

## Honors Chemistry Lab #5: Evidence for Chemical Change

**Objectives:** To observe evidence that a *chemical change* has taken place, infer from observations that a *new substance* has formed, identify and record observations that show *heat* is involved in chemical changes, observe the *color and solubility* of some substances, and to continue getting practice writing *word equations*.

**Precautions:** Wear your goggles at all times. Do not touch the chemicals with your bare hands. If it spills on you, wash off with copious of water in the sink and notify the teacher.

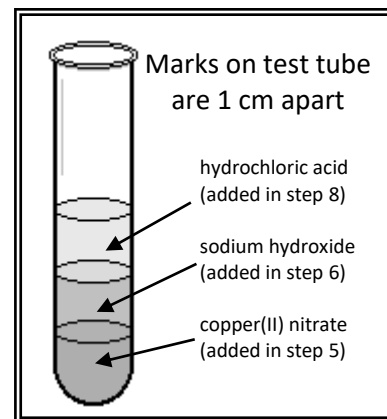
**Materials:**

1.0 M copper(II) nitrate, $\text{Cu}(\text{NO}_3)_2$	12 cm aluminum ribbon	glass stirring rod
1.0 M hydrochloric acid, HCl	Sharpie marker	250 mL glass beaker
1.0 M sodium hydroxide, NaOH	ruler	hot plate
test tube	plastic beaker (water)	beaker tongs

**Procedure:** Follow the sequence of events exactly, or the series of reactions will not work properly.

- Place approx. 150 mL of water (from the sink) into the 250 mL glass beaker. This does not need to be measured exactly. Gently place the beaker on the hot plate and turn it to HIGH. You will heat this water until it is at a gentle boil. This will be the water bath you will use to heat the test tube contents in step 6.
- Use this table to record your observations in subsequent steps of the lab.

Step	Observation
7	
8	
10	
11	
12	



- While the water bath is heating, use the lab marker and the ruler to make three marks on the test tube that are 1 cm apart. Make the marks starting at the bottom of the test tube, moving towards the top. See the figure to the right.
  - Fill a plastic beaker a little over halfway with water. Place this out of the way for now.
- Note:** While one lab partner holds the test tube, the other lab partner should perform steps 5, 6, and 7.
- Add enough of the 1.0 M copper(II) nitrate to fill to the first mark on the test tube, as shown in the figure.
  - Add enough of the sodium hydroxide to fill to the second mark on the test tube, as shown in the figure. Mix this solution with the glass stirring rod. Rinse the stirring rod off in the sink before you set it back down on the lab table.
  - Gently touch the bottom of the test tube with your finger to see if heat is being released as the reaction takes place.

**Note:** Predict the products of this reaction.

Record your observations in the data table above. Be very specific in describing what you see.

- Using the beaker tongs, gently place the test tube into the gently-boiling water bath you prepared in step 1. Watch the test tube closely, as you will observe some changes occurring. Heat the contents of the test tube until no more changes occur.

**Note:** The products of this decomposition reaction are copper(II) oxide and water.

Record the changes that took place in the data table above. Be very specific in describing what you see.

- Remove the test tube from the water bath with the test tube tongs. Turn off the hot plate. Cool off the test tube contents for about 2 minutes in room temperature water in the plastic beaker. Be careful not to get any more water into the test tube.
- When the test tube has cooled, add enough 1.0 M hydrochloric acid to fill to the third mark on the test tube, as shown in the figure. Wipe off the stirring rod with a dry paper towel and then mix the contents of the test tube. Rinse off the stirring rod in the sink.

**Note:** Predict the products of this reaction.

Record the changes that took place in the data table on the other side of this sheet. Be very specific in describing what you see.

- Place a 12 cm piece of folded aluminum foil in the test tube. Watch closely—you will begin to see a change occur. Leave the aluminum in the test tube until no reaction is observed. Touch (gently with your finger) the bottom of the test tube to see if heat is being released as the reaction takes place.

**Note:** Two reactions are taking place. Copper(II) chloride and aluminum react. The aluminum also reacts with the hydrochloric acid. Predict the products for both these reactions.

Record the changes that took place in the data table on the other side of this sheet. Be very specific in describing what you see.

- Remove the foil from the test tube. Compare the copper that was formed to the copper you would see on a penny. How are they alike? How are they different? Record the changes that took place in the data table on the other side of this sheet. Be very specific in describing what you see.
- Bring your test tube (and all of its contents) to the teacher for disposal. Do not pour anything down the drain. Rinse out all other glassware and dry it with a paper towel. Wash your hands thoroughly.

#### Post Lab Questions:

- Refer to the procedure steps 7 – 11 (shaded predictions), then complete and balance the following equations.
  - copper(II) nitrate + sodium hydroxide →
  - copper(II) hydroxide + heat →
  - copper(II) oxide + hydrochloric acid →
  - copper(II) chloride + aluminum →
  - hydrochloric acid + aluminum →
- Which of the following reactions above (a-e) could be categorized as oxidation-reduction reactions?
- For the identified redox reactions in question 2, label the oxidizing and reducing agents.
- Write and balance the half reactions for one of your identified redox reactions.

Self-assess your lab report using the rubric/checklist