# 1.8 Investigation

**SKILLS MENU**
○ Questioning ● Conducting ● Analyzing
● Hypothesizing ● Recording ○ Communicating
○ Planning

# Observing Changes

Using their knowledge of physical and chemical properties and current technology, chemists cause many useful changes, including transforming crude oil into plastics, and changing minerals from the ground into copper and iron.

In this investigation, you will learn more about physical and chemical changes. Remember that a change is probably physical unless there is almost certain evidence that a new substance has been produced.

## Materials

- safety goggles
- apron
- 4 test tubes
- test-tube rack
- distilled water
- 2-mL measuring spoon
- copper(II) sulfate powder
- test-tube stopper
- iron (a piece of steel wool about 1 cm × 1 cm × 2 cm)
- stirring rod
- dilute sodium carbonate (5% solution)
- dilute hydrochloric acid (3% solution)
- magnesium ribbon (2-cm strip)
- tongs

(T) Copper(II) sulfate is poisonous. Report any spills to your teacher.

Hydrochloric acid is corrosive. Any spills on the skin, in the eyes, or on clothing should be washed immediately with cold water. Report any spills to your teacher.

## Question

How can we recognize physical and chemical changes?

## Hypothesis

**1** Write a statement to answer the question. (4A)

## Procedure

### Part 1: Copper(II) Sulfate and Water

**2** Put on your apron and safety goggles.

**3** Make a table similar to **Table 1** to record all your observations and inferences.

**Table 1 Physical and Chemical Changes**

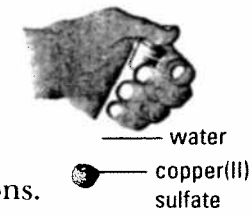
| Part | Starting Substances | | Observations after Mixing | Inference Physical? Chemical? | Evidence |
|---|---|---|---|---|---|
| | Name | Properties | | | |
| 1 | water | ? | ? | ? | ? |
| | copper(II) sulfate | ? | ? | ? | ? |
| 2 | ? | ? | ? | ? | ? |

**4** Obtain a small amount of copper(II) sulfate in a test tube. Put the test tube in the test-tube rack. Obtain some distilled water.

(a) In your table, describe the water and the copper(II) sulfate.

**5** Pour distilled water into the test tube containing the copper(II) sulfate, to a depth of about 4 cm. Put a stopper in the test tube to seal it. Take the tube out of the rack and mix the contents by turning the tube upside down several times. Return the test tube to the rack.

Step 5




(a) Was there a change? Record your observations.

(b) Make an inference based on your observations: if there was a change, was it physical or chemical? How do you know? Record your inference and the evidence to support it.

### Part 2: Copper(II) Sulfate and Iron

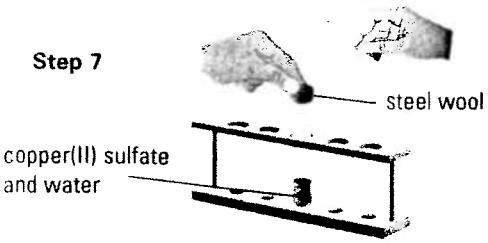
**6** Into another clean, dry test tube in the rack, pour some of your mixture of copper(II) sulfate and water, to a depth of about 2 cm. (Save the remainder of your copper(II) sulfate mixture to use in Part 3.) Obtain a piece of steel wool (iron).

(a) Describe the steel wool and the solution before you continue.



**SKILLS HANDBOOK:** (4A) Asking Questions and Hypothesizing

7 Using a stirring rod, push the steel wool into the copper(II) sulfate mixture.




✎ (a) Record your observations.

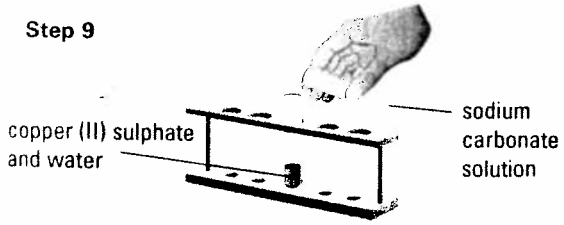
(b) Was there a physical or a chemical change? What is the evidence?

### Part 3: Copper(II) Sulfate and Sodium Carbonate

8 Into another clean, dry test tube, pour sodium carbonate solution to a depth of about 1 cm.

✎ (a) Describe the sodium carbonate solution and the remainder of your copper(II) sulfate mixture.

9 Pour one solution into the other.




✎ (a) Record your observations.

(b) Was there a physical or chemical change? What is the evidence?

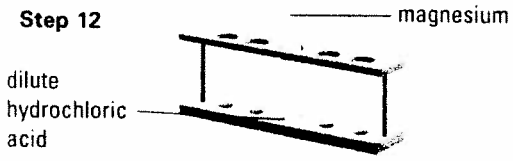
10 Dispose of the mixtures in the test tubes as instructed by your teacher.

### Part 4: Hydrochloric Acid and Magnesium

11 Into another clean, dry test tube, pour dilute hydrochloric acid to a depth of about 2 cm. Obtain a small piece of magnesium ribbon.

✎ (a) Describe the dilute hydrochloric acid and the magnesium.

12 Using tongs, carefully add the magnesium ribbon to the test tube without splashing. As any change occurs, feel the bottom of the tube to check for any temperature change.




✎ (a) Record your observations.

(b) Was there a physical or chemical change? What is the evidence?

13 Dispose of the mixtures as instructed by your teacher. Wash your hands.

## Analysis and Communication

14 Analyze your observations using your completed table by answering the following questions:

(a) What kind of change took place when you mixed the substances in each part of the investigation? What evidence do you have? Does this support the hypothesis?

(b) In each part of this investigation, identify what physical properties changed?

(c) Look at **Table 2** on page 30. Which of those clues did you observe?

(d) Which of the changes you observed might be reversed? Explain how.

### Understanding Concepts

1. What are some examples of physical and chemical changes in the home? Give reasons for your classification.

### Reflecting

2. If you wanted to test more properties of a new substance formed in Part 2, how could you separate it from other materials in the test tube?