

## 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 $\text{CuSO}_4$          |
| 0.1 M $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$ | 0.1 M $\text{Na}_2\text{PO}_4$ | 1 M $\text{Na}_2\text{SO}_3$ |

### 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  $\text{CuCO}_3$  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  $\text{CO}_2$  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!