TYPES OF CHEMICAL REACTIONS

There are many different types of chemical reactions and ways of classifying them. One popular method is to classify reactions into four types: (1) synthesis or combination (2) decomposition or analysis (3) single replacement (4) double replacement or ion exchange. Although not all chemical reactions can be placed into these categories, many can.

In this experiment, you will observe examples of the four types of reactions listed above and write equations representing the observed reactions.

EQUIPMENT

burner	crucible tongs	microspatula
test tubes (7)	test tube holder	test tube rack
wood splints	sandpaper	goggles
evaporating dish		

MATERIALS

zinc	copper wire	magnesium ribbon
copper(II) carbonate	6 M HCl	1 M $CuSO_4$
0.1 M $Zn(C_2H_3O_2)_2$	0.1 M Na_3PO_4	1 M Na_2SO_3

PROCEDURE

1. Prepare a data table for this experiment. In it, label the name of the reactant(s) and space for a) a description of the reactants and b) a description of the products.

2. Synthesis

   a) Use a piece of sandpaper to clean a piece of copper wire until the wire is shiny. Note the appearance of the copper wire. Using crucible tongs, hold the wire in the hottest part of the burner flame for 1-2 minutes. Examine the wire and note any changes in its appearance caused by the heat.

   b) Place an evaporating dish handy to the base of the burner. Examine a piece of magnesium ribbon. Using crucible tongs, hold the ribbon in the burner until the magnesium starts to burn. DO NOT LOOK DIRECTLY AT THE FLAME. HOLD THE BURNING MAGNESIUM AWAY FROM YOU AND DIRECTLY OVER THE EVAPORATING DISH. When the ribbon stops burning, examine and describe the material in the evaporating dish.

3. Decomposition

Place 2 heaping microspatulas of copper(II) carbonate in a clean dry testtube. Note its appearance. Using a testtube holder, heat the $CuCO_3$ strongly in a burner flame for about 3 minutes. Extinguish the burner flame and insert a burning wood splint in the testtube to test for the presence of CO_2 gas, which will put the flame out. Note any change in the appearance of the material in the test tube.

4. Single Replacement

a) Stand a clean, dry testtube in a testtube rack. Add about 5 mL of 6 M hydrochloric acid to the tube.
CAUTION: *Handle this acid, and all acids, with care. They can cause painful burns.*
Carefully drop a small piece of Zn metal in the tube. Observe and record what happens.
Using a testtube holder, invert a second testtube over the mouth of the testtube in which the reaction is taking place. Remove the tube after about 30 seconds and insert a burning wood splint into the mouth of the tube. Note what happens as well as the appearance of the substance in the first testtube.

b) Add about 5 mL of 1 M copper(II) sulfate solution to a clean dry, testtube. Place a small piece of Zn metal in the solution. Wait a few minutes and note any changes in the mixture.

5. Double Replacement

a) Add about 2 mL of 0.1 M zinc acetate solution to a clean, dry testtube. Next, add about 2 mL of 0.1 M sodium phosphate solution to the same testtube. Observe what happens; note any changes.

b) Add about 5 mL of 1 M sodium sulfite solution to a clean, dry testtube. To this solution, add about 1 mL of 6 M HCl. Observe the odor given off by the mixture by wafting some of the gas toward your nose. DO NOT SMELL THE GAS DIRECTLY!

CALCULATIONS

A. Write a balanced equation (molecular) for each of the reactions which you performed in this laboratory.

1. copper metal + oxygen gas gives copper(II) oxide

2. magnesium metal + oxygen gas gives magnesium oxide

3. copper(II) carbonate decomposes to carbon dioxide and copper(II) oxide

4. zinc metal + hydrochloric acid gives hydrogen gas and a solution of zinc chloride

5. zinc metal + copper(II) sulfate solution gives copper metal and zinc sulfate solution

6. solutions of zinc acetate and sodium phosphate give a precipitate of zinc phosphate and a solution of sodium acetate

7. solutions of sodium sulfite and hydrochloric acid give a solution of sodium chloride, water, and sulfur dioxide gas

B. For the reactions represented in equations #4 – 7 above, write the net ionic equation.

QUESTIONS AND CONCLUSIONS

1. In this lab, what method was used to test for the presence of carbon dioxide gas?

2. What test is used to test for the presence of hydrogen gas? Write the chemical reaction for this reaction? (Hint: one of the reactants is present in air)

3. Write a molecular equation for each equation below. If the reaction does not occur, write no reactions after the potential products. If the reaction does occurs, balance the molecular equation (include phase of each species) and give the net ionic equation.

   a. Copper metal is added to a solution of silver nitrate.

   b. A solution of barium chloride is added to a solution of potassium sulfate?

   c. Chlorine gas is bubbled through a solution of potassium bromide?

   d. Solid potassium decomposes. Hint: Look at previous labs (NO NET IONIC EQUATION)?

   e. A solution of sodium hydroxide is added to a solution of sulfurous acid?

   f. A solution of potassium carbonate is added to acetic acid?