Electrolysis – GCSE Chemistry

1. No.4

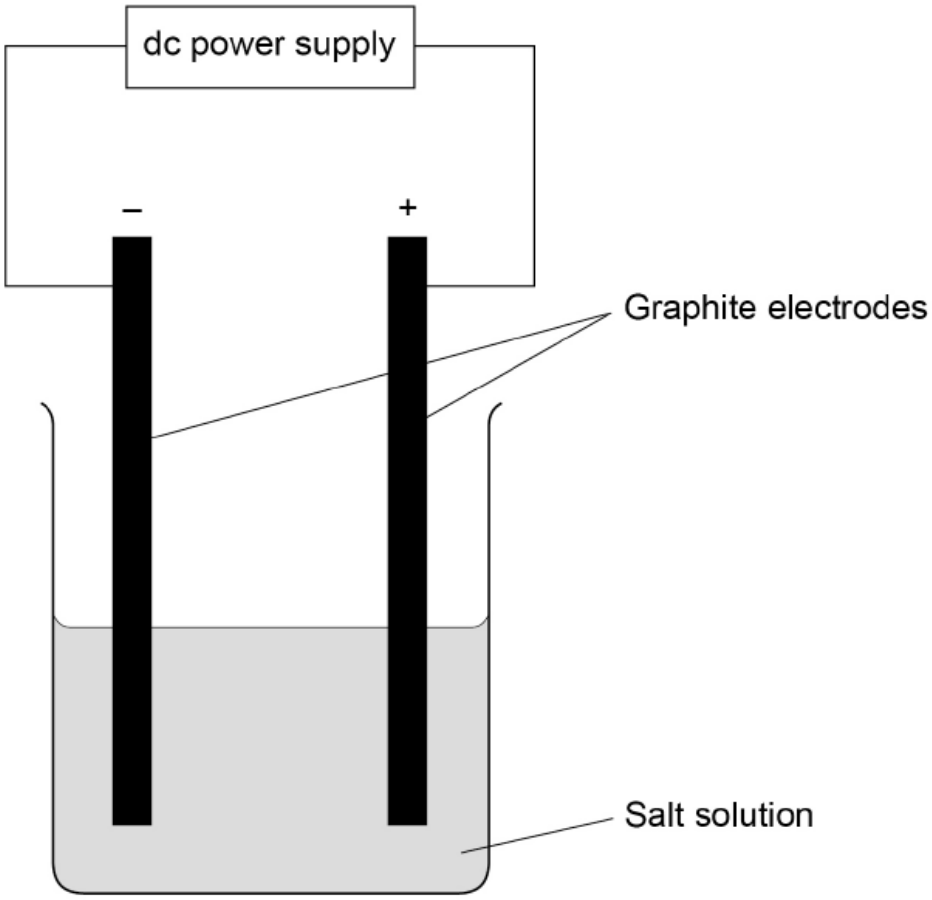
This question is about electrolysis.

A student investigated the hypothesis:

'The electrolysis of a salt solution produces a metal at the negative electrode and a gas at the positive electrode.'

Figure 4 shows the apparatus used.

Figure 4



What observation would be made at each electrode if the hypothesis is correct?

[2 marks]

Observation if metal produced at the negative electrode _____

_____

Observation if gas produced at the positive electrode _____

_____

Table 3 shows the student's results.

Table 3

Salt solution	**Product at the negative electrode**	**Product at the positive electrode**
Copper chloride	Copper	Chlorine
Potassium nitrate	Hydrogen	Oxygen
Silver nitrate	Silver	Oxygen

Which salt solution in **Table 3** does **not** match the student's hypothesis?

Give **one** reason why.

[2 marks]

Salt solution _____

Reason _____

_____

Give **two** reasons why graphite is used for the electrodes.

[2 marks]

1 _____

_____

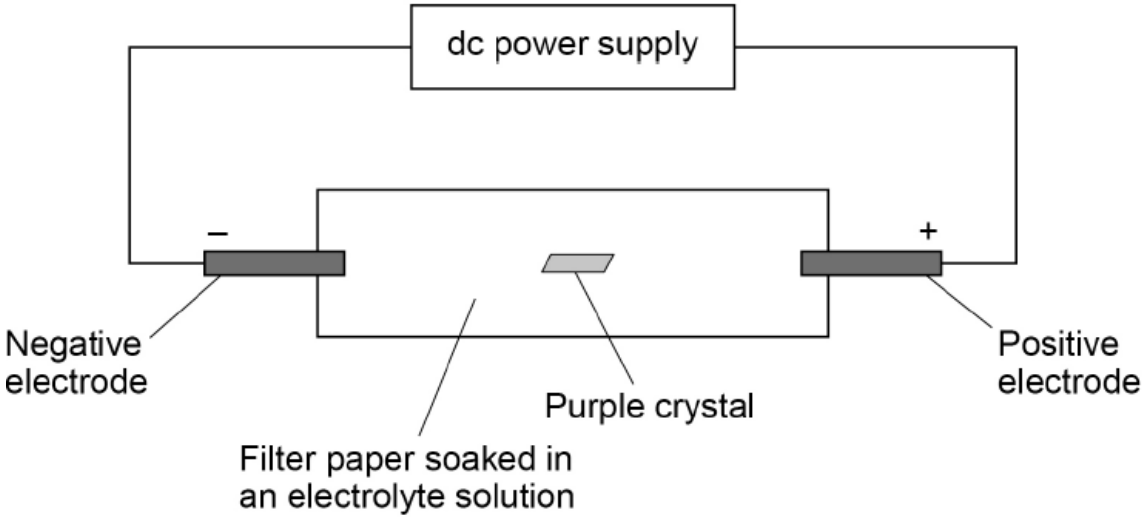
2 _____

_____

A different student investigated what happens during electrolysis.

Figure 5 shows the apparatus.

Figure 5



The purple crystal contained:

- colourless positive ions
- purple coloured negative ions.

The purple crystal dissolved in the electrolyte solution.

What happens to the purple coloured ions?

Give **one** reason for your answer.

[2 marks]

Tick (✓) **one** box.

The ions do not move. ☐

The ions move towards the negative electrode. ☐

The ions move towards the positive electrode. ☐

Reason _____

_____

2. No.5.6 & 5.7

What is the reason for adding cryolite to the aluminium oxide?

[1 mark]

Tick (✓) **one** box.

To increase the amount of aluminium extracted ☐

To lower the melting point of the mixture ☐

To reduce the amount of aluminium oxide needed ☐

Complete the sentences.

Choose answers from the box.

[2 marks]

aluminium	**carbon**	**fluorine**
oxygen	**sodium**	

When the molten aluminium oxide and cryolite mixture is electrolysed the product at the positive electrode is _____.

This product reacts with the positive electrode because the positive electrode is made of _____.

3. No.4

This question is about electrolysis.

A student investigated the electrolysis of copper chromate solution.

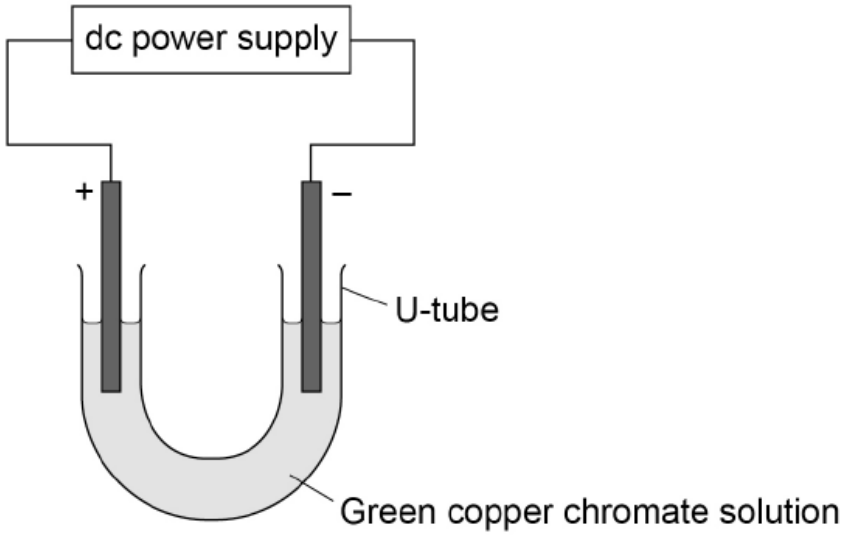
Copper chromate solution is green.

Copper chromate contains:

- blue coloured Cu^{2+} ions
- yellow coloured CrO_4^{2-} ions.

Figure 1 shows the apparatus used.

Figure 1



The student switched the power supply on.

The student observed the changes at each electrode.

Table 4 shows the student's observations.

Table 4

Changes at positive electrode	Changes at negative electrode
Solution turned yellow Bubbles formed at the electrode	Solution turned blue Solid formed on the electrode

Explain why the colour changed at the positive electrode.

[2 marks]

The gas produced at the positive electrode was oxygen.

The oxygen was produced from hydroxide ions.

Name the substance in the solution that provides the hydroxide ions.

[1 mark]

Describe how the solid forms at the negative electrode.

[3 marks]

The student repeated the investigation using potassium iodide solution instead of copper chromate solution.

Name the product at each electrode when potassium iodide solution is electrolysed.

[2 marks]

Negative electrode _____

Positive electrode _____

4. No.4.1

Suggest **two** variables the student should keep the same to make the investigation valid.

[2 marks]

1 _____

_____

2 _____

_____

5. No.4.3-4.5

Copper is used as electrode **X** in **Figure 7**.

Predict the voltage of this cell.

Give **one** reason for your answer.

[2 marks]

Voltage = _____ volts

Reason _____

_____

Describe how to make a 12 V battery using 1.5 V cells.

[2 marks]

_____

_____

_____

_____

Which is the most suitable use for a non-rechargeable cell?

[1 mark]

Tick (✓) **one** box.

Electric toy ☐

Laptop computer ☐

Mobile phone ☐

6. No.7

This question is about electrolysis.

Aluminium is produced by electrolysing a molten mixture of aluminium oxide and cryolite.

Explain why a mixture is used as the electrolyte instead of using only aluminium oxide.

[2 marks]

What happens at the negative electrode during the production of aluminium?

[1 mark]

Tick (✓) **one** box.

Aluminium atoms gain electrons. ☐

Aluminium atoms lose electrons. ☐

Aluminium ions gain electrons. ☐

Aluminium ions lose electrons. ☐

Oxygen is produced at the positive electrode.

Complete the balanced half-equation for the process at the positive electrode.

[2 marks]

$\rightarrow \quad O_2 \quad +$

Explain why the positive electrode must be continually replaced.

[3 marks]

The overall equation for the electrolysis of aluminium oxide is:

$$2\,Al_2O_3 \rightarrow 4\,Al + 3\,O_2$$

Calculate the mass of oxygen produced when 2000 kg of aluminium oxide is completely electrolysed.

Relative atomic masses (A_r): O = 16 Al = 27

[4 marks]

Mass of oxygen = _____ kg

Sodium metal and chlorine gas are produced by the electrolysis of molten sodium chloride.

Explain why sodium chloride solution **cannot** be used as the electrolyte to produce sodium metal.

[2 marks]

Calculate the volume of 150 kg of chlorine gas at room temperature and pressure.

The volume of one mole of any gas at room temperature and pressure is 24.0 dm^3

Relative formula mass (M_r): Cl_2 = 71

[2 marks]

Volume = _____ dm^3