

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 | • stop clock |
| • emery paper | • 2 graphite rods |
| • low voltage d.c. supply | • 2 pieces of copper foil |
| • ammeter | • copper sulfate solution |
| • variable resistor | • access to propanone |
| • connecting leads | • access to a balance |
| • crocodile clips | • graph paper |
| • 100 cm ³ beaker | |

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.

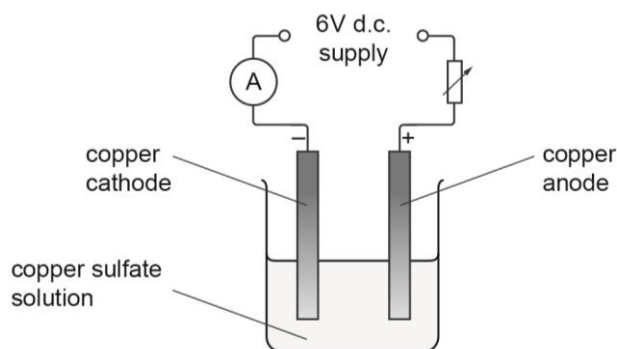
E Turn the power on and adjust the variable resistor to give a current of 0.2 A. Record the current. Leave the power on for 20 minutes, adjusting the variable resistor to keep the current constant, if necessary.

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.



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

Recording your results

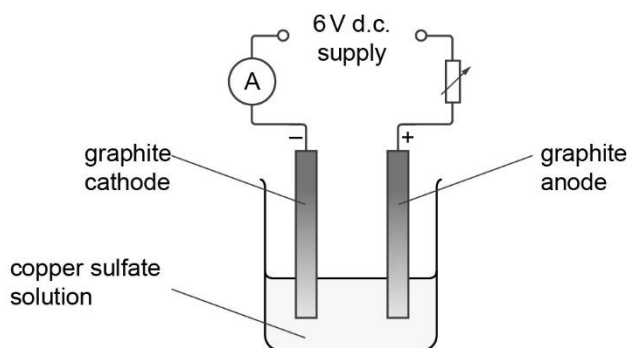
- 1 Record your results in a table, including the change in mass of each electrode.

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**.