating. Toward the end of the heating, light a wood splint and insert the flaming splint into the mouth of the test tube. Note what happens to the splint. Once the tube has cooled, mass the tube and contents again.

C. Single replacement reactions:

1. Place a strip of copper in a test tube with enough 0.1M $AgNO_3$ to cover it. Set this test tube aside, then observe the surface of the metal after 5-10 minutes.

2. Place a couple of pieces of mossy zinc metal in a test tube approximately 1/4 full of 3M HCl. Cover the tube with a larger test tube. After a few minutes, light a wood splint and lift up the small test tube and insert the flaming splint into the mouth of the test tube. Hold the test tube in your hand to feel if the temperature has changed.

D. Double replacement reactions:

1. Add 0.1M $AgNO_3$ to a test tube to a depth of about 1 cm. Add a similar quantity of 0.1M $CaCl_2$ solution. Observe the reaction.

2. Place a scoopful of solid Na_2CO_3 in a test tube to a depth of about 1 cm. Add a dropperful of 3M HCl. While the reaction is occurring, test with a flaming splint as in part B.
   Check to see if the temperature of the mixture has changed.

E. Combustion reactions:

1. Place about 10 drops of isopropyl alcohol, C_3H_7OH, in a small evaporating dish. Ignite the alcohol from the top of the liquid with a Bunsen burner. Hold a cold watch glass well above the flame and observe the condensation of water on the bottom. The formation of the mist will be fleeting; watch closely.

Lab Report

Your lab report should include the **purpose of the lab,** the completed data and evaluation sheet, and **answers (in complete sentences) to the following questions on a separate piece of paper. Include a conclusion** following the guidelines on your long lab writeup. You can type or write out your answers.

1. What are some of the observable changes that are evidence that a chemical reaction has taken place?

2. How did the flaming splint behave when it was inserted into the tube with $CO_{2\ (g)}$? In what way was this different from the reaction of the $H_{2(g)}$ to the flaming splint?

3. In the reaction of magnesium with oxygen gas, a considerable amount of energy was released. This is an example of an *exothermic* reaction. From this evidence what can you conclude about the energy stored in the reactants compared to the energy stored in the product? What other examples of exothermic reactions did you observe? Re-write the balanced equation for the reaction of Mg and O_2, this time with the term "+ energy" on the appropriate side of the equation.

4. You had to heat the $NaHCO_3$ strongly in order for it to decompose. This is an example of an *endothermic* reaction. What does this tell you about the energy stored in the reactants compared to the energy stored in the product? Write the balanced equation for the decomposition of $NaHCO_3$, this time with the term "+ energy" on the appropriate side of the equation.

Name: _____ Per: _____ Date: _____

Purpose:_____

_____

_____

Data and Evaluation

Record your observations and balance the equations in the section below.

A. Combination reactions:

1. Observations:

1. _____ Mg + ____O_2 → _____ MgO

Write equation out using words:

2. Observations:

2. _____ MgO + __ H_2O → ___ $Mg(OH)_2$ (aq)

Write equation out using words:

3. Observations:

3. _____ Cu + _____ O_2 --> _____CuO

Write equation out using words:

B. Decomposition reactions

4. Observations:

4. _____ $NaHCO_3$ → ____ Na_2CO_3 + _____ H_2O + ___ CO_2 (g)

Write equation out using words:

C. Single replacement reactions

5. Observations:

5. _____ $AgNO_{3\,(aq)}$ + __ Cu → ____ Ag + ____ $Cu(NO_3)_{2\,(aq)}$
Write equation out using words:

6. Observations

6. _____ Zn + ____ $HCl_{(aq)}$ → _____$ZnCl_{2(aq)}$ + _____$H_{2(g)}$
Write equation out using words:

D. Double replacement reactions

7. Observations

7. _____$AgNO_{3(aq)}$ + ____ $CaCl_{2(aq)}$ → ____ $AgCl_{(s)}$ + _____ $Ca(NO_3)_{2(aq)}$
Write equation out using words:

8. Observations

8. _____ Na_2CO_3 + _____ $HCl_{\,(aq)}$ → _____$NaCl_{(aq)}$ + _____ H_2O + ___$CO_{2(g)}$
Write equation out using words:

E. Combustion reactions

9. Observations

9. _____$C_3H_7OH_{(l)}$ + ____ $O_{2(g)}$ → ___ $CO_{2(g)}$ + __$H_2O_{(g)}$
Write equation out using words:

Post-lab Discussion

Groups prepare White Board presentations for selected reactions describing:

- Reaction Type
- Observed evidence for a reaction (what proof that a chemical change actually occurred?)
- Balanced equation for the reaction
- Word equation: describe the reaction in standard English
- Is this an endothermic or exothermic reaction?(if observed: double replacement not obvious)
- Add energy into the equation on the correct side.
- Explain your reasoning for the side of the equation you put it on
- Did the chemical energy in your particle system increase or decrease during this change?
- Particle diagram of mixture before and after reaction is complete