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STUDENT BOOK:	**Chapter 2, pp. 55–56**
CONCEPTS:	CHEMICAL CHANGES DECOMPOSITION
METHOD:	OBSERVATION

A MAGIC KEY

The process of electrolysis has many practical applications. It is used to produce hydrogen and oxygen from water and chlorine from salt and to extract metals from ores. This activity is designed to determine whether copper can be extracted from a copper compound solution and to observe how a metal object changes through electrolysis.

IDENTIFYING THE OBSERVATION CRITERIA

Read pp. 55–56 in your student book for help in answering questions 1–5.

1. Does the electrolysis process involve a physical reaction or a chemical reaction?

_____

2. What is the name of that reaction?

_____

3. Does electrolysis absorb or release energy?

_____

4. What type of energy is involved in electrolysis?

_____

_____

5. Knowing that electrolysis decomposes water (H_2O) into hydrogen (H_2) and oxygen (O), what compounds will be released during electrolysis of a copper chloride solution ($CuCl_2$)?

_____

_____

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6. What tells you that electrolysis has taken place?

ESTABLISHING AN OBSERVATION PROTOCOL

7. A key was chosen as the small object for the copper deposition experiment. Why do you think the object should not be too big?

8. In your opinion, what other ordinary small objects would be suitable?

9. Below is the list of materials you should use to copper-plate your key by electrolysis:

- 150-mL glass beaker
- 100 mL copper chloride
- 2 metal paper clips
- source of variable current
- 3 connector wires with alligator clips
- dissection tweezers
- ammeter
- stopwatch
- small metal object (key)
- liquid soap

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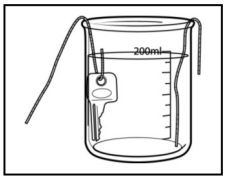
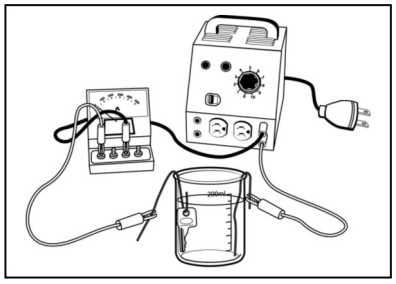
10. Below are the steps of the procedure for copper deposition by electrolysis.

Procedure

1. Use the dissection tweezers to handle the key.
2. Clean the key with soap.
3. Thoroughly rinse the key with water to remove the soap residue, then dry the key with a paper towel.
4. Measure the key's mass and record the measurement in the table of results.
5. Measure the mass of one of the paper clips, and record the measurement in the table of results. This will be the "plain" paper clip.
6. Unbend the plain paper clip and attach to the rim of the beaker. Fold one end over into the beaker, making sure it extends below the 100 mL line.
7. Hook the key onto the second paper clip.
8. Bend the paper clip holding the key over the rim and into the beaker, making sure the key is below the 100-mL line. Make sure that the key and the plain paper clip do not touch.



9. Connect the plain paper clip to the positive terminal of the current source.
10. Connect the paper clip holding the key to the "500" positive terminal of the ammeter.
11. Connect the negative terminal of the ammeter to the negative terminal of the variable current source.
12. Pour 150 mL of copper chloride solution into the beaker.
13. Adjust the current in the circuit to 500 mA.



14. Start the stopwatch.
15. Record any changes that occur while the current is flowing (over the metal objects and in the solution).
16. After 20 minutes, turn off and disconnect the current, then remove the key and paper clips from the solution.
17. Observe the appearance of the key.
18. Rinse and dry the key, then measure its mass.
19. Repeat steps 17 and 18 with the plain paper clip.
20. Record the results in the table.
21. Return the copper solution to its original container.
22. Clean and store the materials.

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APPLYING THE OBSERVATION PROTOCOL

11. Use the table below to record the changes you observed (before, during and after electrolysis).

Table of results

Starting mass of key: _____

Starting mass of "plain" paper clip: _____

Final mass of key: _____

Final mass of "plain" paper clip: _____

Observation	Reaction time	Changes
Colour of key	Start:	
	After _____ min:	
	End: _____ min.	
Deposit on key	Start:	
	After _____ min:	
	End: _____ min.	
Solution	Start:	
	After _____ min:	
	End: _____ min.	
Other change	Start:	
_____	After _____ min:	
_____	End: _____ min.	

12. What do you observe during the electrolytic reaction? Describe what happens on the key.

_____

_____

_____

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13. What do you observe about the colour of the solution?

14. Do you observe anything else in the solution?

REFLECTING ON YOUR APPROACH

15. What indicates that electrolysis took place and produced copper?

16. What do these changes mean?

17. Has this activity improved your understanding of electrolysis? Explain your answer.

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18. Would the experiment have produced the same observations if the solution had contained a metal other than copper? Explain your answer.

19. How could you improve the observation protocol?