Electrolysis

Question Paper

Level	O Level
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Electrolysis
Booklet	Question Paper

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

1 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

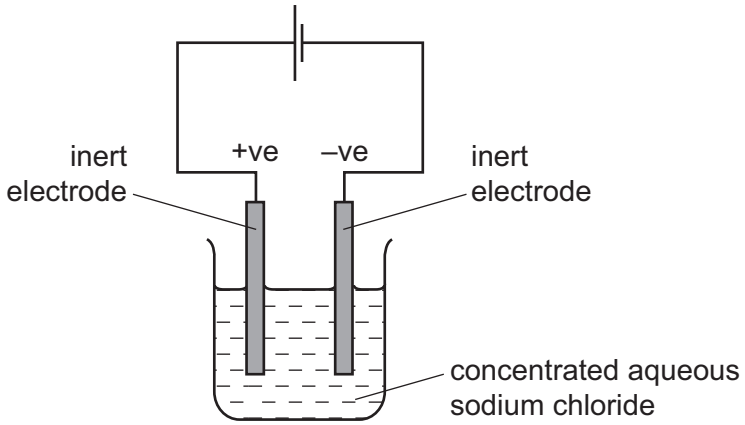
Which observations will be made?

	at the positive electrode	electrolyte	at the negative electrode
A	colourless gas forms	blue colour fades	pink solid forms
B	colourless gas forms	no change	colourless gas forms
C	electrode decreases in mass	blue colour fades	colourless gas forms
D	electrode decreases in mass	no change	pink solid forms

2 What are the correct anode (positive electrode) and cathode (negative electrode) products when aqueous copper(II) sulfate is electrolysed using copper electrodes?

	anode product	cathode product
A	aqueous copper(II) ions	copper metal
B	aqueous copper(II) ions	hydrogen gas
C	oxygen gas	copper metal
D	oxygen gas	hydrogen gas

3 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.



Which statement about this electrolysis is correct?

A Chloride ions travel through the solution to the negative electrode.

B Electrons travel through the solution to the sodium ions.

C Gases are given off at both electrodes.

D Sodium is formed at the negative electrode.

4 Which occurs during the electrolysis of dilute sulfuric acid?

A Hydrogen and oxygen are formed in the ratio two volumes of oxygen to one volume of hydrogen.

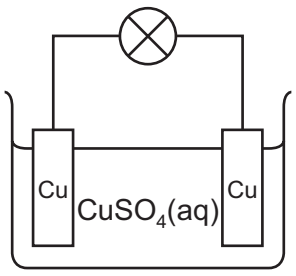
B Hydrogen is formed at the positive electrode.

C Oxide ions are oxidised to oxygen.

D The dilute sulfuric acid becomes more concentrated.

5 In which circuit does the bulb light?

A



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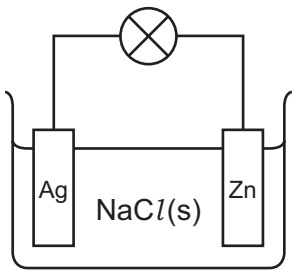
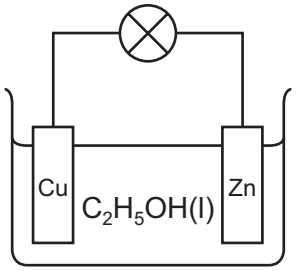


key

= bulb

C



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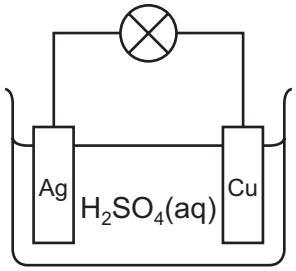
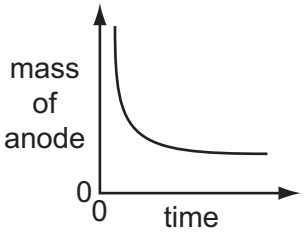


6 Aqueous copper(II) sulfate is electrolysed using copper electrodes. The current is constant and the anode (positive electrode) is weighed at regular intervals.

Which graph is obtained when the mass of the anode is plotted against time?

A



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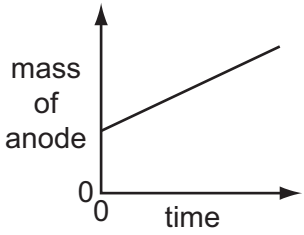

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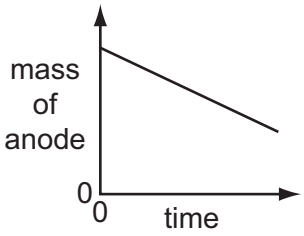

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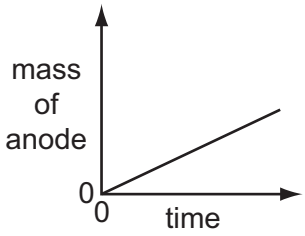
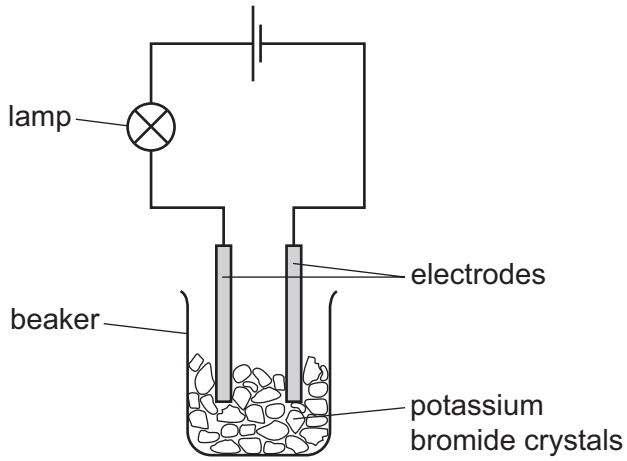


7 The experiment shown is used to test potassium bromide crystals.



The lamp does not light.

Distilled water is then added to the beaker and the lamp lights.

Which statement explains these results?

A Electrons are free to move in the solution when potassium bromide dissolves.

B Metal ions are free to move when potassium bromide melts.

C Metal ions are free to move when potassium reacts with water.

D Oppositely charged ions are free to move in the solution when potassium bromide dissolves.

8 Which changes are observed during the electrolysis of aqueous copper(II) sulfate using copper electrodes?

1 A pink solid is deposited on the negative electrode.

2 Bubbles form on the positive electrode.

3 The colour of the solution does not change.

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

9 Which substance conducts an electric current but remains chemically unchanged?

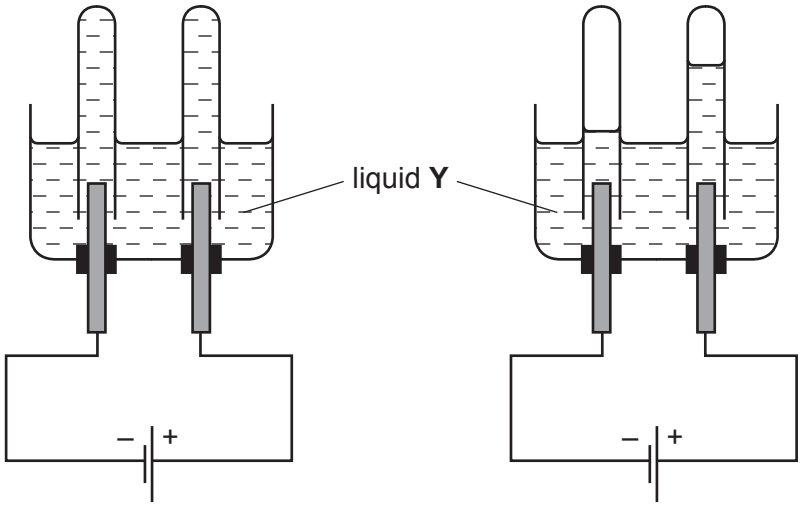
A aluminium

B aqueous sodium chloride

C molten lead(II) bromide

D pure ethanoic acid

10 The diagrams show an electrolysis experiment using inert electrodes.



before electrolysis after electrolysis

Which could be liquid **Y**?

A aqueous copper(II) sulfate

B concentrated aqueous sodium chloride

C dilute sulfuric acid

D ethanol

11 Which substance, when added to water, does **not** make a solution that is a good conductor of electricity?

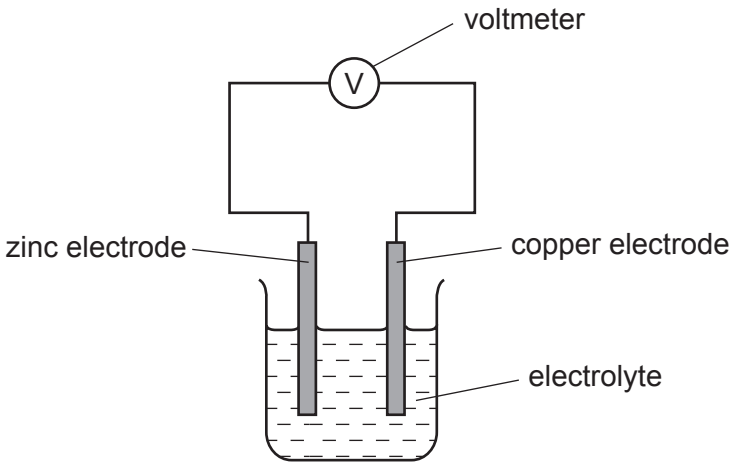
A barium nitrate

B calcium chloride

C lead(II) nitrate

D zinc carbonate

12 A simple cell is shown below.



Which statement about the process occurring when the cell is in operation is correct?

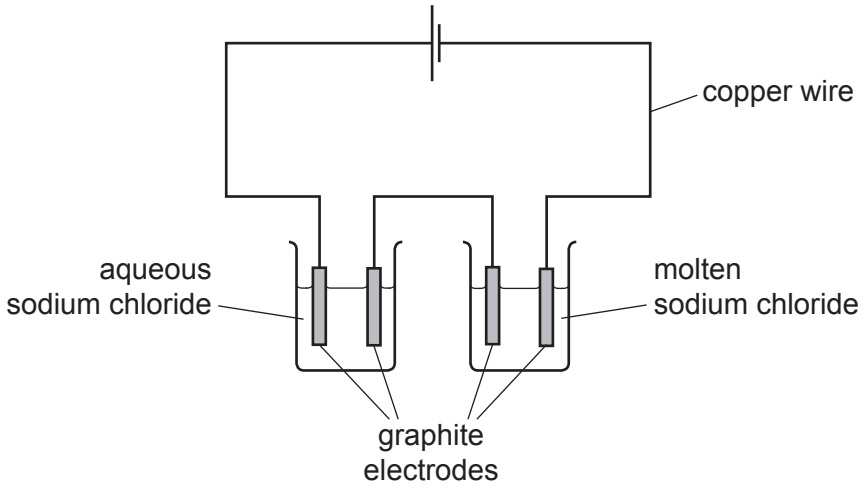
A Cu^{2+} ions are formed in solution.

B Electrons travel through the solution.

C The reaction $Zn \rightarrow Zn^{2+} + 2e^{-}$ occurs.

D Zinc increases in mass.

13 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.



Which substance in the diagram has both positive ions and mobile electrons?

A aqueous sodium chloride

B copper wire

C graphite electrodes

D molten sodium chloride

14 When dilute sulfuric acid is electrolysed between inert electrodes, which statements are correct?

1 Hydrogen is released at the negative electrode.

2 Oxygen is released at the positive electrode.

3 Sulfur dioxide is released at the positive electrode.

4 The acid becomes more concentrated.

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

15 Which statement about conduction of electricity is correct?

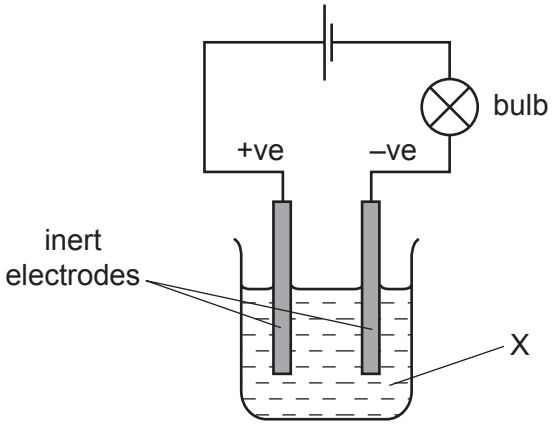
A Electricity is conducted in aqueous solution by electrons.

B Electricity is conducted in a metal wire by ions.

C Electricity is conducted in a molten electrolyte by electrons.

D Electricity is conducted in an acid solution by ions.

16 In the experiment shown in the diagram, the bulb lights and a gas is produced at each electrode.



What is X?

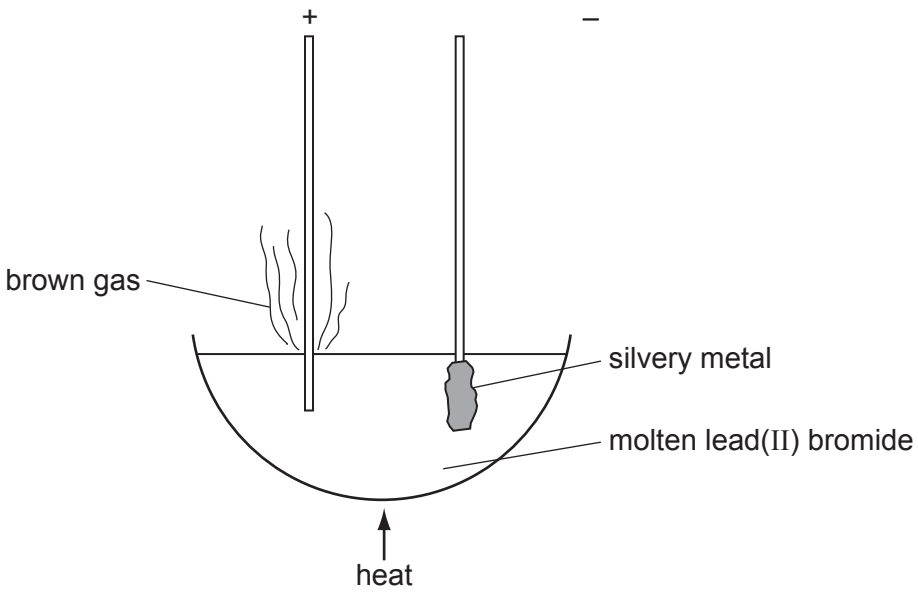
A aqueous copper(II) sulfate

B concentrated aqueous sodium chloride

C ethanol

D molten lead bromide

17 The diagram shows the electrolysis of molten lead(II) bromide using inert electrodes.



What happens during this electrolysis?

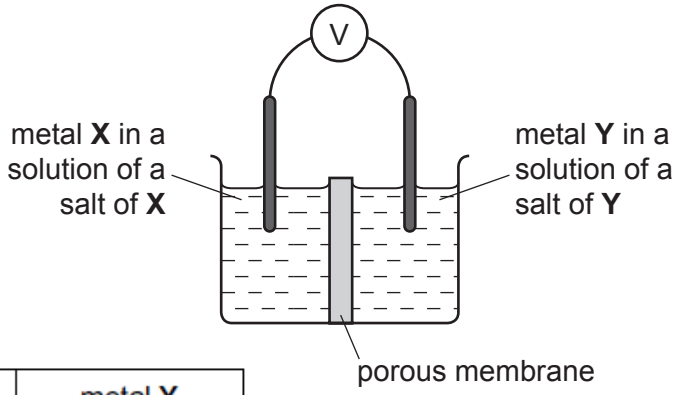
A Atoms change to ions.

B Covalent bonds are broken.

C Ions change to atoms.

D New compounds are formed.

18 Which pair of metals **X** and **Y** will produce the highest voltage when used as electrodes in a simple cell?



	metal **X**	metal **Y**
A	copper	silver
B	magnesium	silver
C	magnesium	zinc
D	zinc	copper

19 How can sodium be manufactured?

A by electrolysing aqueous sodium chloride

B by electrolysing aqueous sodium hydroxide

C by electrolysing molten sodium chloride

D by heating sodium oxide with carbon

20 Which statement about the electrolysis of an aqueous solution of copper(II) sulfate with platinum electrodes is correct?

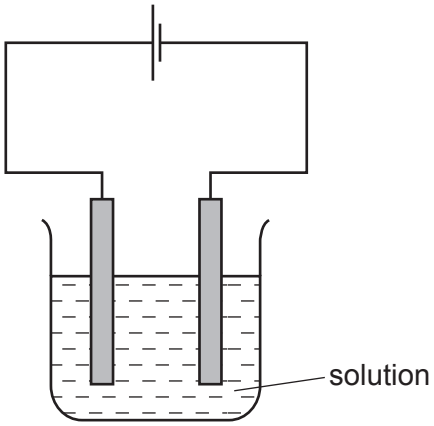
A Oxygen is given off at the positive electrode.

B The mass of the negative electrode remains constant.

C The mass of the positive electrode decreases.

D There is no change in the colour of the solution.

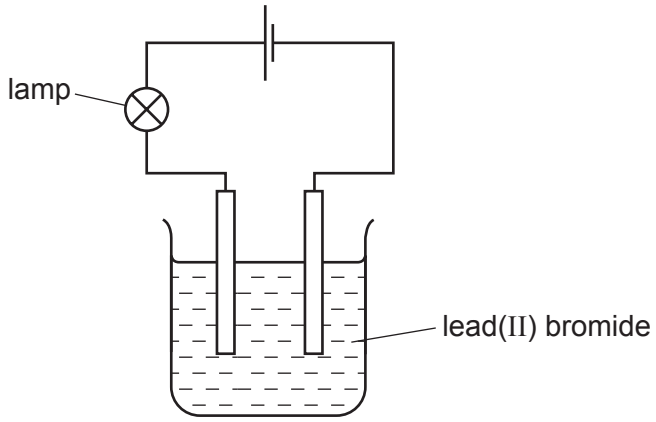
21 The diagram shows the electrolysis of a concentrated aqueous solution containing both copper(II) ions and sodium ions.



Which metal is deposited at the negative electrode and why?

	metal deposited	reason
A	copper	copper is less reactive than sodium
B	copper	copper is more reactive than hydrogen
C	sodium	copper is less reactive than hydrogen
D	sodium	copper is more reactive than sodium

22 The diagram shows the apparatus used to electrolyse lead(II) bromide using inert electrodes.



Why does the lamp light up only when the lead(II) bromide is melted?

A Bromine atoms in the lead(II) bromide are converted to ions when it is melted.

B Electrons flow through the lead(II) bromide when it is melted.

C The ions in lead(II) bromide are free to move only when the solid is melted.

D There are no ions in solid lead(II) bromide.

23 Which substance could be sodium chloride?

	melting point / °C	conduction of electricity	
		when liquid	in aqueous solution
A	−114	nil	good
B	180	nil	nil (insoluble)
C	808	good	good
D	3550	nil	nil (insoluble)

24 In the electrolysis of molten aluminium oxide for the extraction of aluminium, the following three reactions take place.

1 $Al^{3+} + 3e^- \rightarrow Al$

2 $2O^{2-} \rightarrow O_2 + 4e^-$

3 $C + O_2 \rightarrow CO_2$

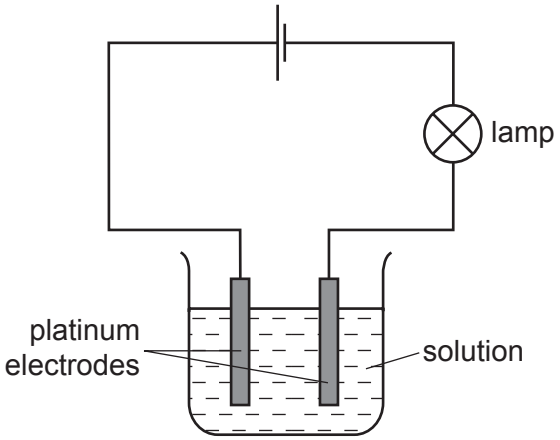
Which reactions take place at the anode?

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

25 Which reactions take place during the electrolysis of aqueous copper(II) sulfate with copper electrodes?

	reaction at positive electrode	reaction at negative electrode
A	$Cu^{2+} + 2e^- \rightarrow Cu$	$Cu \rightarrow Cu^{2+} + 2e^-$
B	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$Cu^{2+} + 2e^- \rightarrow Cu$
C	$Cu \rightarrow Cu^{2+} + 2e^-$	$2H^+ + 2e^- \rightarrow H_2$
D	$Cu \rightarrow Cu^{2+} + 2e^-$	$Cu^{2+} + 2e^- \rightarrow Cu$

26 The diagram shows apparatus used to investigate the conductivity of different solutions.



Which substance, in aqueous solution of concentration 1 mol / dm^3, would cause the lamp to give the brightest light?

A ammonia

B ethanoic acid

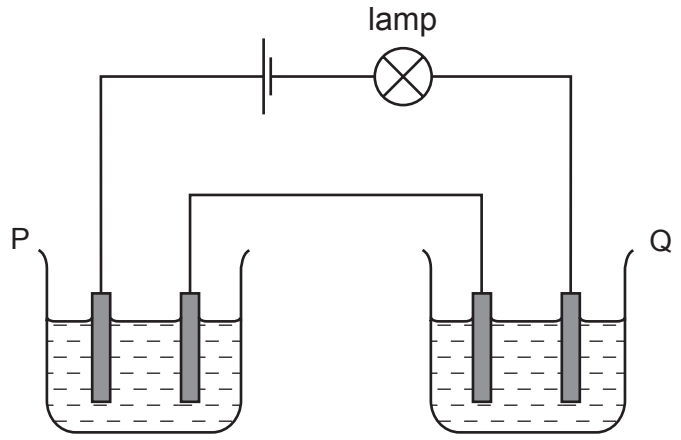
C ethanol

D sulfuric acid

27 What products are formed when concentrated aqueous potassium chloride is electrolysed?

	at the anode (positive)	at the cathode (negative)
A	chlorine	hydrogen
B	chlorine	potassium
C	oxygen	hydrogen
D	oxygen	potassium

28 Two cells, P and Q, containing different liquids, were connected in series with a battery, a suitable lamp and inert electrodes, as shown in the diagram.



For which pair of liquids did the lamp light up?

	in P	in Q
A	concentrated sodium chloride solution	concentrated sugar solution
B	copper(II) sulfate solution	propanol
C	ethanol	molten lead(II) bromide
D	mercury	dilute hydrochloric acid

29 A substance **Q** conducts electricity both when solid and molten.

What is **Q**?

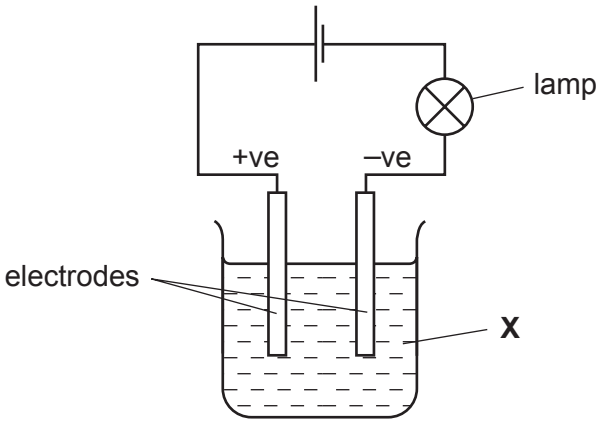
A an alloy

B a hydrocarbon

C a metal oxide

D a salt

30 When the experiment shown is set up, the bulb lights, but there are no decomposition products at the electrodes.



What is **X**?

A aqueous sodium chloride

B bromine

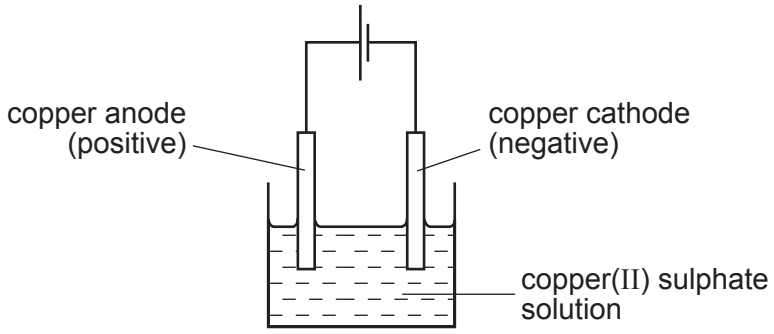
C molten sodium chloride

D mercury

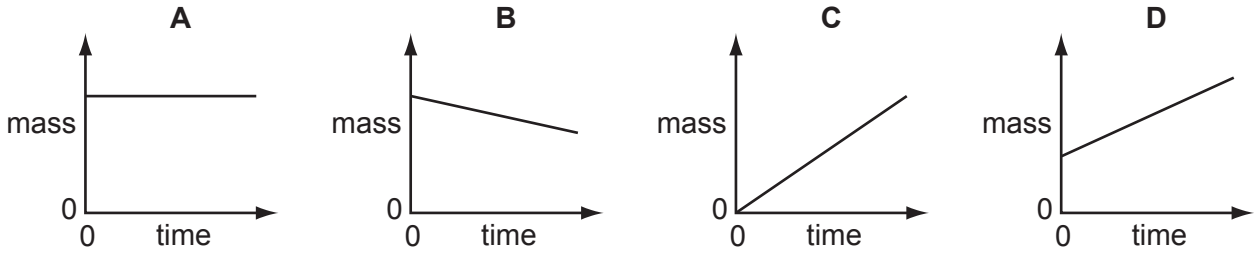
31 What are the products formed at the electrodes during the electrolysis of molten magnesium chloride between carbon electrodes?

	positive electrode	negative electrode
A	oxygen	magnesium
B	magnesium	chlorine
C	chlorine	magnesium
D	chlorine	hydrogen

32 The diagram shows the electrolysis of aqueous copper(II) sulphate using copper electrodes.



Which graph shows how the mass of the cathode changes during electrolysis?



33 A coil of clean copper wire is suspended in aqueous silver nitrate. Crystals of silver are deposited on the copper wire.

Which statement is **not** correct?

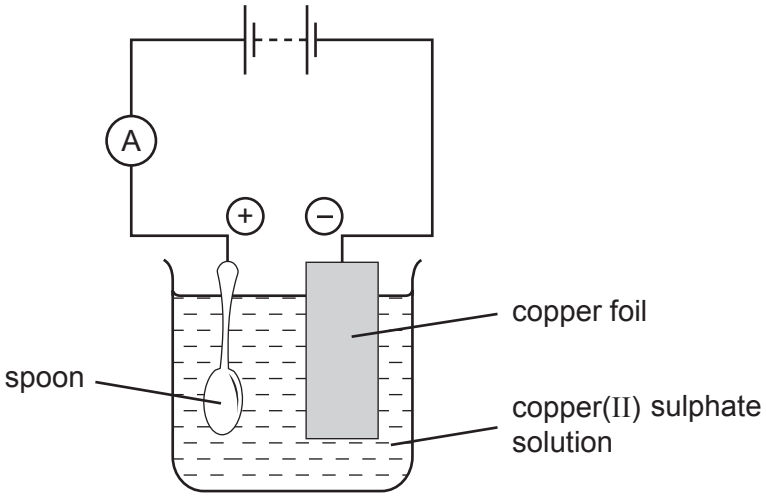
A The copper is oxidised.

B The total mass of the crystals of silver increases gradually.

C The total number of positive ions in the solution is unchanged.

D The solution turns blue.

34 The apparatus shown below was set up to copper plate the metal spoon.



The experiment did **not** work.

What was the mistake in the apparatus?

A A variable resistor should be included in the electrical circuit.

B Dilute sulphuric acid should be used as the electrolyte.

C The copper electrode should all be in the solution.

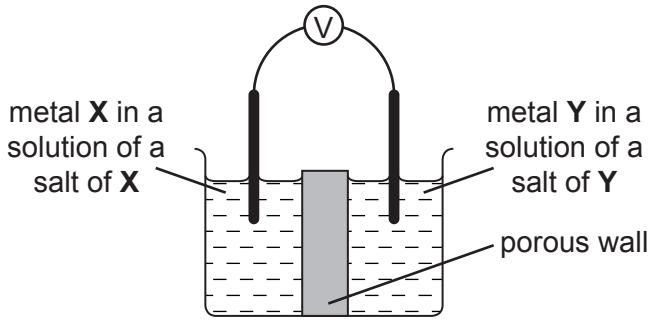
D The spoon should be the negative electrode.

35 Aqueous copper(II) sulphate is electrolysed using copper electrodes.

Which observations will be made?

	at anode (+ve)	at cathode (–ve)	electrolyte
A	anode dissolves	pink solid forms	blue colour fades
B	anode dissolves	pink solid forms	no change
C	colourless gas forms	colourless gas forms	no change
D	colourless gas forms	pink solid forms	blue colour fades

36 Which pair of metals **X** and **Y** will produce the highest voltage when used as electrodes in a simple cell?



	metal **X**	metal **Y**
A	copper	silver
B	magnesium	silver
C	magnesium	zinc
D	zinc	copper

37 The heat-reflecting shields of some space rockets are gold-plated, using electrolysis.

Which electrodes and electrolyte would be used to gold-plate the heat shield?

	negative electrode	positive electrode	electrolyte
A	carbon	heat shield	gold compound
B	gold	heat shield	copper compound
C	heat shield	carbon	copper compound
D	heat shield	gold	gold compound

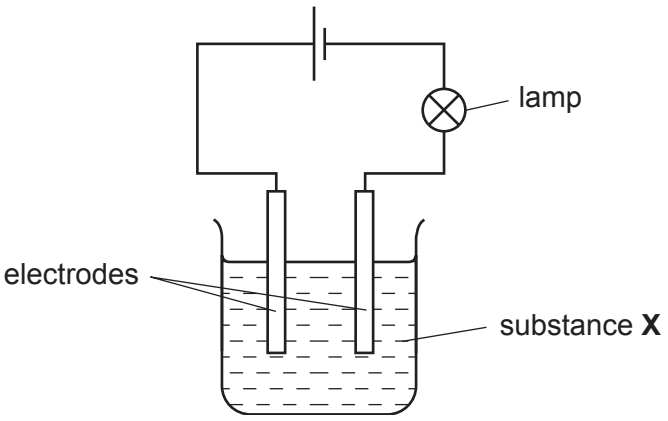
38 Four substances have the following electrical properties.

substance	property
W	does not conduct under any conditions
X	conducts only in aqueous solution
Y	conducts in both the molten and solid states
Z	conducts in both the molten and aqueous states

What are these four substances?

	W	**X**	**Y**	**Z**
A	HC*l*	S	NaC*l*	Pb
B	Pb	HC*l*	NaC*l*	S
C	S	HC*l*	Pb	NaC*l*
D	S	NaC*l*	HC*l*	Pb

39 In the circuit below, the lamp lights up.



What could **X** be?

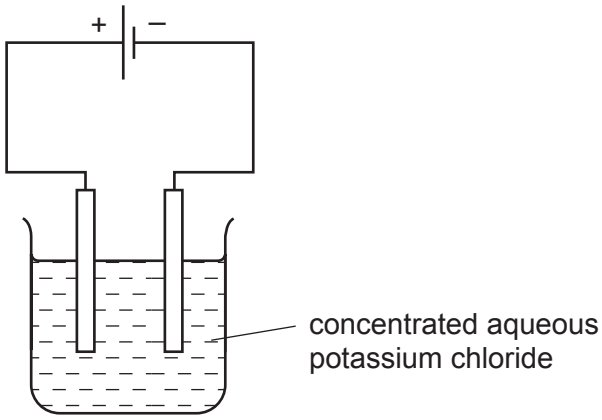
A a solution of ethanol in water

B a solution of sodium chloride in water

C liquid ethanol

D solid sodium chloride

40 A current was passed through concentrated aqueous potassium chloride, KC*l*, as shown.



Which entry in the table is correct?

	ions moving towards	
	the cathode (-ve)	the anode (+ve)
A	K^+ only	Cl^- and OH^-
B	K^+ only	Cl^- only
C	K^+ and H^+	Cl^- only
D	K^+ and H^+	Cl^- and OH^-

41 What are the products when concentrated aqueous lithium chloride is electrolysed?

	at the anode (positive)	at the cathode (negative)
A	chlorine	hydrogen
B	chlorine	lithium
C	oxygen	hydrogen
D	oxygen	lithium

42 A solid deposit of element **R** is formed at the cathode(-ve) when an aqueous solution containing ions of **R** is electrolysed.

Which statement about element **R** must be correct?

A **R** forms negative ions.

B **R** ions gain electrons at the cathode.

C **R** ions lose electrons at the cathode.

D **R** is above hydrogen in the reactivity series.

43 A piece of metal is to be electroplated.

Which set of conditions give the thickest plate?

	type of current	size of current	time
A	a.c.	low	short
B	d.c.	high	long
C	a.c.	high	short
D	d.c.	low	long

44 Rubidium is above sodium in the reactivity series.

What is formed when concentrated aqueous rubidium chloride is electrolysed?

	products	
	cathode (–)	anode (+)
A	chlorine	hydrogen
B	hydrogen	rubidium
C	hydrogen	chlorine
D	rubidium	chlorine

45 Why is cryolite, Na_3AlF_6, used in the extraction of aluminium from aluminium oxide?

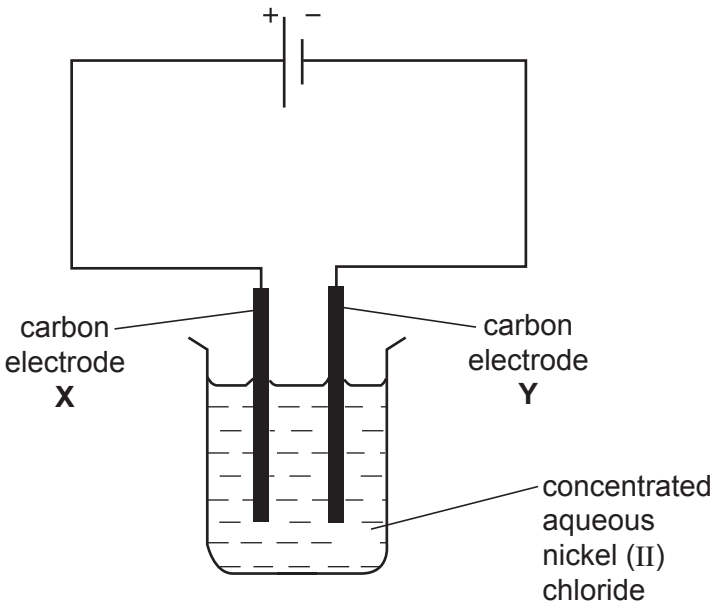
A to dissolve aluminium oxide

B to prevent the anodes from burning away

C to prevent the oxidation of aluminium

D to remove the impurities from the aluminium oxide

46 Apparatus is set up as shown in the diagram.



What occurs at electrode **X**?

A Chloride ions are oxidised.

B Chloride ions are reduced.

C Nickel ions are oxidised.

D Nickel is deposited.

47 Which of the following, when added to water, makes a solution that is a good conductor of electricity?

A calcium carbonate

B copper

C ethanol

D sodium hydroxide

48 Aqueous copper(II) sulphate is electrolysed using carbon electrodes.

What happens to the electrolyte?

A It becomes more acidic.

B It becomes more alkaline.

C It turns deeper blue.

D It remains unchanged.