SC10a.1 Electrolysis of copper sulfate solution – Core practical

Your teacher may watch to see if you can…

- follow instructions carefully
- make accurate measurements.

Aim

To electrolyse copper sulfate solution using inert (graphite) **electrodes** and copper electrodes.

Method 1 – Using copper electrodes

Apparatus

- eye protection
- emery paper
- low voltage d.c. supply
- ammeter
- variable resistor
- connecting leads
- crocodile clips
- 100 cm^3 beaker
- stop clock
- 2 graphite rods
- 2 pieces of copper foil
- copper sulfate solution
- access to propanone (in a fume cupboard)
- access to a balance
- graph paper

⚠ Safety

Wear eye protection.

Propanone is an irritant. It is highly flammable; there must not be any naked flames in the laboratory.

A Select two pieces of copper foil to use as electrodes and clean them with emery paper.

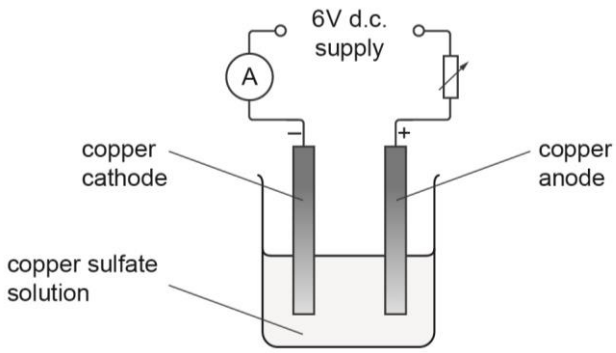
Label one of the electrodes as '**anode**' and the other as '**cathode**'.

B Measure and record the mass of each electrode.

C Half fill the beaker with copper sulfate solution.

D Set up the circuit as shown in diagram A.

E Turn the power on and adjust the variable resistor to give a current of 0.2 A. Record the current. Leave the power on for 20 minutes, adjusting the variable resistor to keep the current constant, if necessary.



***A** circuit diagram for the **electrolysis** of copper sulfate solution using copper electrodes*

F Turn off the power and remove the electrodes from the beaker.

G Gently rinse the electrodes with distilled water then dip them into propanone. Remove the electrodes from the propanone and gently shake them until the propanone evaporates.

H Measure and record the masses of the dry electrodes.

I Repeat the experiment using currents of 0.3 A, 0.4 A and 0.5 A.

Recording your results

1 Record your results in a table, including the change in mass of each electrode.

Considering your results/Conclusions

2 Plot suitable graphs to look for a correlation between the change in mass of each electrode and the current.

3 Describe the relationship between the change in mass at each electrode and the current.

4 Explain the changes in mass of each electrode.

5 Use the graph to predict the change in mass of the anode when the current is 0.35 A.

6 Suggest a reason why the change in mass at the cathode is not the same as the change in mass at the anode when the same current is used.

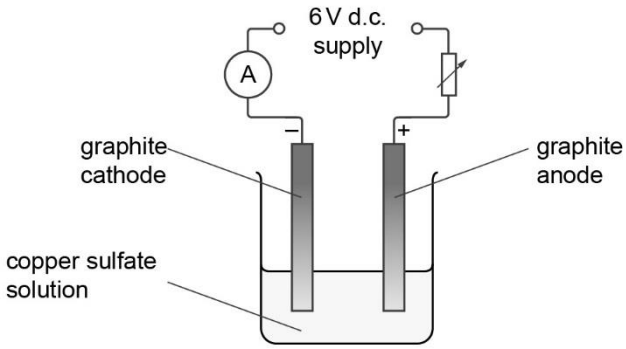
7 Describe how you could improve the experiment to be more certain that the data collected is correct and free from error.

Method 2 – Using inert electrodes

J Set up the circuit as shown in diagram B.

K Turn the power on.

L Observe what happens at each electrode.



***B** circuit diagram for the **electrolysis** of copper sulfate solution using graphite electrodes*

Recording your results

8 Record your observations and the name of the product formed at each electrode.

Considering your results/Conclusions

9 Explain the formation of the product at each electrode.

10 **H** Write a **half equation** for the formation of the product at each electrode and classify each reaction as **oxidation** or **reduction**.

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Name _____ **Class** _____ **Date** _____

Recording your results

1 Record your results in this table.

Current (A)	Mass of anode at start (g)	Mass of anode at end (g)	Change in mass of anode (g)	Mass of cathode at start (g)	Mass of cathode at end (g)	Change in mass of cathode (g)

2 Calculate the change in mass of the electrodes and record these masses in the table.

Considering your results/Conclusions

3 **a** Plot a graph of change in mass of the anode against the current.

b Draw a best-fit line through the points.

4 Describe the relationship between the change in mass of the anode and the current.

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_____

5 Explain the change in mass of the anode as the current changes.

_____

_____

6 Use the graph to predict the change in mass of the anode when the current is 0.35 A. _____

7 **a** Plot a graph of change in mass of the cathode against the current.

b Draw a best-fit line through the points.

8 Describe the relationship between the change in mass of the cathode and the current.

_____

_____

9 Explain the change in mass of the cathode as the current changes.

_____

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10 Suggest a reason why the change in mass at the cathode is not the same as the change in mass at the anode when the same current is used.

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11 Describe how you could improve the experiment to be more certain that the data are correct and error free.

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