Electrolysis of aqueous solutions

Chemistry required practical | AQA Combined Science 8464 and AQA GCSE Chemistry 8462 | 14 questions, 36 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ / 36

Aim: To find out which products form at each inert electrode when different aqueous salt solutions are electrolysed, and to identify any gases made.

Equipment: beaker or small plastic electrolysis cell; two graphite (carbon) rod electrodes; low-voltage DC power supply (about 4-6 V); connecting leads and crocodile clips; two small graduated tubes to collect gas; solutions such as copper(II) chloride, copper(II) sulfate, sodium chloride, sodium sulfate and potassium bromide; blue litmus paper; wooden splints; safety goggles.

Results

Aisha and Tom electrolysed five solutions using graphite electrodes at 4 V. Each time they collected the gas over each electrode for 5 minutes and measured its volume in a small graduated tube.

Solution	Seen at cathode (negative)	Seen at anode (positive)	Volume of gas at cathode after 5 min in cm^3	Volume of gas at anode after 5 min in cm^3
Copper(II) chloride	Pink-brown coating	Bubbles; gas bleached damp blue litmus	0.0	2.9
Copper(II) sulfate	Pink-brown coating	Bubbles; gas relit a glowing splint	0.0	4.0
Sodium chloride	Bubbles; gas gave a squeaky pop	Bubbles; gas bleached damp blue litmus	8.6	6.2
Sodium sulfate	Bubbles; gas gave a squeaky pop	Bubbles; gas relit a glowing splint	8.4	4.1
Potassium bromide	Bubbles; gas gave a squeaky pop	Solution turned orange near the electrode	8.2	0.0

Questions

1 Explain why graphite is used for the electrodes. (2 marks)

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2 State the independent variable in this investigation and give one control variable. (2 marks)

3 Chlorine is made when sodium chloride solution is electrolysed. Describe the hazard of chlorine, what could happen, and one way to reduce the risk. (3 marks)

4 Describe how to test for each of these gases and give the positive result:

a. hydrogen

b. oxygen

c. chlorine

(3 marks)

5 Use the table to name the products at the cathode and at the anode when potassium bromide solution is electrolysed. (2 marks)

6 Explain why hydrogen, not sodium, is made at the cathode when sodium chloride solution is electrolysed. (2 marks)

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7 Calculate the mean rate at which hydrogen was produced from sodium sulfate solution, in cm^3 per minute. Give your answer to 2 significant figures.

(2 marks)

8 For sodium sulfate solution, calculate the ratio of the volume of gas at the cathode to the volume of gas at the anode. Give your answer to 2 significant figures.

(2 marks)

9 The volume of chlorine collected from sodium chloride solution (6.2 cm^3) is less than the volume of hydrogen (8.6 cm^3), although they should be equal. Suggest why.

(2 marks)

10 In another experiment, Tom weighed the cathode before and after electrolysing copper(II) sulfate solution for 10 minutes. Its mass went from 12.46 g to 12.71 g. Calculate the mass of copper deposited each minute. Show your working.

(3 marks)

11 **Higher tier**

Write half equations for the reactions at each electrode when copper(II) chloride solution is electrolysed.

(2 marks)

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12 **Higher tier**

Explain, in terms of electrons, why the reaction at the cathode is reduction and the reaction at the anode is oxidation. Use copper(II) chloride as your example.

(3 marks)

13 The gas tubes are only marked every 1 cm^3, so Aisha and Tom had to estimate each reading between the marks. Suggest one improvement and explain why it helps.

(2 marks)

14 Plan an investigation to find out how the current affects the mass of copper deposited on a graphite cathode when copper(II) sulfate solution is electrolysed.

(6 marks)

End of questions | Total 36 marks | The answers sheet has the full method as revision notes.

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