

GCSE Chemistry (9 – 1)

Electrolysis – Easy

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/3
2	/8
3	/13
4	/7
5	/7
6	/6
7	/15
Total	/59
%	
Grade	

Information

- The maximum mark for this paper is 59 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Electrolysis is a process that uses an electric current to break down an ionic compound into its simpler elements. Circle the letter of the correct answer for each of the following questions.

a. An electrolysis experiment is done using graphite (carbon) electrodes.

Hydrogen and oxygen are formed at the electrodes during this electrolysis.

Which of the following substances **could** act as the electrolyte in this experiment?

- A molten sodium chloride
- B molten lead bromide
- C dilute sulfuric acid
- D molten potassium iodide

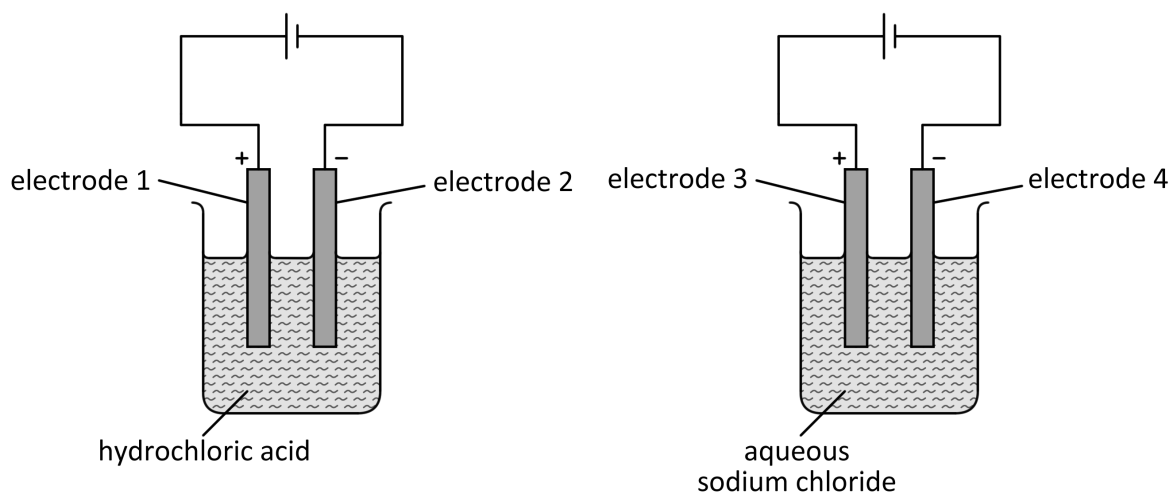
(1 mark)

b. Which substance produces hydrogen and bromine when electrolysed?

- A molten sodium bromide
- B concentrated aqueous sodium chloride
- C concentrated aqueous sodium bromide
- D solid copper(II) bromide

c. A student sets up two experiments to electrolyse two different solutions, as shown in the diagram. In both experiments, a gas is produced at the negative electrode (the cathode).

Identify the electrode or electrodes where **hydrogen gas** is produced.



A

B

C

D

Only at electrode 2

Only at electrode 4

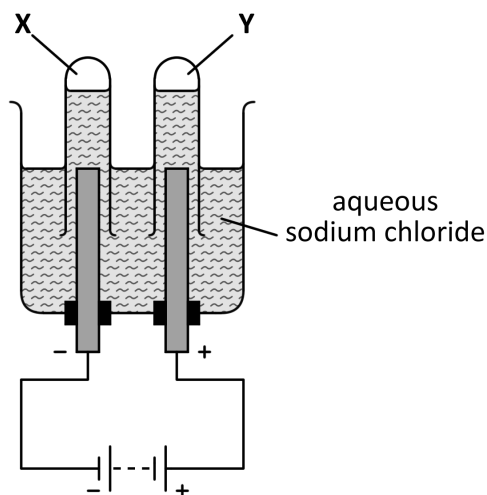
At both 1 and 3

At both 2 and 4

(1 mark)

(Total for Question 1 is 3 marks)

2. A student investigates what happens when electricity is passed through concentrated aqueous sodium chloride, as shown in the diagram.



- a) The diagram shows that the solution is connected to a power supply.

i. Name the scientific term for the positive electrode.

.....

(1 mark)

ii. Name the scientific term for the negative electrode.

.....

(1 mark)

- b) The electrolyte is 'aqueous sodium chloride'. This means sodium chloride is dissolved in water.
List the four types of ion present in the solution.

.....
.....
.....
.....

(2 marks)

- c) Two different gases, X and Y, are collected in the test tubes.
Use the diagram and your knowledge of electrolysis to identify them.

i. Name Gas X.

(1 mark)

ii. Name Gas Y.

(1 mark)

- d) Describe the simple chemical test a student could use to prove that Gas Y is chlorine.

Test:

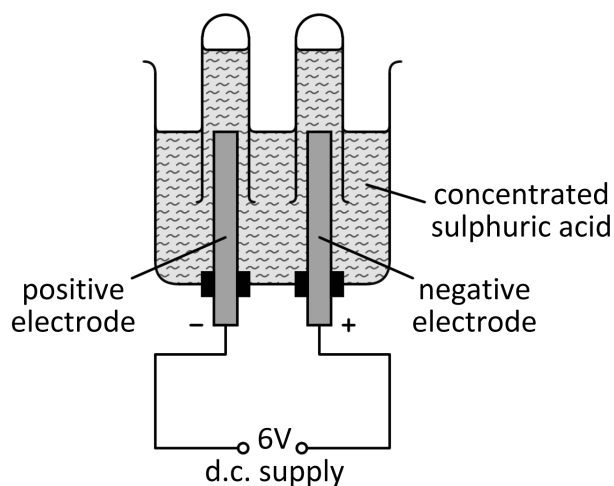
Positive result:

.....

(2 marks)

(Total for Question 2 is 8 marks)

3. The figure below shows the apparatus used for the electrolysis of water acidified with concentrated sulfuric acid.



a) Give the scientific name for:

- i. the positive electrode.

..... (1 mark)

- ii. the negative electrode.

..... (1 mark)

b) Gases are collected in the two test tubes.

- i. Name the gas produced at the negative electrode.

..... (1 mark)

- ii. Describe the chemical test to identify the gas produced at the negative electrode.

Test:

Result:

(2 marks)

c) Pure water does not conduct electricity. Explain why dilute sulfuric acid is added.

.....
.....
.....
.....
.....

(2 marks)

- d) After the experiment runs for some time, the volume of gas collected above the negative electrode is different to the volume of gas collected above the positive electrode.

State how the volumes compare.

.....

.....

.....

.....

.....

(2 marks)

Copper sulfate solution was electrolysed for 10 minutes using copper electrodes.

The table below shows the mass of the cathode and the appearance of the copper sulfate solution before electrolysis and after electrolysis.

	Mass of cathode (g)	Appearance of copper sulfate solution
Before electrolysis	4.12	pale blue solution
After electrolysis	5.20	pale blue solution

- e) After the experiment, the copper cathode is removed from the solution.

Describe the steps a student should take to prepare the cathode for its final weighing to ensure the result is accurate.

.....

.....

.....

.....

.....

(2 marks)

- f) The table shows that the cathode gained mass. Use your knowledge of electrolysis to explain how this happens.

In your answer you should describe:

- which ions in the solution are attracted to the cathode.
- what happens to these ions at the surface of the cathode.

.....

.....

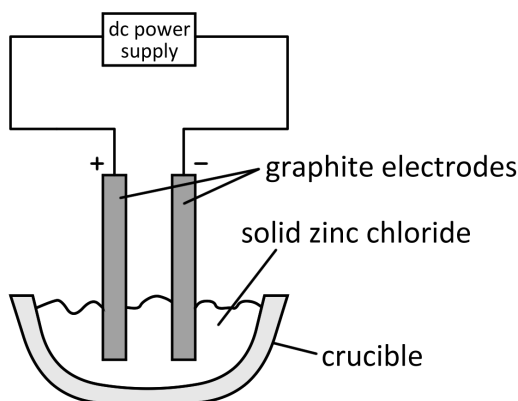
.....

.....

(2 marks)

(Total for Question 3 is 13 marks)

4. A student used electrolysis to break down a number of different chemical substances. The figure below shows some of the apparatus that the student used.



- a) When the student switches on the power supply, no electricity flows and nothing happens. Explain why electrolysis would **not** happen in the apparatus shown in the figure above.

.....

.....

.....

.....

.....

(2 marks)

- b) The student then heats the crucible until the zinc chloride melts. Electrolysis now takes place.

- i. What is the name given to the substance that is broken down by electrolysis?

.....

(1 mark)

- ii. Predict the products formed at the positive and negative electrodes.

At the positive electrode:

At the negative electrode:

(2 marks)

- c) Explain why zinc metal is formed at the negative electrode. Refer to ions and electrons in your answer.

.....

.....

.....

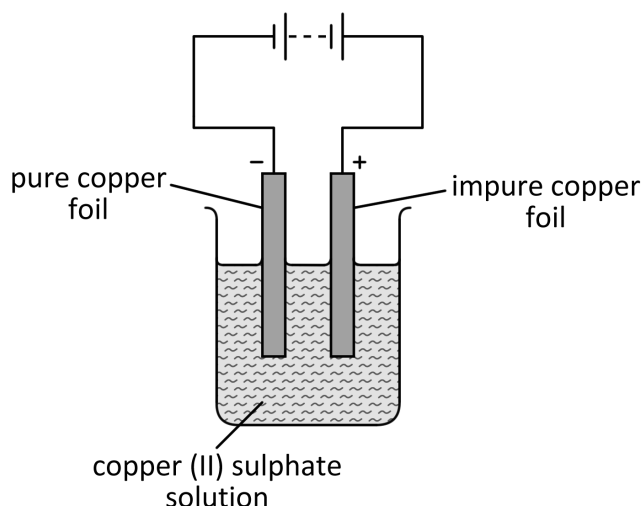
.....

.....

(2 marks)

(Total for Question 4 is 7 marks)

5. Copper can be extracted and later purified by the electrolysis of copper sulphate solution. The image below shows the purification of copper from copper sulphate solution.



- a) What is the name for the positive electrode?

.....

(1 mark)

- b) During the experiment, the masses of the two copper foils change. Describe the change in mass you would expect for:

- i. The pure copper foil.

.....

(1 mark)

- ii. The impure copper foil.

.....

(1 mark)

- c) Explain why the mass of the pure copper foil changes. Your answer should be in terms of copper ions and electrons.

.....
.....
.....
.....

(2 marks)

- d) Write the half-equation for the reaction taking place at the pure copper foil (the negative electrode).

.....

(2 marks)

(Total for Question 5 is 7 marks)

6. Sodium chloride can be electrolysed when it is molten or when it is dissolved in water to form an aqueous solution.

Compare the electrolysis of molten sodium chloride with the electrolysis of aqueous sodium chloride solution.

In your answer you should include:

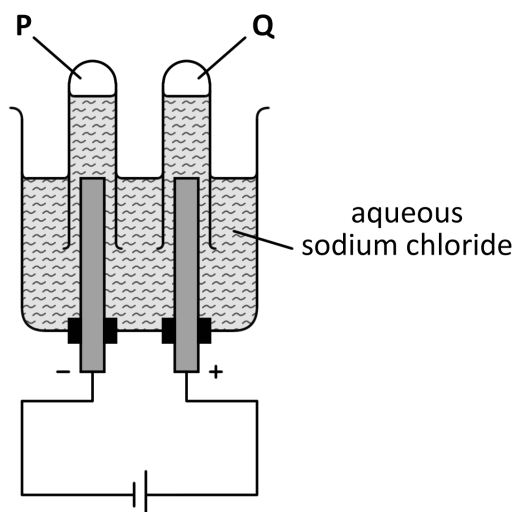
- The ions present in each electrolyte.
- The products formed at the positive electrode (anode) and negative electrode (cathode) for both substances.
- An explanation for the formation of the products at each electrode.

[illegible]

(6 marks)

(Total for Question 6 is 6 marks)

7. A student uses the apparatus shown below to investigate the electrolysis of concentrated aqueous sodium chloride. Gases are collected in test tubes P and Q.



- a) The electrolyte contains four different ions. Name all four ions present in the solution.

.....
.....
.....
.....

(2 marks)

- b) Explain why hydrogen gas is produced at the negative electrode (in test tube P) and not sodium metal.

.....
.....
.....
.....

(2 marks)

- c) Describe the chemical test a student would use to identify the gas collected in test tube Q.
State the positive result.

Test:

Positive Result:

(2 marks)

- d) After the experiment has run for some time, the remaining solution is tested with universal indicator.
The indicator turns blue/purple.

- i. What does this pH change indicate about the solution?

.....

(1 mark)

ii. Name the chemical substance formed during the electrolysis that causes this pH change.

.....
(1 mark)

e) Write the **balanced** half-equation for the reaction occurring at the **positive electrode**.

.....
(2 marks)

f) Write the **balanced** half-equation for the formation of the gas in test tube P.

.....
(2 marks)

g) The student repeats the experiment but uses dilute aqueous sodium chloride instead of a concentrated solution.

i. Name the gas that would now be produced at the positive electrode (in test tube Q).

.....
(1 mark)

ii. Explain why this gas is produced instead of the gas that was formed in the first experiment.

.....
.....
.....
.....
.....
.....
(2 marks)

(Total for Question 7 is 15 marks)