Stoichiometric Determination of the Formation of Copper (II) Oxide from Copper (II) Sulfate Pentahydrate

Procedure: *Record all observations and data in your laboratory notebook. Use distilled or deionized water.*

Prepare anhydrous copper (II) sulfate for your table by placing 10.00 grams of copper sulfate pentahydrate into a mortar and using the pestle grind the compound until it is a fine powder. Place the powder into a 250 mL beaker and dry in the microwave for about 3 minutes. The powder should be a very pale blue – almost white.

In a 250 mL Erlenmeyer weigh about 1.3 grams of anhydrous copper (II) sulfate and record the mass to the nearest 0.01 gram.

Mass of copper (II) sulfate _____ Moles of copper (II) sulfate _____

Add 50 mL of water, and stir until the copper (II) sulfate is completely dissolved. The solution will be blue.

Write the metathesis reaction that occurs between sodium hydroxide and copper (II) sulfate.

Determine the number of grams of sodium hydroxide needed to react completely with the copper (II) sulfate. This will be about 0 .7 gram of sodium hydroxide. **Measure out about 0.05 gram more than this amount and record the mass to 0.01 g.** (Sodium hydroxide is caustic, do not touch it). Sodium hydroxide should be present in slightly excess stoichiometric amounts.

Mass of sodium hydroxide _____ Moles of sodium hydroxide _____

Put 10mL of water in a 150 mL **beaker** and add the sodium hydroxide to the water slowly while stirring. The dissolving of sodium hydroxide is exothermic. Expect the solution to become hot.

Pour the sodium hydroxide solution into the copper solution. Rinse the beaker that contained the sodium hydroxide solution with small amounts of water. Pour the rinse water into the copper solution to ensure all of the sodium hydroxide is transferred to the copper solution. Describe in detail what occurs when the two solutions mix together.

Allow the solid to settle for several minutes. Place the flask on a hot plate and heat gently. Observe any color changes. **DO NOT ALLOW THE SOLUTION TO BOIL.** Some of the copper (II) hydroxide may convert to copper (II) hydroxide carbonate. This will be indicated by a change in color from blue to green. As the copper (II) hydroxide and copper (II) carbonate are heated these precipitates are converted to black copper (II) oxide.

The product is ready when the solution is very dark (black) in color. Write the decomposition reaction of copper (II) hydroxide to copper (II) oxide. This reaction requires heat.

Record the mass of a clean watch glass with one piece of filter paper on it. The paper should be labeled with your computer number. Flute the filter paper and use it to filter the solution containing the precipitate using a gravity funnel. Rinse the flask with a minimum amount of water to ensure all of the precipitate is transferred to the filter paper. Carefully remove the filter paper from the funnel and set it on the watch glass in a safe place to dry for one week.

(One week later) Determine the mass of the copper (II) oxide product.

Calculate percent yield for the production of copper (II) oxide from anhydrous copper (II) sulfate. Show all the steps in your calculations. Construct a table of all of your data in your laboratory notebook.

Questions

1. Where do you think loss of product occurs?
2. What factors contribute to any impurities observed in the products?
3. Do you have any suggestions for improving the procedures used in this experiment?
4. Write a paragraph about the characteristics of copper oxide by researching this compound on the Internet.