

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

Which statement is correct?

- A** Oxygen gas is produced at the positive electrode.
B The blue colour of the solution gradually fades.
C The concentration of copper ions in the solution stays the same.
D The mass of the negative electrode decreases.

13 Which row describes the reactions during the electrolysis of dilute aqueous sodium chloride?

	anode reaction	cathode reaction
A	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$	$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightarrow 4\text{OH}^-$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
C	$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightarrow 4\text{OH}^-$	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
D	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

13 A solution of copper(II) sulfate can be electrolysed using copper electrodes or carbon electrodes.

Which statements are correct?

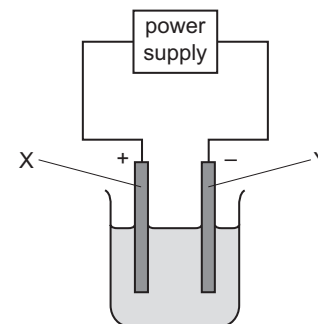
- Using copper electrodes, oxygen gas forms at the anode.
- Using copper electrodes, copper atoms lose electrons at the anode.
- Using carbon electrodes, copper metal forms at the cathode.
- Using carbon electrodes, copper ions gain electrons at the cathode.

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

13 Which product is initially obtained at each electrode during the electrolysis of concentrated aqueous sodium chloride?

	cathode	anode
A	hydrogen	chlorine
B	hydrogen	oxygen
C	sodium	chlorine
D	sodium	oxygen

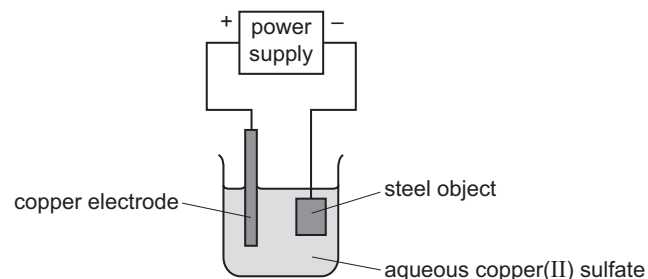
14 Molten lead(II) bromide is electrolysed using inert electrodes.



Which statement describes the movement of electrons?

- A** from X to Y through the external wire
B from Y to X through the external wire
C from X to Y through the electrolyte
D from Y to X through the electrolyte

10 The diagram shows the electroplating of a steel object.



A student makes three statements.

- The steel object turns a reddish-brown colour.
- The aqueous copper(II) sulfate changes to a paler blue colour.
- The copper electrode becomes thinner.

Which statements are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

11 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Which equation shows the correct ionic half-equation for the reaction at the anode?

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

3 This question is about electrolysis.

(a) Complete the definition of electrolysis by filling in the missing words.

The decomposition of compounds when
or by the passage of an electric current.

[3]

(b) Electrolysis of aqueous copper(II) sulfate is carried out using the apparatus shown in Fig. 3.1. The electrodes are made of platinum.

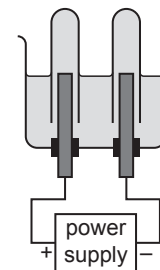


Fig. 3.1

(i) State whether the mass of the cathode increases, decreases or remains the same when platinum electrodes are used.

..... [1]

(ii) Describe the change in appearance, if any, of the electrolyte when platinum electrodes are used.

..... [1]

(iii) Describe what is seen at the anode when platinum electrodes are used.

..... [1]

(iv) Write the ionic half-equation for the reaction at the anode.

..... [3]

(c) The electrolysis is repeated using copper electrodes.

(i) State whether the mass of the cathode increases, decreases or remains the same when copper electrodes are used.

..... [1]

(ii) Describe the change in appearance, if any, of the electrolyte when copper electrodes are used.

..... [1]

(d) Aluminium is extracted from its purified ore by electrolysis.

(i) Name this ore of aluminium.

..... [1]

(ii) Name the substance added to this process to reduce the operating temperature.

..... [1]

(iii) Explain why the anodes need to be continually replaced during this process.

.....

..... [2]

[Total: 15]

14 Dilute sulfuric acid is electrolysed using inert electrodes.

What are the ionic half-equations for the reactions that take place at each electrode?

	positive electrode	negative electrode
A	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$
C	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
D	$4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$