

## Chemical Changes

Purpose: To study chemical change!

Materials: Copper, 3.0 M HCl, 6.0M NaOH, 250 ml beaker, 600 ml beaker, 1 liter plastic beaker, Al, burner, stirring rod, ring stand, ring, wire gauze, litmus paper, ice

Procedure: 1. Have your instructor put a piece of **copper**<sub>(s)</sub> into some concentrated **nitric acid**<sub>(aq)</sub> (**HNO<sub>3</sub>**) in a 250 ml beaker. DO THIS OUTSIDE

- *The products of this reaction are **copper(II) nitrate**<sub>(aq)</sub>, **nitrogen dioxide**<sub>(g)</sub> and **water**<sub>(l)</sub>*

**OBSERVATION: The solution turned blue/green, the copper disappeared and a large cloud of brown smoke was emitted.**

2. Prepare a boiling water bath in a 600 ml beaker for later use.

3. Place the 250 ml beaker into an ice bath in a 1 liter plastic beaker. While stirring, slowly add 6 M **sodium hydroxide**<sub>(aq)</sub> to the **copper (II) nitrate**<sub>(aq)</sub> solution until the pH is above 7. (Use the stirring rod to stir the mixture, and touch the rod to litmus paper. If it turns blue you are finished with this step).

- *The products of this reaction are **copper(II) hydroxide**<sub>(s)</sub> and **sodium nitrate**<sub>(aq)</sub>.*

**OBSERVATION: The solution turned into a clumpy blue colloid. Heat was emitted.**

4. Add 100 ml of water to your 250 ml beaker and heat the mixture in the water bath until a notable color change occurs.

- *The **Copper (II) hydroxide** will decompose and the product of this reaction is **copper(II) oxide**<sub>(s)</sub> and **water**<sub>(l)</sub>. Sodium nitrate was not a part of this reaction.*

**OBSERVATION: The solution turned into a suspension of a black solid, which settled to the bottom of the beaker.**

5. Remove the beaker from the hot water bath and decant the clear liquid. Add **HCl**<sub>(aq)</sub> to the **copper(II) oxide** until the color has completely changed.

- *The products of this reaction are **copper(II) chloride**<sub>(aq)</sub> and **water**<sub>(l)</sub>.*

**OBSERVATION: The black solid turned into a blue/green liquid**

6. Place a wad of **Al**<sub>(s)</sub> foil into the beaker until the color changes again.

- *The Al reacts with the **copper(II) chloride**<sub>(aq)</sub>. One of the products is **aluminum chloride**. What is the other?*

**OBSERVATION: Lots of bubbles, and heat was emitted. A "copper colored" solid began to form, and the solution turned colorless while the Al disappeared.**

Conclusion Questions:

1. What part of the atom was most involved in these changes?

2. Give two examples of where heat changed in this lab.
  
3. Make a list of all elements used in this lab. There were **two**.
  
4. Make a list of four of the compounds used in this lab.
  
5. Give two examples of solutions that were in this lab. **Solutions are have the subscript "aq."**
6. What was the color of most of the solutions in the lab? \_\_\_\_\_
7. What ion(element) do you think was responsible for the color? \_\_\_\_\_
8. In this lab there were five chemical reactions. Use the information in the procedure to write **word equations** for these five reactions. Under each word equation write the correct formulas for the words.

Word Equation One: \_\_\_\_\_

Formulas Equation One: \_\_\_\_\_

Word Equation Two: \_\_\_\_\_

Formulas Equation Two: \_\_\_\_\_

Word Equation Three: \_\_\_\_\_

Formulas Equation Three: \_\_\_\_\_

Word Equation Equation Four: \_\_\_\_\_

Formulas Equation Four: \_\_\_\_\_

Word Equation Equation Five: \_\_\_\_\_

Formulas Equation Five: \_\_\_\_\_

9. In the last step of the experiment, where is the aluminum chloride? How could you recover it?