Colton Kreischer

3 OBSERVING A CHEMICAL REACTION

EXPERIMENT

Text Reference
Section 2.4

PURPOSE

To learn how qualitative and quantitative observations of a chemical reaction are used to formulate a hypothesis.

BACKGROUND

You and your friend's feelings about a movie you've just seen may be very different. You may disagree about whether you liked the movie, or about the movie's intended meaning. Although you both have observed the same movie, your interpretations of the movie may differ. Distinguishing between observation and interpretation is very important in chemistry. An *observation* is a statement of fact, based on what you detect by your senses. An *interpretation* is your judgment or opinion about what you have observed. A statement such as "the liquid is clear and colorless" is an observation. It would be an interpretation to say, without further testing, that the clear and colorless liquid is water.

The purpose of this experiment is to help you distinguish observation from interpretation while examining a chemical reaction. Try to make as many observations of the reaction as possible. Remember that there are two types of observations: A *quantitative* observation is an observation that involves a measurement; a *qualitative* observation is a general description and does not involve a measurement. "The liquid is hot" is a qualitative observation. "The temperature of the liquid is 95.0 °C" is a quantitative observation.

MATERIALS (PER PAIR)

safety goggles
1 100-mL beaker
1 thermometer
1 glass stirring rod
1 plastic spoon
1 magnifying glass
copper(II) chloride dihydrate, $CuCl_2 \cdot 2H_2O$ T I
aluminum foil, 8 cm × 8 cm
distilled water

SAFETY FIRST!

In this lab, the solution you are working with may become quite hot following the addition of aluminum foil. Observe all precautions, especially the ones listed below. If you see a safety icon beside a step in the procedure, refer to the list below for its meaning.

Caution: Wear safety goggles. (All steps.)

Caution: Copper(II) chloride is an irritant. Avoid skin contact with this chemical. (All steps.)

Caution: Mercury is extremely toxic by skin absorption, ingestion, and by inhalation of vapor. If you break a mercury thermometer, report it immediately to your teacher. (Step 4.) Copper chloride is toxic by ingestion and inhalation. (Step 1.)

Note: Return or dispose of all materials according to the instructions of your teacher. (Step 5.)

PROCEDURE

As you perform the experiment, record your observations in Data Table 1.

1. Obtain and describe a sample of copper(II) chloride dihydrate, $CuCl_2 \cdot 2H_2O$ crystals.

2. Fill the 100-mL beaker about one-fourth full with distilled water. Without stirring, add 1 level teaspoonful of crystals to the water. Record your observations of both the crystals and the water.

3. Use the glass stirring rod to stir the mixture until the crystals are completely dissolved. Record your observations of the solution.

4. Place the thermometer in the copper(II) chloride solution and record the temperature. **CAUTION:** *Observe the mixture from the side; do not look directly down into the beaker.* Place a loosely crumpled ball of aluminum in the solution and record your observations. Stir the mixture occasionally and observe for at least 10 minutes. Record any change in temperature.

5. Follow your teacher's instructions for proper disposal of the materials.

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OBSERVATIONS

DATA TABLE 1: OBSERVATIONS	
System	Observations
dry copper(II) chloride dihydrate	They look like blue sugar and resemble fire glass. They are very shiny and crystallized.
copper(II) chloride in water	The water turns green, but the chemicals are both still separate. The solution is 21 degrees Celsius.
stirred copper(II) chloride in water	The water turned blue and the crystals dissipated, but no other physical changes are observable; however, the temperature increased to 23 degrees.
copper(II) chloride solution plus aluminum foil	The water turned grey, started to evaporate quickly, and the aluminum foil dissipated. The temperature increased to 44 degrees Celsius
initial temperature: 21 C	
final temperature: 44 C	

ANALYSES AND CONCLUSIONS

1. Check your observations. Cross out any that are interpretations rather than observations.
2. List each of your observations in one of four following sections. Number your observations consecutively. Circle the number of any observation that is quantitative.

   a. observations of the dry crystals

   1- They are blue; 2- They are crystal-like; 3- They are shiny; Quant- N/A

   b. observations of the wet crystals before stirring

   1- The crystals turn the water green; 2- The chemicals are still separate; 3- The solution is 21 degrees Celsius; Quant- 3

   c. observations of the solution before addition of aluminum

   1- The crystals turned the water blue; 2- The chemicals dissipated; 3- It is 23 degrees Celsius; Quant- 3

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d. observations of the reaction that occurs when the aluminum is added to the solution

1- The water turned grey; 2- The aluminum foil dissipated; 3- The solution started evaporating; The temperature increased to 44 degrees Celsius

3. Would you expect your observations or your interpretations to most closely match those of your classmates? Explain.

I would, considering I didn't include any of my own interpretations in the recorded observations. Anybody doing the lab should be able to note the temperature, color, and physical aspects in the same manner that I did.

GOING FURTHER

Develop a Hypothesis

Based on the observations you made during this lab, develop a hypothesis about what happened when aluminum metal was added to the solution of copper(II) chloride.

Design an Experiment

Propose an experiment to test your hypothesis. If resources are available and you have the permission of your teacher, perform the experiment.