

GCSE Chemistry

Worksheet: Electrolysis of aqueous solutions

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Electrolysis of aqueous solutions

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Dilute sulfuric acid is electrolysed using inert electrodes. It contains H^+ and SO_4^{2-} ions, and OH^- ions from water.

0 1 . 1

Which gas forms at the negative electrode?

Tick (✓) **one** box.

Oxygen

☐

Hydrogen

☐

Sulfur dioxide

☐

Water vapour

☐

[1 mark]

0 1 . 2

Name the gas formed at the positive electrode.

.....

.....

.....

.....

[1 mark]

0 2

A student electrolysed sodium chloride solution using inert electrodes.

0 2 . 1

Name the gas produced at the negative electrode.

.....

.....

.....

.....

[1 mark]

0 2 . 2

Name the gas produced at the positive electrode.

.....

.....

.....

.....

[1 mark]

0 2 . 3

Describe the test for chlorine and give the result.

.....

.....

.....

.....

[2 marks]

0 3

A student electrolyses two solutions, sodium chloride solution and copper(II) sulfate solution, using inert graphite electrodes.

0 3 . 1

What forms at the negative electrode when copper(II) sulfate solution is electrolysed?

Tick (✓) **one** box.

Copper

☐

Hydrogen

☐

Oxygen

☐

Sulfur

☐

[1 mark]

0 3 . 2

When sodium chloride solution is electrolysed, the gas produced at the positive electrode bleaches damp litmus paper.

Name this gas.

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.....

.....

[1 mark]

0 3 . 3

Describe the test for the gas produced at the negative electrode when sodium chloride solution is electrolysed.

Give the result of the test.

.....

.....

.....

.....

[2 marks]

0 3 . 4

Suggest why graphite electrodes are used.

.....

.....

[1 mark]

0 3 . 5

Give **one** safety precaution the student should take when electrolysis sodium chloride solution. Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 4

A student is going to electrolyse concentrated sodium chloride solution, which produces chlorine gas at the positive electrode.

0 4 . 1

Give one safety precaution the student should take.

.....

.....

[1 mark]

0 4 . 2

Describe the test for chlorine gas, and its positive result.

.....

.....

.....

.....

[2 marks]

Table 1 lists four aqueous solutions to be electrolysed with inert electrodes. Complete the table to predict the products at each electrode.

Table 1

Solution	Product at negative electrode	Product at positive electrode
Potassium bromide, KBr(aq)	?	?
Copper(II) sulfate, CuSO ₄ (aq)	?	?
Dilute hydrochloric acid, HCl(aq)	?	?
Sodium sulfate, Na ₂ SO ₄ (aq)	?	?

05.1

Complete the table.

.....

.....

.....

.....

.....

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.....

.....

[4 marks]

0 6

A student investigates how the current affects the volume of hydrogen produced in 5 minutes when sodium sulfate solution is electrolysed using inert electrodes. The student changes the current using a variable resistor and collects the hydrogen in an upturned measuring tube filled with the solution.

0 6 . 1

Write a hypothesis for this investigation. Give a reason for your prediction.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Identify the independent variable and the dependent variable in this investigation.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Give **two** variables the student should control.

.....

.....

.....

.....

[2 marks]

0 6 . 4

At a current of 0.40 A, the student collected 14.6 cm³, 15.4 cm³ and 15.0 cm³ of hydrogen.

Calculate the mean volume and its uncertainty. Use half the range for the uncertainty.

.....

.....

.....

.....

.....

[2 marks]

0 7

The product at the positive electrode during the electrolysis of an aqueous solution depends on the ions in the solution.

0 7 . 1

Which **two** solutions produce oxygen at the positive electrode when electrolysed with inert electrodes?

Tick (✓) **two** boxes.

Sodium chloride solution

☐

Copper(II) sulfate solution

☐

Potassium bromide solution

☐

Sodium nitrate solution

☐

Copper(II) chloride solution

☐

[2 marks]

0 7 . 2

Describe what you would see near the positive electrode during the electrolysis of potassium bromide solution.

.....

.....

[1 mark]

0 7 . 3

State the rule for predicting the product at the positive electrode during the electrolysis of an aqueous solution.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Electrolysis of aqueous solutions · 32 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: Hydrogen

01.2 [1 mark]

Answer: oxygen

- oxygen (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Answer: hydrogen

- hydrogen (1)
-

02.2 [1 mark]

Answer: chlorine

- chlorine (1)
-

02.3 [2 marks]

- (hold) damp litmus paper (in the gas) (1)
- the litmus paper is bleached / turns white (1)

Notes: Allow damp blue litmus paper turns red then white. Do not accept dry litmus paper for the first mark. The second mark depends on the first.

Question 3 (7 marks)

03.1 [1 mark]

Correct: Copper

03.2 [1 mark]

Answer: Chlorine.

- chlorine (1)

Notes: Do not accept chloride or Cl.

03.3 [2 marks]

Answer: Hold a burning splint at the mouth of the tube: it burns with a (squeaky) pop.

- hold a burning / lit splint at the mouth of the tube (of gas) (1)
- (squeaky) pop (1)

Notes: Do not accept a glowing splint. The result mark depends on a burning splint.

03.4 [1 mark]

Answer: Graphite is inert: it conducts electricity but does not react with the solution or the products.

- graphite is inert / does not react with the solution or the products (and it conducts electricity) (1)
-

03.5 [2 marks]

Answer: Work in a fume cupboard (or a well-ventilated room), because chlorine is toxic.

- work in a fume cupboard / a well-ventilated room / run the electrolysis for a short time only (1)
 - because chlorine is toxic (1)
-

Question 4 (3 marks)

04.1 [1 mark]

- allow: work in a fume cupboard or a well-ventilated room (chlorine is toxic) / wear eye protection / collect only a small volume of chlorine (1)
-

04.2 [2 marks]

- put damp litmus paper into the gas (1)
- the litmus paper is bleached / turns white (1)

Notes: Allow 'blue litmus turns red then white'. Allow damp universal indicator paper. Do not accept dry litmus paper. The second mark depends on the first.

Question 5 (4 marks)

05.1 [4 marks]

Answer: KBr: hydrogen, bromine; CuSO₄: copper, oxygen; HCl: hydrogen, chlorine; Na₂SO₄: hydrogen, oxygen

- potassium bromide: hydrogen (negative), bromine (positive) (1)
 - copper(II) sulfate: copper (negative), oxygen (positive) (1)
 - hydrochloric acid: hydrogen (negative), chlorine (positive) (1)
 - sodium sulfate: hydrogen (negative), oxygen (positive) (1)
-

Question 6 (8 marks)

06.1 [2 marks]

Answer: The greater the current, the greater the volume of hydrogen, because more electrons flow each second so more hydrogen ions are discharged each second.

- the greater the current, the greater the volume of hydrogen (produced in 5 minutes) (1)
- because more electrons flow each second, so more hydrogen ions gain electrons (are discharged) each second (1)

Notes: The hypothesis must give a direction; 'the current affects the volume' scores 0 for the first mark.

06.2 [2 marks]

Answer: Independent: the current. Dependent: the volume of hydrogen collected in 5 minutes.

- independent variable: the current (1)
 - dependent variable: the volume of hydrogen (collected in 5 minutes) (1)
-

06.3 [2 marks]

Answer: The concentration of the sodium sulfate solution; the distance between the electrodes.

- concentration of the sodium sulfate solution (1)
- volume of solution (1)
- time (5 minutes) (1)
- distance between the electrodes (1)
- size / surface area of the electrodes (1)
- temperature of the solution (1)

Any 2 of the points above.

06.4 [2 marks]

Answer: $15.0 \pm 0.4 \text{ cm}^3$

- mean = $(14.6 + 15.4 + 15.0) \div 3 = 15.0 \text{ (cm}^3\text{)}$ (1)
 - uncertainty = $(15.4 - 14.6) \div 2 = (\pm) 0.4 \text{ (cm}^3\text{)}$ (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Correct: Copper(II) sulfate solution; Sodium nitrate solution

07.2 [1 mark]

- the solution turns orange / yellow-brown (as bromine forms) (1)
-

07.3 [1 mark]

- oxygen is produced unless the solution contains halide ions, in which case the halogen is produced (1)
-