

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?

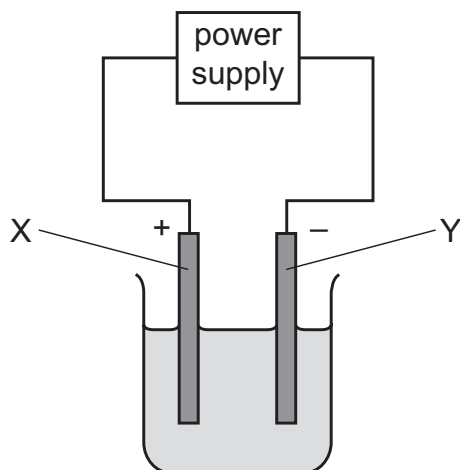
- 1 Using copper electrodes, oxygen gas forms at the anode.
- 2 Using copper electrodes, copper atoms lose electrons at the anode.
- 3 Using carbon electrodes, copper metal forms at the cathode.
- 4 Using carbon electrodes, copper ions gain electrons at the cathode.

- 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

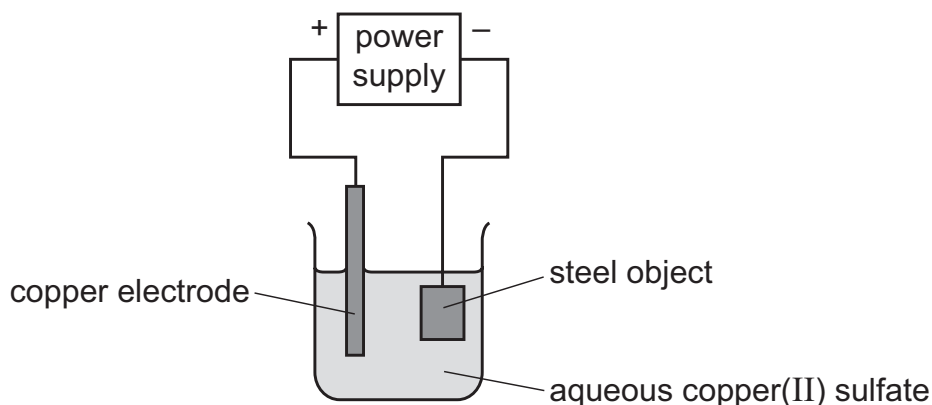
14 Molten lead(II) bromide is electrolysed using inert electrodes.



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.

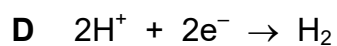
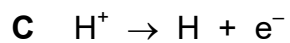
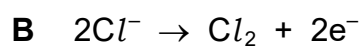
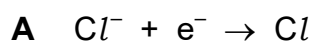
- 1 The steel object turns a reddish-brown colour.
- 2 The aqueous copper(II) sulfate changes to a paler blue colour.
- 3 The copper electrode becomes thinner.

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?



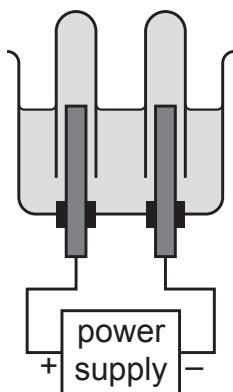
3 This question is about electrolysis.

- (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	$4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$