

## Introduction to Matter • Skills Lab

# Isolating Copper by Electrolysis

## Problem

How can electrical energy be used to isolate copper metal?

## Skills Focus

making models, inferring, observing, interpreting data

## Materials

glass jar, about 250 mL

two metal paper clips

6-volt battery

index card

wires with alligator clips or a battery holder with wires

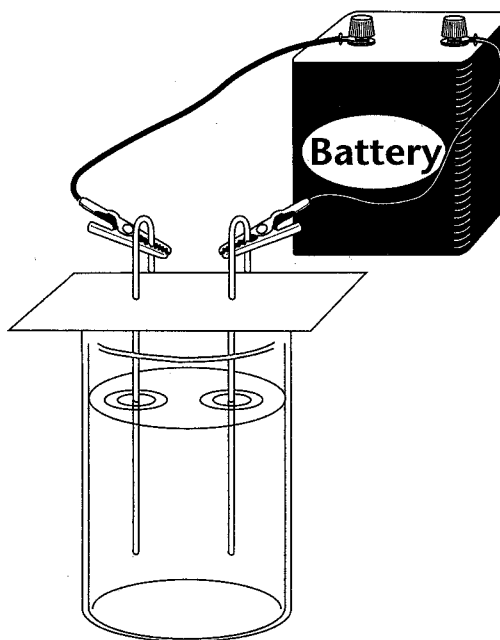
copper chloride solution (0.6 M), 100 mL

## Procedure



Review the safety guidelines in Appendix A of your textbook.

1. Unbend a paper clip and make a hook shape as shown in the figure below. Push the long end through an index card until the hook just touches the card.
2. Repeat Step 1 with another paper clip so that the paper clips are about 3 cm apart. The paper clips serve as your electrodes.
3. Pour enough copper chloride solution into a jar to cover at least half the length of the paper clips when the index card is set on top of the jar. **CAUTION:** *Copper chloride solution can be irritating to the skin and eyes. Do not touch it with your hands or get it into your mouth. The solution can stain skin and clothes.*
4. Place the index card on top of the jar. If the straightened ends of the paper clips are not at least half covered by the copper chloride solution, add more solution.
5. Attach a wire to one pole of a battery. Attach a second wire to the other pole. Attach each of the other ends of the wires to a separate paper clip. See the drawing. Do not allow the paper clips to touch one another.



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**Isolating Copper by Electrolysis** *(continued)*

6. Predict what you think will happen if you allow the setup to run 2 to 3 minutes. (*Hint: What elements are present in the copper chloride solution?*) Write your prediction on the lines below.

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7. Let the set up run 2 to 3 minutes or until you see a deposit forming on one of the electrodes. Also look for bubbles.
8. Disconnect the wires from both the battery and the paper clips. Bring your face close to the jar and gently wave your hand toward your nose. Note any odor on the line below.
9. Note on the line below whether the color of the solution has changed since you began the procedure.
10. Note on the line the color of the ends of the electrodes.
11. Discard the solution as directed by your teacher, and wash your hands.

**Analyze and Conclude**

*Write your answers in the space provided.*

1. **Making Models** Make a labeled diagram of your laboratory setup. Indicate which electrode is connected to the positive (+) side of the battery and which is connected to the negative (-) side.

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2. **Inferring** Based on your observations, what substances do you think were produced at the electrodes? On which electrode was each substance produced? Recall that one of the substances was a solid you could see and the other was a gas you could smell.

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3. **Observing** Compare the properties of the substances produced to those of the copper chloride in solution.

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4. **Interpreting Data** If the color of the solution changed, how can you explain the change?

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5. **Inferring** Based on your observations, does electrolysis produce a chemical change? Explain your reasoning.

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6. **Communicating** Write a paragraph describing what you think happened to the copper chloride solution as the electric current flowed through it.

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**Design an Experiment**

What do you think would happen if you switched the connections to the battery without disturbing the rest of the equipment? Design an experiment to answer this question. *Obtain your teacher's permission before carrying out your investigation.*