AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.4.3.4

Electrolysis of aqueous solutions

Past-paper questions

Tier	**Foundation**
Question groups	**6**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.4.3.4 Electrolysis of aqueous solutions

Question 01

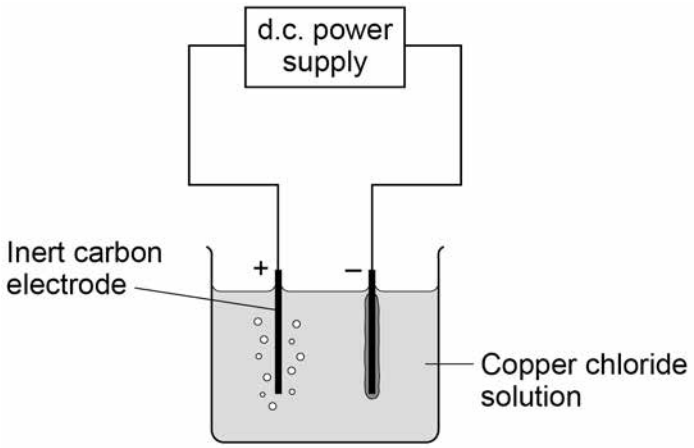
June 2018 | 8464/C/1F | Original Q5

0 5 This question is about electrolysis.

A student investigates the mass of copper produced during electrolysis of copper chloride solution.

Figure 12 shows the apparatus.

Figure 12



0 5 . 1 Which gas is produced at the positive electrode (anode)?

[1 mark]

Tick **one** box.

- carbon dioxide ☐
- chlorine ☐
- hydrogen ☐
- oxygen ☐

0 5 . 2 Copper is produced at the negative electrode (cathode).

What does this tell you about the reactivity of copper?

[1 mark]

Tick **one** box.

Copper is less reactive than hydrogen ☐

Copper is less reactive than oxygen ☐

Copper is more reactive than carbon ☐

Copper is more reactive than chlorine ☐

Table 4 shows the student's results.

Table 4

	Total mass of copper produced in mg			
Time in mins	**Experiment 1**	**Experiment 2**	**Experiment 3**	**Mean**
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	**X**	3.01	3.06

0 5 . 3 Determine the **mean** mass of copper produced after 3 minutes.

[1 mark]

Mass = _____ mg

Question 5 continues on the next page

5.4.3.4 Electrolysis of aqueous solutions

Question 01 · continued

0 5 . 4 Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.

Use **Table 4** on page 19

[2 marks]

Mass **X** = _____ mg

0 5 . 5 The copper chloride solution used in the investigation contained 300 grams per dm^3 of solid $CuCl_2$ dissolved in 1 dm^3 of water.

The students used 50 cm^3 of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

[3 marks]

Mass = _____ g

8

5.4.3.4 Electrolysis of aqueous solutions

Question 02

June 2019 | 8464/C/1F | Original Q2

0 2 This question is about salts and electrolysis.

A student wants to make copper chloride crystals.

The student adds excess copper oxide to some hot acid.

The student stirs the mixture.

0 2 . 1 Which acid should the student use?

[1 mark]

Tick (✓) **one** box.

- Hydrochloric acid ☐
- Nitric acid ☐
- Sulfuric acid ☐

0 2 . 2 Suggest how the student would know that excess copper oxide has been added.

[1 mark]

_____

_____

Question 2 continues on the next page

0 2 . 3 There are four more stages, **A**, **B**, **C** and **D**, to make copper chloride crystals.

The stages **A**, **B**, **C** and **D** are not in the correct order.

Stage **A**	Partially evaporate by heating with a water bath
Stage **B**	Filter the mixture into an evaporating basin
Stage **C**	Leave to crystallise
Stage **D**	Remove and dry the crystals

Put stages **A**, **B**, **C** and **D** in the correct order.

[2 marks]

First stage _____

Second stage _____

Third stage _____

Fourth stage _____

0 2 . 4 Molten copper chloride can be electrolysed.

State the product at each electrode when molten copper chloride is electrolysed.

[2 marks]

Negative electrode _____

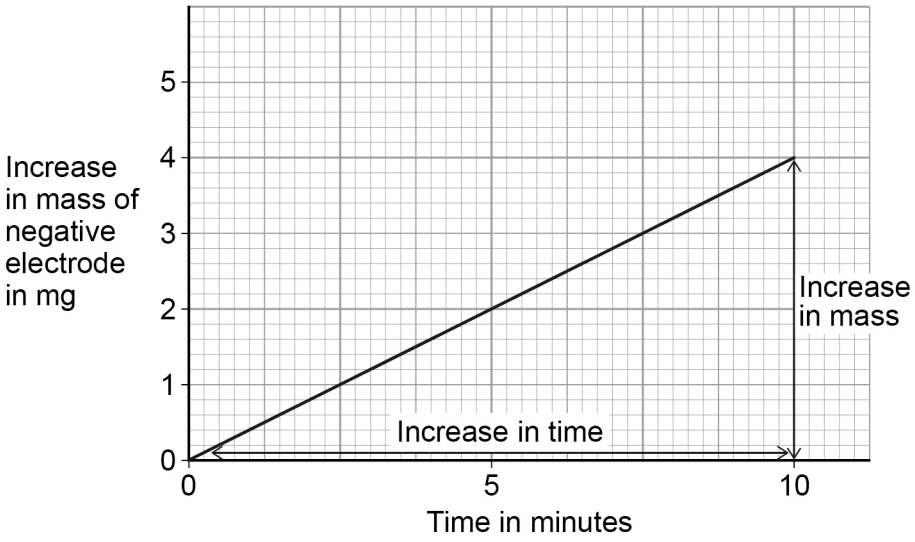
Positive electrode _____

0 2 . 5 A solution of copper chloride is electrolysed.

Figure 3 shows a graph of the increase in mass of the negative electrode.

This increase is shown over a time of 10 minutes.

Figure 3



Calculate the gradient of the line in **Figure 3**.

Use the equation:

$$\text{Gradient} = \frac{\text{increase in mass in mg}}{\text{increase in time in minutes}}$$

[3 marks]

Increase in mass _____

_____

Increase in time _____

_____

Gradient _____

_____

_____

_____

Gradient = _____ mg per minute

5.4.3.4 Electrolysis of aqueous solutions

Question 02 · continued

0 2 . 6 Aluminium is produced by electrolysis of a molten mixture.

Complete the sentence.

Choose the answers from the box.

[2 marks]

carbon	**chloride**	**cryolite**	**oxide**	**sulfate**	**water**

The molten mixture contains _____ and

aluminium _____ .

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5.4.3.4 Electrolysis of aqueous solutions

Question 03

November 2021 | 8464/C/1F | Original Q2

0 2 This question is about electrolysis.

0 2 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

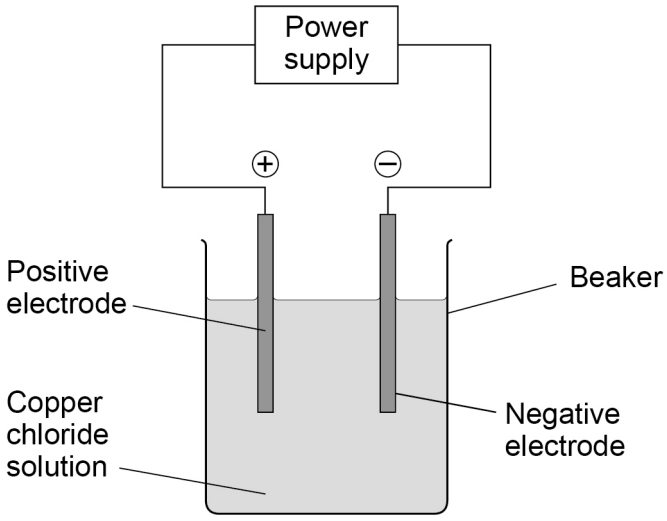
gaseous	**molten**	**solid**

Copper chloride can conduct electricity when in solution or

when _____ .

Figure 1 shows the apparatus used for the electrolysis of copper chloride solution.

Figure 1



There are four ions in copper chloride solution:

- Cu^{2+}
- Cl^{-}
- H^{+}
- OH^{-}

5.4.3.4 Electrolysis of aqueous solutions

Question 03 · continued

0 2 . 2 Why do Cl^- ions and OH^- ions move to the positive electrode?

[1 mark]

0 2 . 3 Where do the H^+ and OH^- ions come from in the electrolysis of copper chloride solution?

[1 mark]

Tick (✓) **one** box.

Air ☐

Copper chloride ☐

Water ☐

0 2 . 4 Which ion produces a metal?

[1 mark]

Tick (✓) **one** box.

Cu^{2+} ☐

Cl^- ☐

H^+ ☐

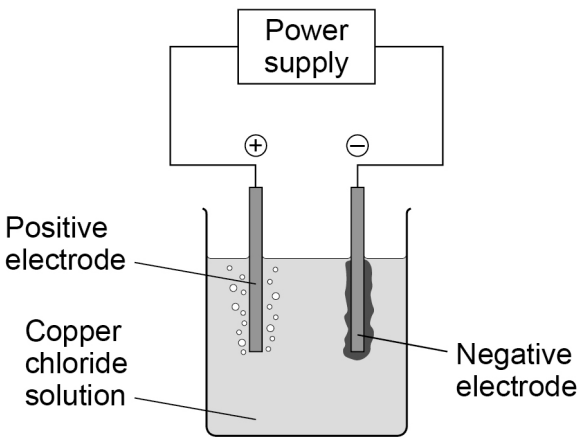
OH^- ☐

Question 2 continues on the next page

5.4.3.4 Electrolysis of aqueous solutions

0 2 . 5 **Figure 2** shows the apparatus during the electrolysis of copper chloride solution.

Figure 2



Describe what is seen at each electrode during the electrolysis of copper chloride solution.

[2 marks]

Positive electrode _____

_____

Negative electrode _____

_____

0 2 . 6 500 cm^3 of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 cm^3 of this copper chloride solution.

[2 marks]

_____

_____

_____

Mass = _____ g

8

5.4.3.4 Electrolysis of aqueous solutions

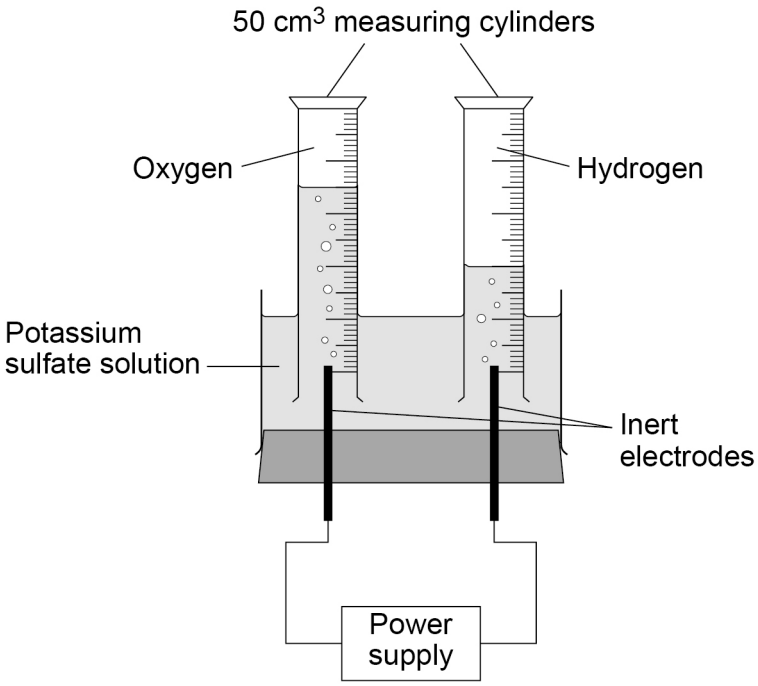
Question 04

June 2022 | 8464/C/1F | Original Q6

0 6 This question is about electrolysis.

Figure 14 shows the apparatus used to investigate the electrolysis of potassium sulfate solution.

Figure 14



0 6 . 1 Potassium sulfate contains K^+ and SO_4^{2-} ions.

What is the formula of potassium sulfate?

[1 mark]

Tick (✓) **one** box.

- KSO_4 ☐
- K_2SO_4 ☐
- $K(SO_4)_2$ ☐
- $K_2(SO_4)_2$ ☐

5.4.3.4 Electrolysis of aqueous solutions

Question 04 · continued

0 6 . 2 What are the volumes of gases collected in the electrolysis experiment?

Use **Figure 14**.

[1 mark]

Volume of hydrogen = _____ cm^3

Volume of oxygen = _____ cm^3

0 6 . 3 A student made the following hypothesis:

'The volumes of gases collected in this electrolysis experiment are in the same ratio as hydrogen atoms to oxygen atoms in a water molecule.'

Explain how the volumes of gases collected in the experiment in **Figure 14** support the student's hypothesis.

Use your answer to Question **06.2**

[2 marks]

Question 6 continues on the next page

Question 04 · continued

0 6 . 4 The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

6 cm^3 9 cm^3 10 cm^3 11 cm^3

The mean volume of oxygen collected in the 4 experiments is 9 cm^3

The measure of uncertainty is the range of a set of measurements about the mean.

What is the measure of uncertainty in the 4 experiments?

[1 mark]

Tick (✓) **one** box.

9 ± 1 cm^3 ☐

9 ± 2 cm^3 ☐

9 ± 3 cm^3 ☐

0 6 . 5 The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in 25 cm^3 of water.

Calculate the mass of potassium sulfate needed to make 1.0 dm^3 of solution.

[3 marks]

Mass = _____ g

8

5.4.3.4 Electrolysis of aqueous solutions

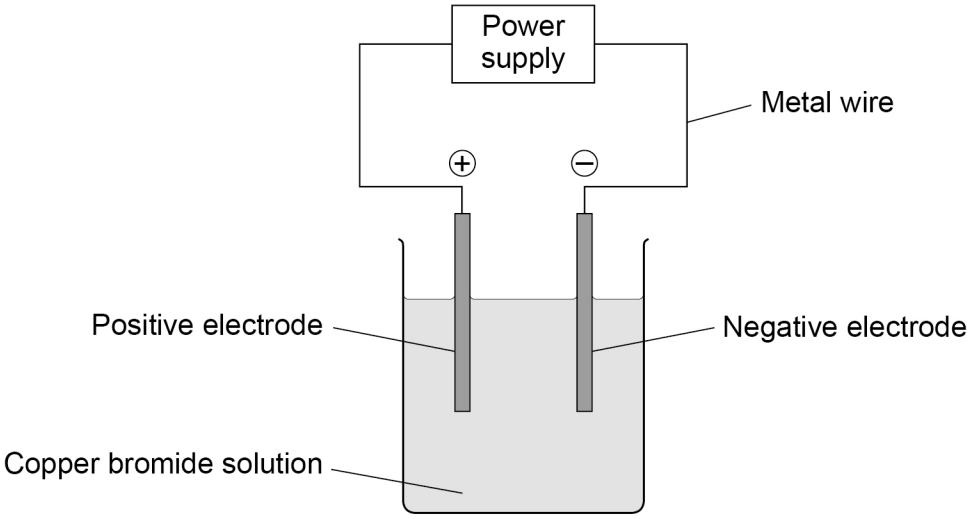
Question 05

June 2023 | 8464/C/1F | Original Q4

0 4 Copper bromide solution is electrolysed using inert electrodes.

Figure 11 shows the apparatus.

Figure 11



0 4 . 1 Which particles carry the electrical charge through the metal wire?

[1 mark]

Tick (✓) **one** box.

Electrons ☐

Neutrons ☐

Protons ☐

Question 4 continues on the next page

5.4.3.4 Electrolysis of aqueous solutions

Question 05 · continued June 2023 | 8464/C/1F | Original Q4

There are four ions in copper bromide solution:

- Cu^{2+}
- Br^-
- H^+
- OH^-

0 4 . 2 Two of these ions are formed when a water molecule breaks down.

The symbol equation when a water molecule breaks down is:

$$H_2O \rightarrow H^+ + OH^-$$

Complete the **word** equation for the breakdown of a water molecule.

[2 marks]

water → _____ ion + _____ ion

0 4 . 3 Copper ions and bromide ions carry the electrical charge through the solution.

The formula of a copper ion is Cu^{2+}

The formula of a bromide ion is Br^-

What is the formula of copper bromide?

[1 mark]

Tick (✓) **one** box.

CuBr ☐

Cu_2Br ☐

$CuBr_2$ ☐

5.4.3.4 Electrolysis of aqueous solutions

Question 05 · continued

0 4 . 4 Explain why copper ions (Cu^{2+}) move to the negative electrode.

[2 marks]

0 4 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

decomposed	**discharged**	**distilled**

At the negative electrode copper metal is produced when the

copper ions are _____ .

0 4 . 6 What happens to the mass of the **negative** electrode during electrolysis?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

No change ☐

Increases ☐

5.4.3.4 Electrolysis of aqueous solutions

Question 05 · continued

There are four ions in copper bromide solution:

- Cu^{2+}
- Br^-
- H^+
- OH^-

0 4 . 7 What is produced at the **positive** electrode when copper bromide solution is electrolysed?

[1 mark]

Tick (✓) **one** box.

Bromine ☐

Hydrogen ☐

Oxygen ☐

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5.4.3.4 Electrolysis of aqueous solutions

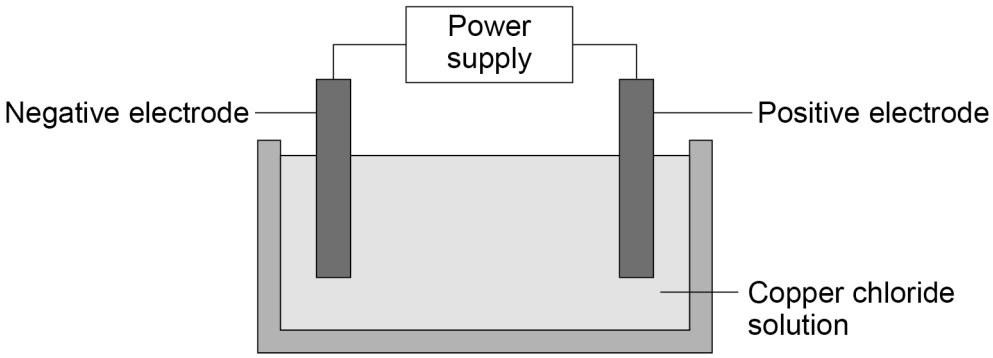
Question 06

June 2025 | 8464/C/1F | Original Q6

0 6 A teacher demonstrated the electrolysis of copper chloride solution.

Figure 12 shows the apparatus.

Figure 12



The teacher measured the mass of the negative electrode every 60 seconds.

0 6 . 1 Chlorine gas is given off during the electrolysis of copper chloride solution.

Chlorine gas is poisonous.

Give **one** way of reducing the risk of harm.

[1 mark]

Question 6 continues on the next page

Table 5 shows the results.

Table 5

Time in seconds	Mass of negative electrode in grams
0	20.2
60	22.0
120	23.4
180	24.2
240	24.8
300	25.2
360	25.2

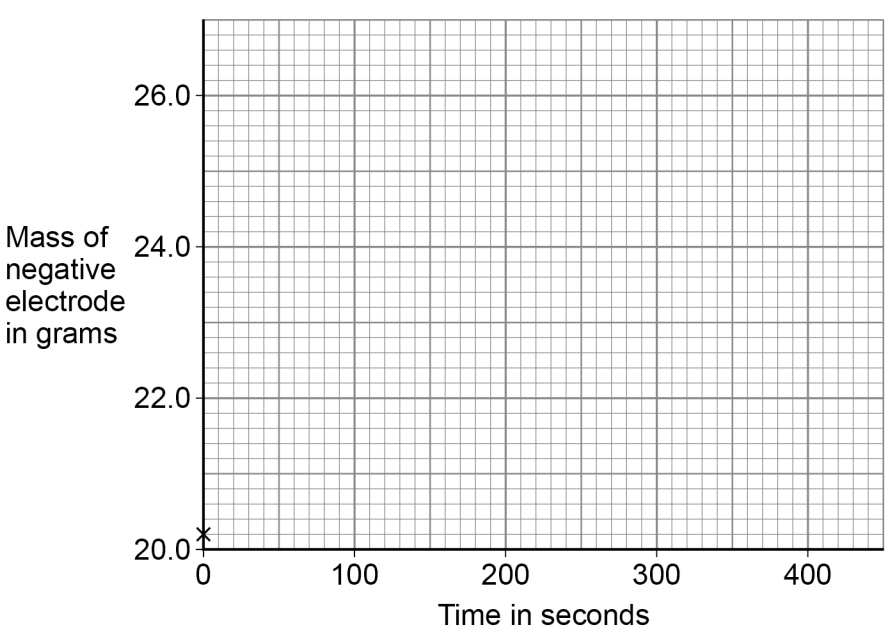
0 6 . 2 Plot the data from **Table 5** on **Figure 13**.

Draw a line of best fit.

The first point has been plotted for you.

[3 marks]

Figure 13



Question 06 · continued

0 6 . 3 A student made the hypothesis:

'The negative electrode will increase by a constant mass every 60 seconds.'

How do the results in **Table 5** show that the hypothesis is **not** correct?

[1 mark]

0 6 . 4 25 cm^3 of the solution of copper chloride contained 5.5 g of copper chloride.

Calculate the concentration of the solution in g/dm^3.

1 dm^3 = 1000 cm^3

[3 marks]

Concentration = _____ g/dm^3

Question 6 continues on the next page

5.4.3.4 Electrolysis of aqueous solutions

0 6 . 5 The teacher also electrolysed potassium chloride solution.

Hydrogen gas was given off at the negative electrode.

Why was hydrogen gas given off?

[1 mark]

Tick (✓) **one** box.

Hydrogen is less reactive than potassium. ☐

Hydrogen has the same reactivity as potassium. ☐

Hydrogen is more reactive than potassium. ☐

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