

Paper 1

Questions are applicable for both core and extended candidates

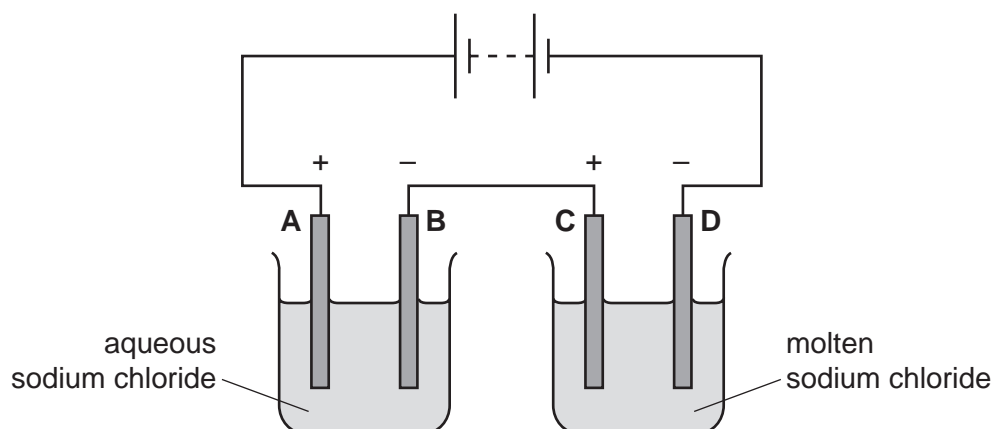
- 1 Concentrated aqueous sodium chloride is electrolysed using graphite electrodes.

What is the product formed at the cathode?

- A chlorine
- B hydrogen
- C oxygen
- D sodium

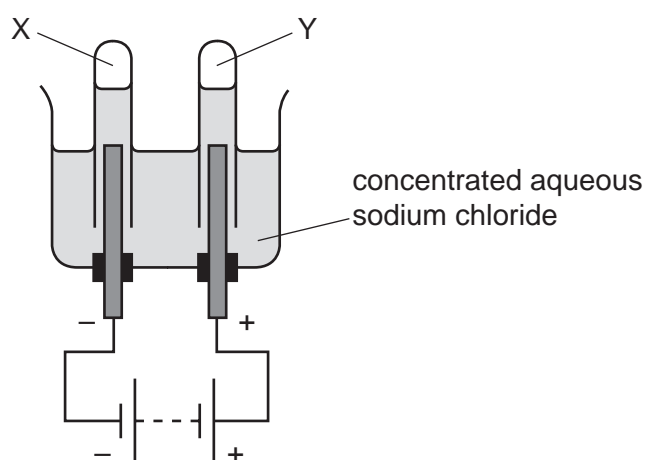
- 2 The diagram shows an electrolysis circuit.

At which electrode is hydrogen formed?



- 3 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Gases X and Y are produced at the electrodes shown.



What are X and Y?

	X	Y
A	chlorine	hydrogen
B	hydrogen	chlorine
C	hydrogen	oxygen
D	oxygen	hydrogen

- 4 What is produced at each electrode during the electrolysis of aqueous solutions using inert electrodes?

	positive electrode (anode)	negative electrode (cathode)
A	metals or hydrogen	non-metals only
B	metals or oxygen	non-metals only
C	non-metals only	metals or hydrogen
D	non-metals only	metals or oxygen

- 5 When molten lead(II) bromide is electrolysed using platinum electrodes, what is observed at each electrode?

	negative electrode	positive electrode
A	bubbles of a colourless gas	bubbles of a brown gas
B	bubbles of a colourless gas	bubbles of a colourless gas
C	shiny grey liquid	bubbles of a brown gas
D	shiny grey liquid	bubbles of a colourless gas

- 6 Aqueous nickel(II) sulfate is used as the electrolyte to electroplate a piece of steel with nickel.

Which materials are used as the negative electrode and positive electrode?

	negative electrode	positive electrode
A	carbon	steel
B	nickel	steel
C	platinum	nickel
D	steel	nickel

- 7 Molten sodium chloride and concentrated aqueous sodium chloride are electrolysed using platinum electrodes.

What are the products at the negative electrode (cathode) in each electrolysis?

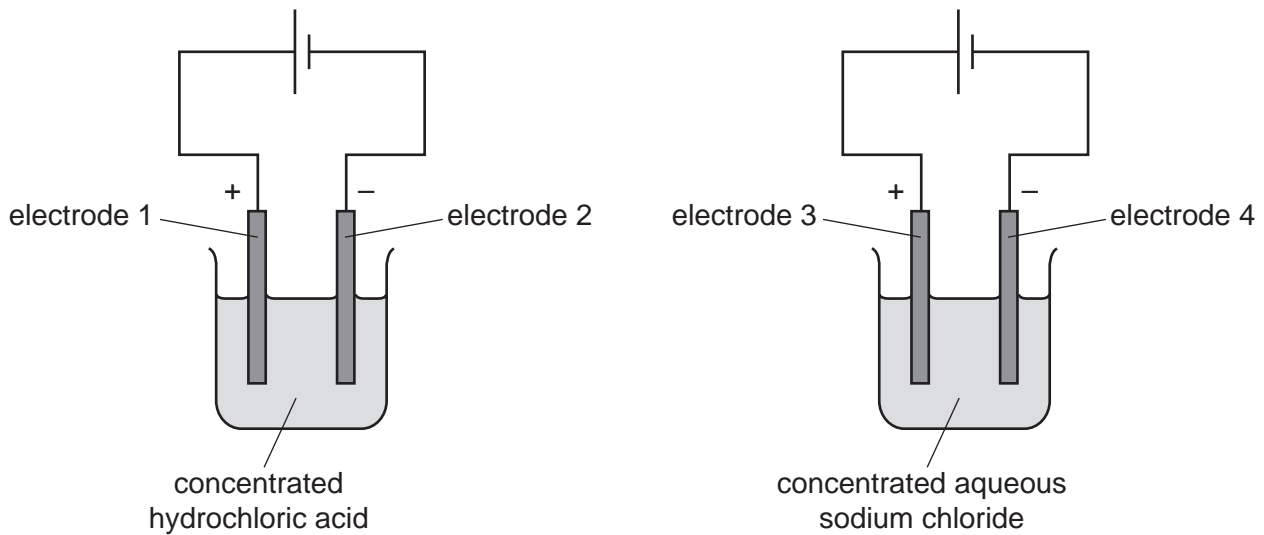
	molten sodium chloride	concentrated aqueous sodium chloride
A	hydrogen	hydrogen
B	hydrogen	sodium
C	sodium	hydrogen
D	sodium	sodium

- 8 An object is electroplated with silver using an aqueous silver salt as the electrolyte.

Which row is correct?

	the object to be electroplated is the	the other electrode is made from
A	anode	carbon
B	anode	silver
C	cathode	carbon
D	cathode	silver

- 9 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



At which electrodes is hydrogen produced?

- A** electrode 1 only
- B** electrodes 1 and 3
- C** electrode 2 only
- D** electrodes 2 and 4

10 Which statement about the electrolysis of concentrated aqueous sodium chloride is correct?

- A** Chlorine is produced at the positive electrode.
- B** Hydrogen is produced at the positive electrode.
- C** Oxygen is produced at the negative electrode.
- D** Sodium is produced at the negative electrode.

Paper 2

**Questions are applicable for both core and extended candidates
unless indicated in the question**

- 11** Concentrated aqueous sodium chloride and dilute sulfuric acid are both electrolysed using inert electrodes.

Which row identifies the product at the cathode in each electrolysis?

	aqueous sodium chloride	dilute sulfuric acid
A	hydrogen	oxygen
B	hydrogen	hydrogen
C	chlorine	oxygen
D	chlorine	hydrogen

- 12** Electrolytes can be broken down by electrolysis.

Which rows are correct for each electrolyte? **(extended only)**

	electrolyte	reaction at cathode	product at anode
1	dilute aqueous potassium chloride	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	oxygen
2	concentrated hydrochloric acid	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	chlorine
3	molten aluminium oxide	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$	aluminium
4	concentrated aqueous sodium bromide	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	bromine

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

- 13** An electrolysis experiment is done using carbon electrodes.

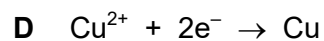
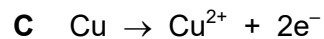
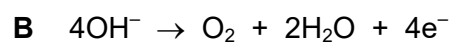
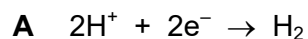
Hydrogen and oxygen are formed at the electrodes.

What is the electrolyte?

- A** aqueous copper(II) sulfate
B concentrated hydrochloric acid
C dilute aqueous sodium chloride
D molten potassium oxide

14 Concentrated aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which ionic half-equation describes the reaction taking place at the cathode? **(extended only)**



15 Which substance produces hydrogen and bromine when electrolysed? **(extended only)**

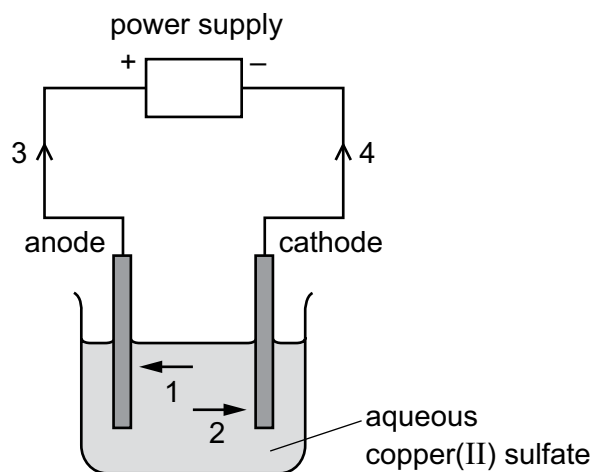
A concentrated aqueous copper(II) bromide

B concentrated aqueous sodium bromide

C dilute aqueous potassium bromide

D molten lead(II) bromide

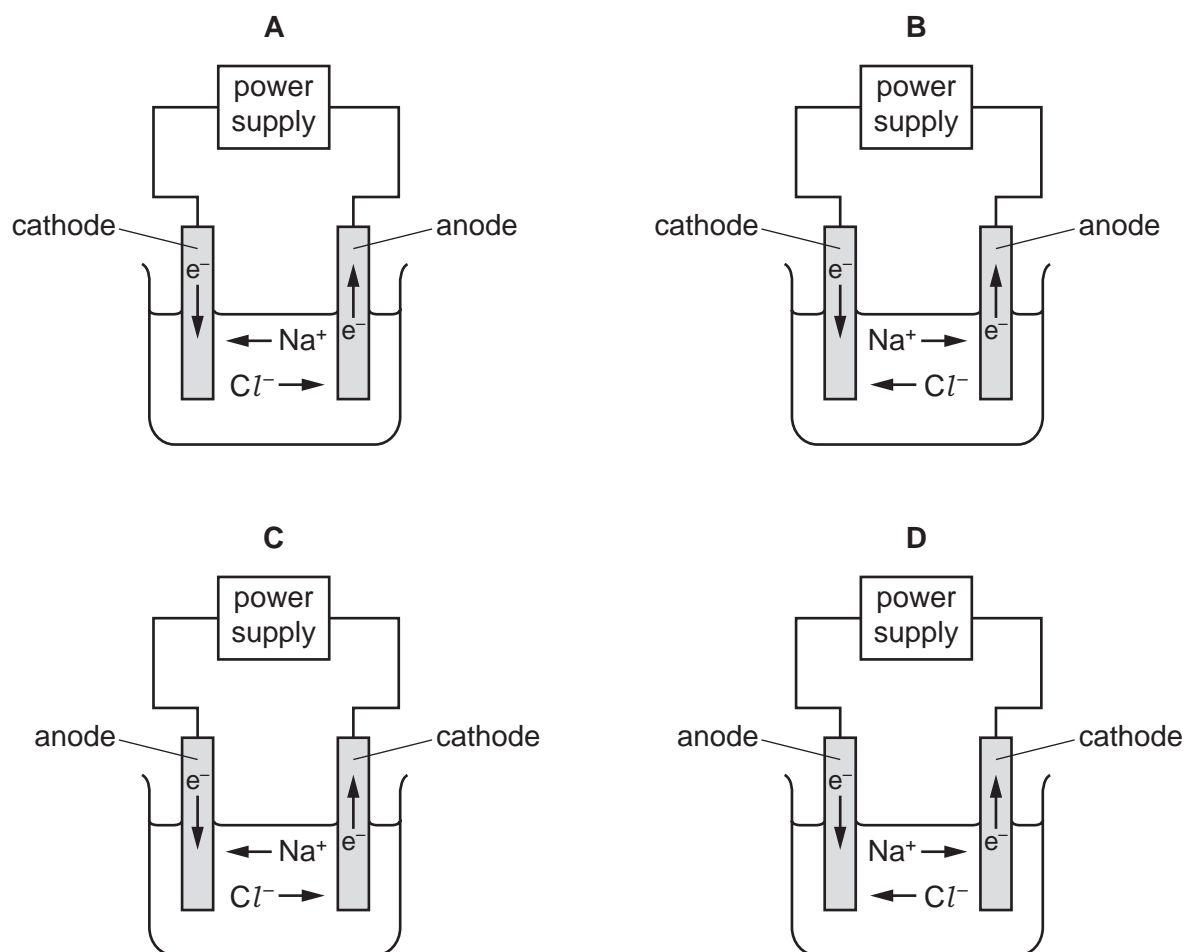
16 The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate. **(extended only)**



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit? **(extended only)**

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

- 17 Which diagram shows the direction of movement of ions and electrons during the electrolysis of molten sodium chloride? (extended only)



- 18 Molten sodium chloride and concentrated aqueous sodium chloride are electrolysed using platinum electrodes.

What are the products at the negative electrode (cathode) in each electrolysis?

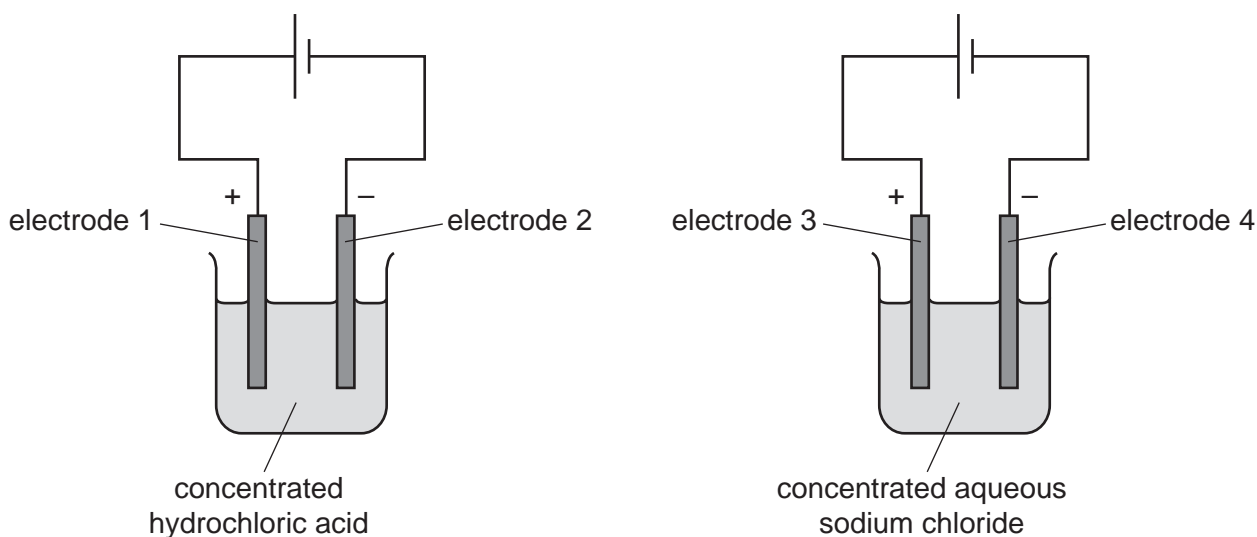
	molten sodium chloride	concentrated aqueous sodium chloride
A	hydrogen	hydrogen
B	hydrogen	sodium
C	sodium	hydrogen
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19 An object is electroplated with silver using an aqueous silver salt as the electrolyte.

Which row is correct?

	the object to be electroplated is the	the other electrode is made from
A	anode	carbon
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20 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



At which electrodes is hydrogen produced?

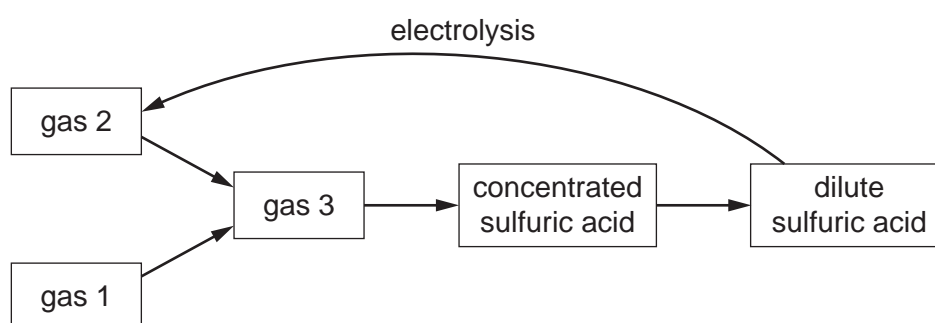
- A** electrode 1 only
- B** electrodes 1 and 3
- C** electrode 2 only
- D** electrodes 2 and 4

21 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

What is the ionic half-equation for the reaction at the cathode? **(extended only)**

- A $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$
 B $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$
 C $2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$
 D $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^{-}$

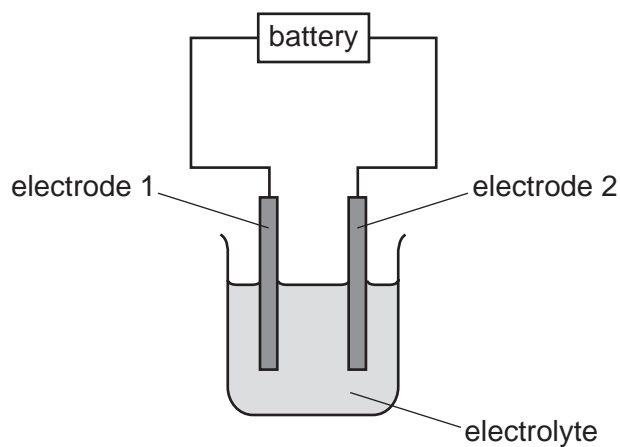
22 The flow chart shows part of the process for the manufacture of sulfuric acid and its electrolysis.



What are gases 1, 2 and 3?

	gas 1	gas 2	gas 3
A	sulfur dioxide	hydrogen	sulfur trioxide
B	sulfur dioxide	oxygen	sulfur trioxide
C	sulfur trioxide	hydrogen	sulfur dioxide
D	sulfur trioxide	oxygen	sulfur dioxide

23 In the electrolysis diagram, oxidation is occurring at electrode 1 and reduction at electrode 2.



Which row shows the directions of movement of the electrons in the external circuit and of the positive ions in the electrolyte? **(extended only)**

	direction of movement of electrons in external circuit	direction of movement of positive ions in electrolyte
A	1 → 2	1 → 2
B	1 → 2	2 → 1
C	2 → 1	1 → 2
D	2 → 1	2 → 1