Chemical Change Lab

In this experiment, you will observe a sequence of changes that occur when a solution that begins as copper (II) nitrate is subjected to a series of different reactions. All of the reactions will take place in the same test tube. At each step, you will look for evidence that a new substance has formed as a result of a chemical change. You will also observe energy changes and relate them to chemical reactions.

Purpose

Observeevidence that a chemical change has taken place.

Identifyand record observations that show energy changes that occur during a chemical reaction.

Identify products that form from chemical reactions.

Materials

* aluminum wire, 12 cm
* beaker, 100 mL
* Bunsen burner
* striker
* copper(II) nitrate, 1.0 M
* glass stirring rod
* HCl, 1.0 M
* NaOH, 1.0 M
* ring stand
* safety goggles
* test tube
* test-tube brush
* wire gauze

**Always wear safety goggles to protect your eyes.** If you get a chemical in your eyes, immediately flush



the chemical out at the eyewash station while calling to your teacher. Know the location of the emergency lab shower and the eyewash station and the procedures for using them.

**Do not touch any chemicals.** If you get a chemical on your skin or clothing, wash the chemical off at the sink while calling to your teacher. Make sure



you carefully read the labels and follow the precautions on all containers of chemicals that you use. If there are no precautions stated on the label, ask your teacher what precautions to follow. Do not taste any chemicals or items used in the laboratory. Never return leftover chemicals to their original containers; take only small amounts to avoid wasting supplies.

**Call your teacher in the event of a spill.** Spills should be cleaned up promptly, according to your teacher’s directions.

**Acids and bases are corrosive.** If an acid or base spills onto your skin or clothing, wash the area immediately with running water. Call your teacher in the event of an acid spill. Acid or base spills should be cleaned up promptly.

**Never put broken glass in a regular waste container.** Broken glass should be disposed of separately according to your teacher’s instructions.



**Do not heat glassware that is broken, chipped, or cracked.** Use tongs or a hot mitt to handle heated glassware and other equipment because hot



glassware does not always look hot.

**When using a Bunsen burner, confine long hair and loose clothing.** If your clothing catches on fire, WALK to the emergency lab shower and use



it to put out the fire.

When heating a substance in a test tube, the mouth of the test tube should point away from where you and others are standing. Watch the test tube at all times to prevent the contents from boiling over.

# Procedure

1. Put on safety goggles before beginning the experiment.
2. Place 50 mL of water into the 100 mL beaker and heat it until boiling. This will be the water bath you will use in **Step 6.**
3. Add 2 mL of 1.0 M copper(II) nitrate to the test tube, as shown in figure 1.
4. Then add 2 mL of 1.0 M sodium hydroxide (NaOH) to the test tube, as shown in **Figure 2. CAUTION: Sodium hydroxide is corrosive. Be certain to wear safety goggles at all times. Avoid contact with skin and eyes. If any of this solution should spill on you, immediately flush the area with water and then notify your teacher.**

Mix the solutions with the stirring rod. Rinse the stirring rod thoroughly before setting it down on the lab table. Touch the bottom of the outside of the test tube to see if energy has been released. The copper-containing product in the test tube is copper(II) hydroxide. The other product is sodium nitrate.

Record the changes that occur in the test tube in the space provided below.

## Observations:

1. M

hydrochloric acid

1. M

sodium

hydroxide

1. M

copper (II)

nitrate

Figure 2

Figure 3

Figure 1

1. Put the test tube into the water bath you prepared in **Step 2.** Heat it until no more changes occur. The products of this reaction are copper(II) oxide and water. Record the changes that occur in the test tube.

## Observations:

1. Remove the test tube from the hot-water bath. Turn off the burner. Cool the test tube and its contents for 2 min in room-temperature water. Add 2 mL of 1.0 M hydrochloric acid (HCl) to the test tube, as shown in **Figure 3.**

## CAUTION: Hydrochloric acid is corrosive. Be certain to wear safety goggles at all times. Avoid contact with skin and eyes. Avoid breathing vapors. If any of this solution should spill on you, immediately flush the area with water and then notify your teacher.

Mix with the stirring rod. Rinse the stirring rod.

The new products are copper(II) chloride and water. Record the changes that occur in the test tube.

## Observations:

1. Place a 12-cm piece of aluminum wire in the test tube. Leave it until no reaction is observed. Touch the bottom of the test tube to check for temperature change. Two reactions take place. Copper(II) chloride and aluminum produce copper and aluminum chloride. The aluminum also reacts with the hydrochloric acid to form hydrogen and aluminum chloride. Record the changes that occur in the test tube.

## Observations:

1. Remove the wire from the test tube. Clean all apparatus and your lab station. Return equipment to its proper place. Dispose of chemicals and solutions in the containers designated by your teacher. Do not pour any chemicals down the drain or put them in the trash unless your teacher directs you to do so. Wash your hands thoroughly after all work is finished and before you leave the lab.

# Analysis

1. Identify and explain the four types of observations that indicate a chemical reaction is taking place.
2. Compare and contrast chemical changes vs. physical changes. Give an example of each.
3. In the last step of this experiment, what phase is the aluminum chloride in? How could you recover it?
4. Refer to the procedure to review each reaction conducted during the experiment. Then write the complete balanced equation for each reaction that occurs.
   1. Copper (II) nitrate + sodium hydroxide →
   2. Copper (II) hydroxide + energy →
   3. Copper (II) oxide + hydrochloric acid →
   4. Copper (II) chloride + aluminum →
   5. Hydrochloric acid + aluminum →