

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*.

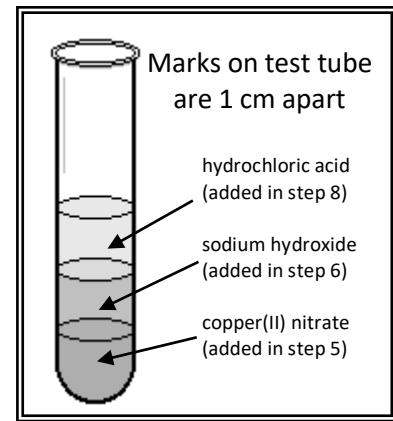
Precautions: Wear your goggles at all times. Do not touch the chemicals with your bare hands. If it spills on you, wash off with copious of water in the sink and notify the teacher.

<u>Materials:</u>	1.0 M copper(II) nitrate, Cu(NO ₃) ₂ 1.0 M hydrochloric acid, HCl 1.0 M sodium hydroxide, NaOH test tube	12 cm aluminum ribbon Sharpie marker ruler Styrofoam cup (water)	glass stirring rod 250 mL beaker (150 mL water) hot plate beaker tongs
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Procedure: Follow the sequence of events exactly, or the series of reactions will not work properly.

1. Place approx. 150 mL of water (from the sink) into the 250 mL 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.
2. Use this table to record your observations in subsequent steps of the lab.

Step	Observation
7	
8	
10	
11	
12	



3. 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.
4. Fill a Styrofoam cup a little over halfway with water (from the sink). 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.

5. 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.
6. Add enough of the sodium hydroxide up 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.
7. Gently touch the bottom of the test tube with your finger to see if heat is being released as the reaction takes place.

Note: The copper-containing product in the bottom of the test tube is copper(II) hydroxide. The other product is sodium nitrate.

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

8. 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. Watch closely—you will begin to see a change occur. Heat the contents of the test tube until no more changes occur.

Note: The products of this 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.

9. 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 Styrofoam cup. Be careful not to get any more water into the test tube.
10. 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: The products of this reaction are copper(II) chloride and water.

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.

11. Place a 12 cm piece of aluminum wire in the test tube. Watch closely—you will begin to see a change occur. Leave the aluminum ribbon 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 produce copper and aluminum chloride. The aluminum also reacts with the hydrochloric acid to form hydrogen gas and aluminum chloride.

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.

12. Remove the wire 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.
13. 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.

Questions: Answer these questions from your observations in the lab.

1. What are some causes of chemical changes
2. In what two ways is heat involved in chemical change? Cite specific examples from this experiment.
3. In step 11, where is the aluminum chloride?
4. What is the color of solutions that contain copper compounds?
5. Using the chemical names of the compounds, tell what substances involved in this experiment dissolve in water: Which ones do not dissolve?
6. Refer to the procedure steps 7 – 11 (shaded), then complete and balance the following equations.
 - a. copper(II) nitrate + sodium hydroxide →
 - b. copper(II) hydroxide + heat →
 - c. copper(II) oxide + hydrochloric acid →
 - d. copper(II) chloride + aluminum →
 - e. hydrochloric acid + aluminum →
7. List four types of observations that indicate when a chemical change has occurred.

Self-assess your lab report using the rubric/checklist