Electricity and chemistry

Question Paper 2

Level	IGCSE
Subject	Chemistry (0620/0971)
Exam Board	Cambridge International Examinations (CIE)
Topic	Electricity and chemistry
Sub-Topic	Electricity and chemistry
Booklet	Question Paper 2

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1 Electrical cables are made from either ……1……, because it is a very good conductor of electricity, or from……2……, because it has a low density.
Overhead cables have a ……3…… core in order to give the cable strength.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	aluminium	copper	magnesium
B	copper	aluminium	magnesium
C	copper	aluminium	steel
D	magnesium	copper	steel

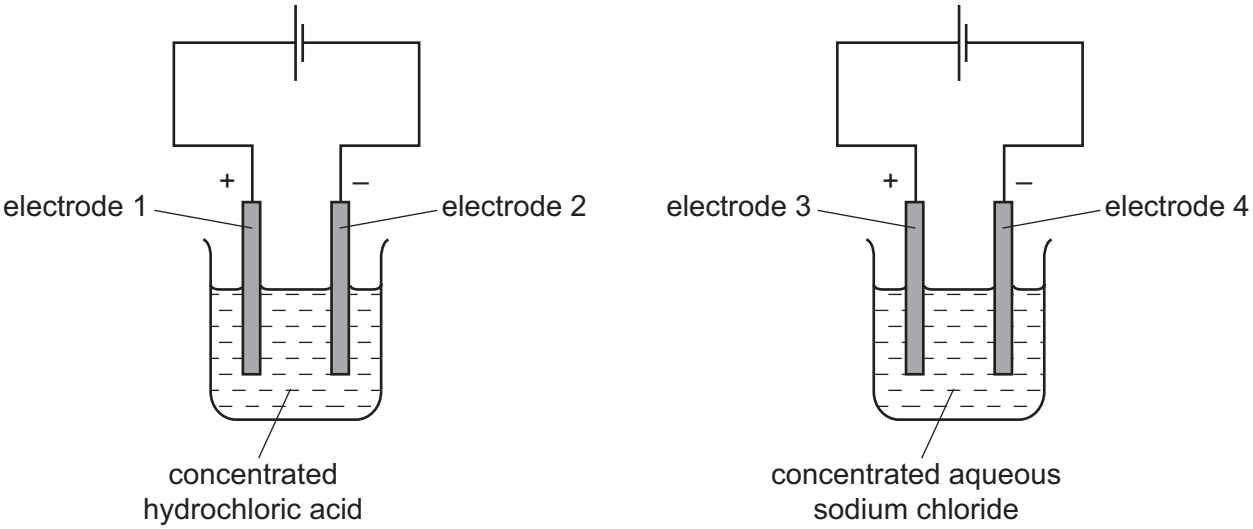
2 What will be produced at the anode and at the cathode, if molten potassium chloride is electrolysed?

	anode (+)	cathode (-)
A	chlorine	hydrogen
B	chlorine	potassium
C	hydrogen	chlorine
D	potassium	chlorine

3 Which row describes the electrolysis of molten potassium bromide?

	product at anode	product at cathode
A	bromine	hydrogen
B	bromine	potassium
C	hydrogen	bromine
D	potassium	bromine

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



At which electrode(s) is hydrogen produced?

A electrode 1 only

B electrodes 1 and 3

C electrode 2 only

D electrodes 2 and 4

5 What are the electrode products when molten silver iodide is electrolysed between inert electrodes?

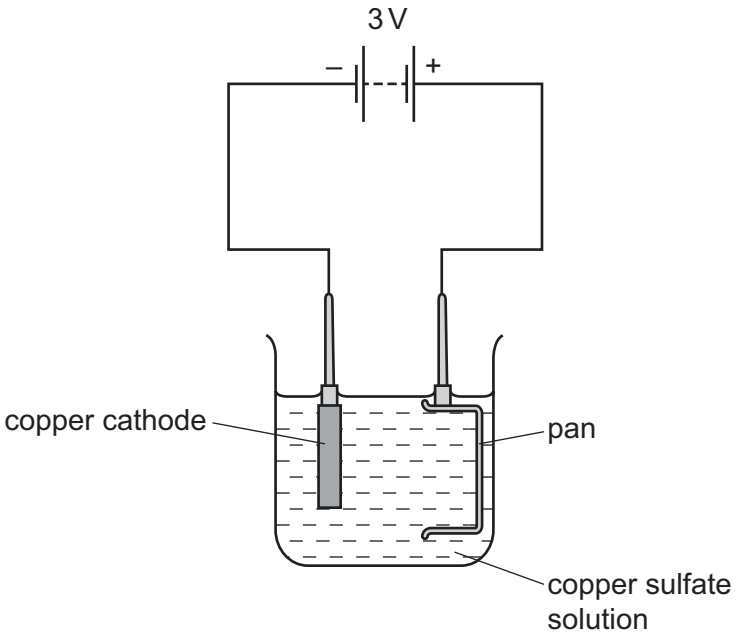
	cathode	anode
A	hydrogen	iodine
B	iodine	silver
C	silver	iodine
D	silver	oxygen

6 Copper and hydrogen can each be formed by electrolysis.

At which electrodes are these elements formed?

	copper	hydrogen
A	anode	anode
B	anode	cathode
C	cathode	anode
D	cathode	cathode

7 The diagram shows a failed attempt to copper-plate a pan.



Which action will plate the pan with copper?

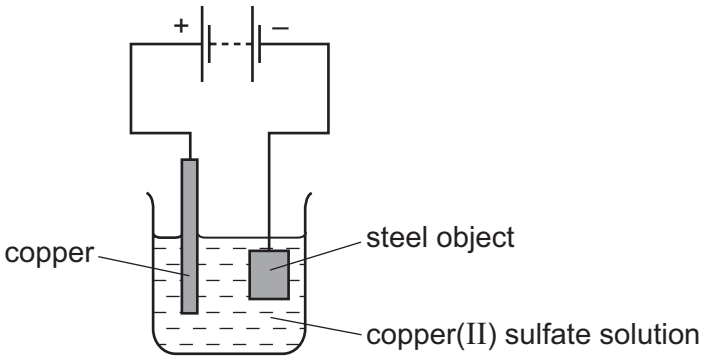
A cooling the copper sulfate solution in an ice bath

B heating the copper sulfate solution to boiling point

C increasing the voltage from 3 V to 6 V

D making the pan the cathode and the copper the anode

8 The diagram shows the electroplating of a steel object.



A student made the following statements.

1 The object turns a reddish-brown colour.

2 The copper sulfate solution changes to a paler blue colour.

3 The copper electrode becomes smaller.

Which statements are correct?

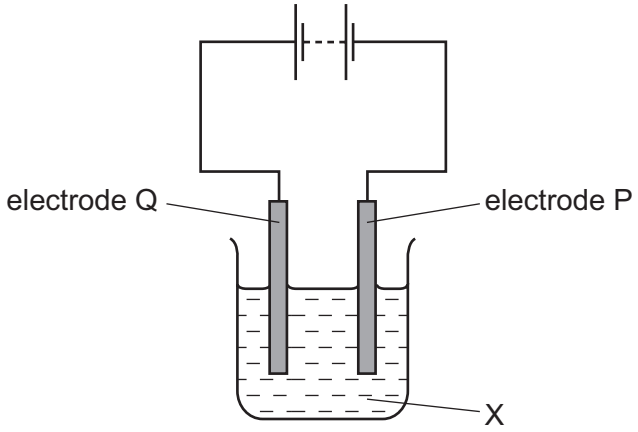
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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

Which set of conditions is used?

	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

10 The diagram shows an electrolysis experiment.

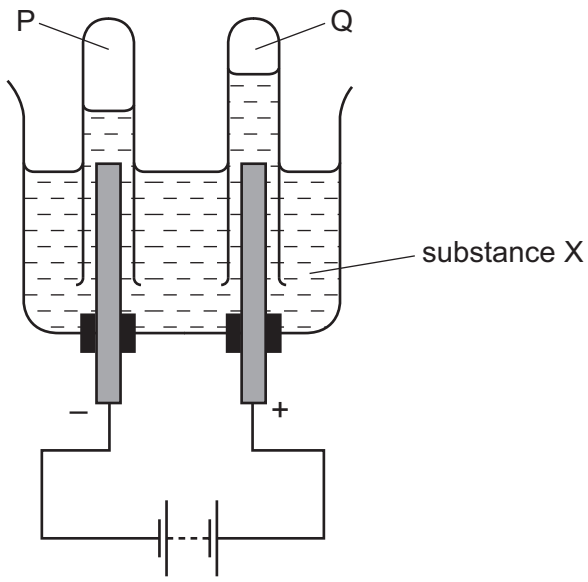


During the electrolysis, sodium was formed at electrode P and chlorine at electrode Q.

Which row correctly identifies P, Q and X?

	P	Q	X
A	anode	cathode	concentrated solution of sodium chloride in water
B	anode	cathode	molten sodium chloride
C	cathode	anode	concentrated solution of sodium chloride in water
D	cathode	anode	molten sodium chloride

11 When substance X is electrolysed, the amount of gases P and Q formed is shown.



What is substance X?

A concentrated aqueous sodium chloride

B concentrated hydrochloric acid

C dilute sulfuric acid

D molten lead(II) bromide

12 What are the products at the electrodes when dilute sulfuric acid is electrolysed using inert electrodes?

	anode	cathode
A	hydrogen	oxygen
B	oxygen	hydrogen
C	sulfur	oxygen
D	sulfur dioxide	hydrogen

13 Electricity is passed separately through concentrated hydrochloric acid, concentrated aqueous sodium chloride and dilute sulfuric acid.

In which rows are the electrolysis products correctly named?

		cathode product	anode product
1	concentrated hydrochloric acid	hydrogen	chlorine
2	concentrated aqueous sodium chloride	sodium	chlorine
3	dilute sulfuric acid	hydrogen	oxygen

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

14 Which reactions could take place at the anode during electrolysis?

1 $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

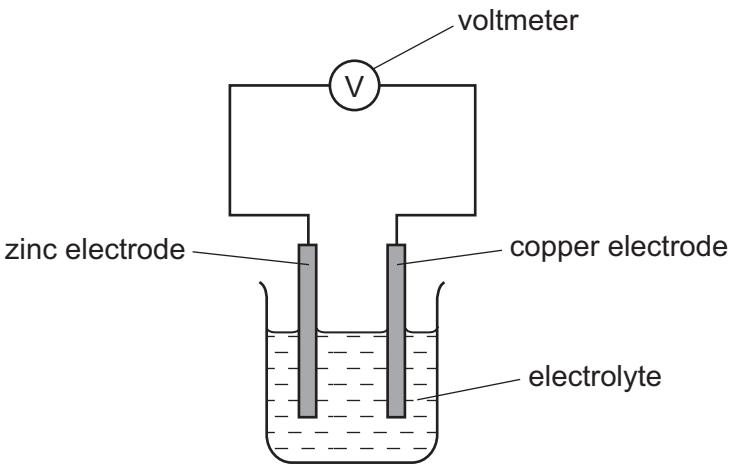
2 $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$

3 $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

4 $2H^+(aq) + 2e^- \rightarrow H_2(g)$

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

15 The diagram shows a simple cell.



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

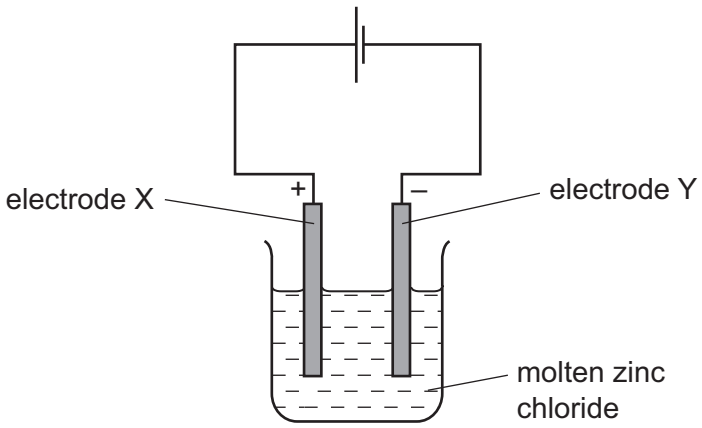
A Cu^{2+} ions are formed in solution.

B Electrons travel through the solution.

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

D The zinc electrode increases in mass.

16 The diagram shows the electrolysis of molten zinc chloride, $ZnCl_2$.



Which statement is correct?

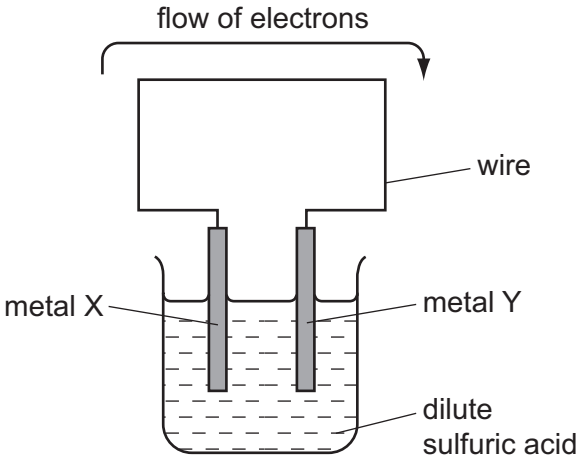
A Oxidation occurs at electrode X and the equation is: $2Cl^- \rightarrow Cl_2 + 2e^-$.

B Oxidation occurs at electrode Y and the equation is: $Zn^{2+} + 2e^- \rightarrow Zn$.

C Reduction occurs at electrode X and the equation is: $Zn^{2+} + 2e^- \rightarrow Zn$.

D Reduction occurs at electrode Y and the equation is: $2Cl^- \rightarrow Cl_2 + 2e^-$.

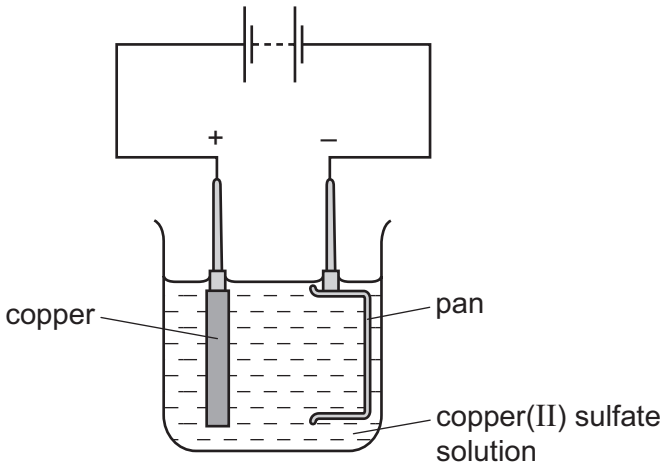
17 The diagram shows a simple cell.



For which pair of metals would electrons flow from metal X to metal Y?

	X	Y
A	copper	iron
B	copper	zinc
C	iron	zinc
D	zinc	iron

18 The diagram shows a method used to copper-plate a pan



Which equation represents the reaction at the cathode?

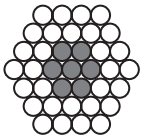
A $Cu^{2+} + 2e^- \rightarrow Cu$

B $2H^+ + 2e^- \rightarrow H_2$

C $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$

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

19 The diagram shows, in cross-section, the arrangement of aluminium and steel wires in an electric power cable.

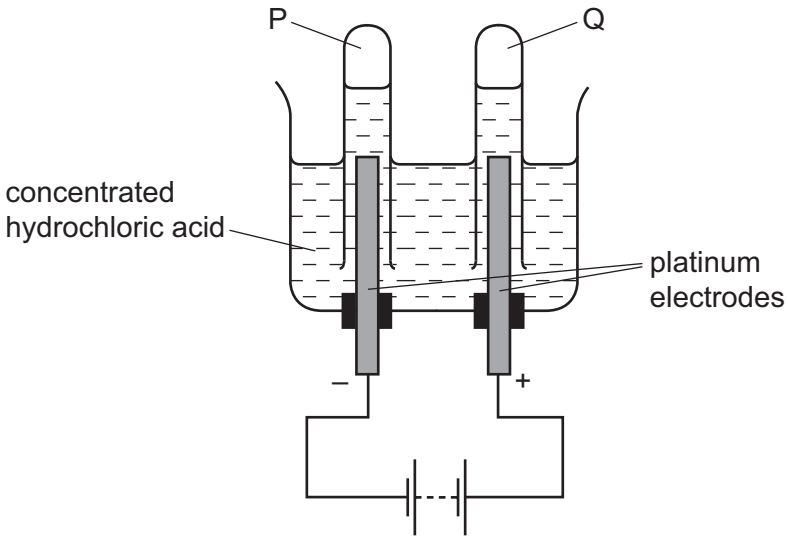


key
○ = aluminium
● = steel

Which metal wire is the better conductor and which metal wire has the greater mechanical strength?

	better conductor	greater mechanical strength
A	aluminium	aluminium
B	aluminium	steel
C	steel	aluminium
D	steel	steel

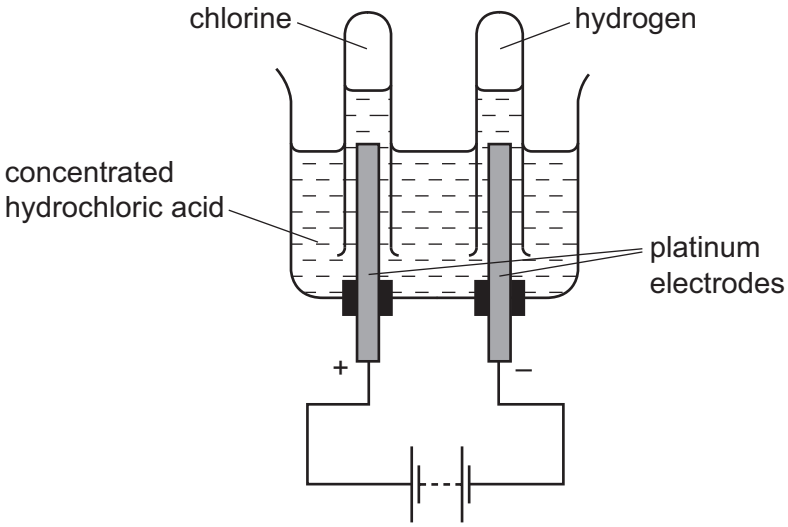
20 When concentrated hydrochloric acid is electrolysed, gases P and Q are formed.



What are P and Q?

	P	Q
A	chlorine	hydrogen
B	chlorine	oxygen
C	hydrogen	chlorine
D	hydrogen	oxygen

21 The electrolysis of concentrated hydrochloric acid is shown.



Which statement describes what happens to the electrons during the electrolysis?

A They are added to chloride ions.

B They are added to hydrogen ions.

C They move through the circuit from positive to negative.

D They move through the solution from negative to positive.

22 Which reaction does **not** occur in the extraction of aluminium?

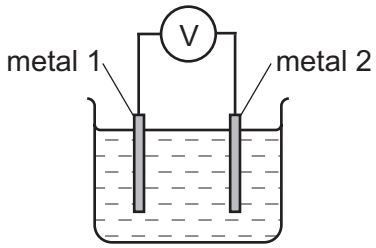
A $Al^{3+} + 3e^- \rightarrow Al$

B $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

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

D $C + O_2 \rightarrow CO_2$

23 Different metals were tested using the apparatus shown.



Which pair of metals would produce the largest voltage?

A copper and silver

B magnesium and silver

C magnesium and zinc

D zinc and copper

24 Three electrolysis cells are set up. Each cell has inert electrodes.

The electrolytes are listed below.

cell 1	aqueous sodium chloride
cell 2	dilute sulfuric acid
cell 3	molten lead(II) bromide

In which of these cells is a gas formed at **both** electrodes?

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

25 The statements refer to the electrolysis of concentrated copper(II) chloride solution.

1 Electrons are transferred from the cathode to the copper(II) ions.

2 Electrons move around the circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

Which statements about the electrolysis of concentrated copper(II) chloride are correct?

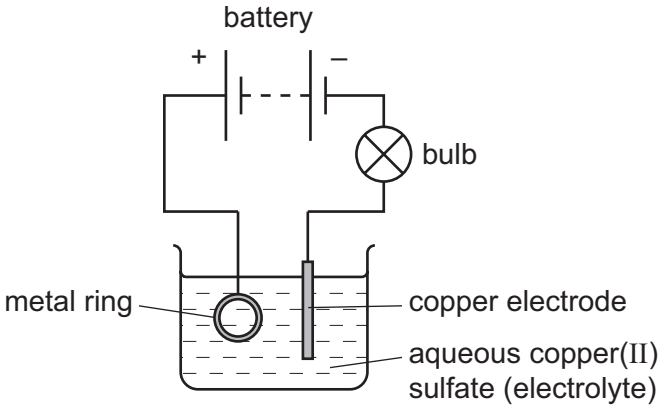
A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

26 The diagram shows apparatus used in an attempt to electroplate a metal ring with copper.



The experiment did not work.

Which change is needed in the experiment to make it work?

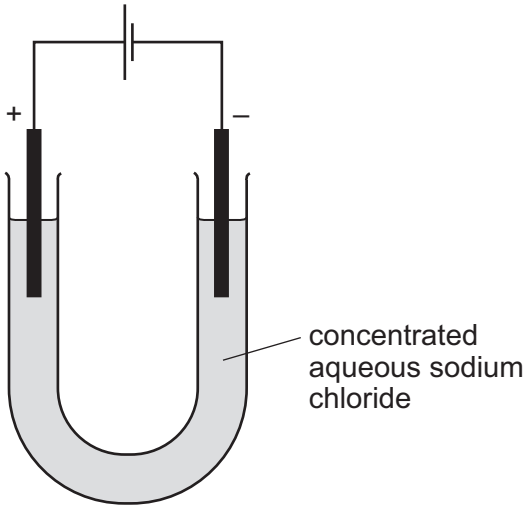
A Add solid copper(II) sulfate to the electrolyte.

B Increase the temperature of the electrolyte.

C Replace the copper electrode with a carbon electrode.

D Reverse the connections to the battery.

27 Electricity is passed through concentrated aqueous sodium chloride. Inert electrodes are used.



What is formed at the negative electrode?

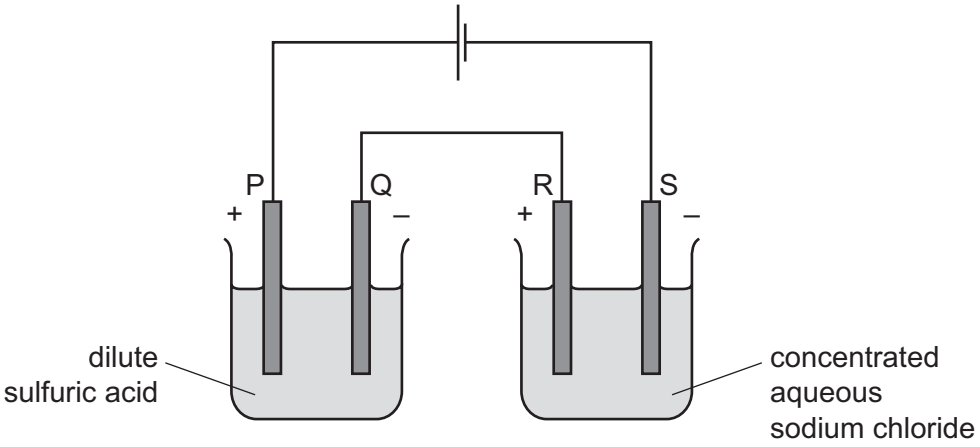
A chlorine

B hydrogen

C oxygen

D sodium

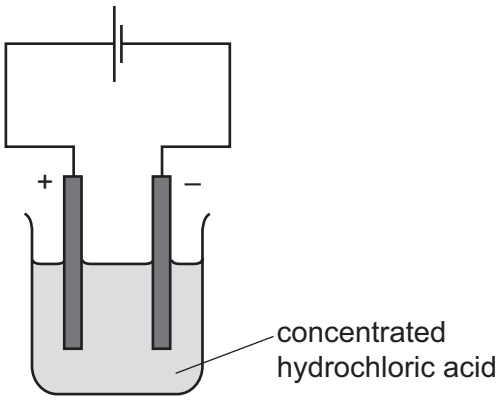
28 The diagram shows the electrolysis of two solutions using inert electrodes.



Which substance is made at each electrode?

	P	Q	R	S
A	hydrogen	oxygen	chlorine	sodium
B	hydrogen	oxygen	sodium	chlorine
C	oxygen	hydrogen	chlorine	hydrogen
D	oxygen	hydrogen	hydrogen	chlorine

29 The electrolysis of concentrated hydrochloric acid using platinum electrodes is shown.



What is observed at each electrode at the start of the electrolysis?

	positive electrode	negative electrode
A	colourless gas	colourless gas
B	colourless gas	green gas
C	green gas	colourless gas
D	green gas	green gas

30 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

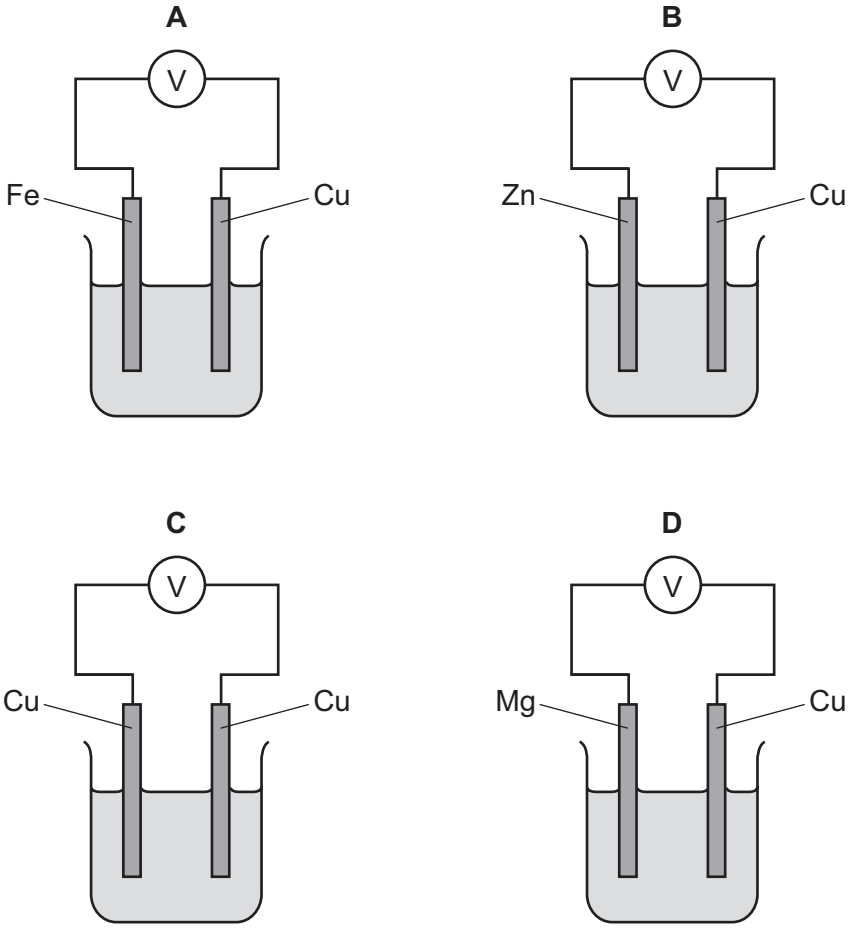
2 Electrons move round the external circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

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

31 Which metal combination produces the highest voltage reading in the cells shown?



32 Concentrated aqueous sodium chloride is electrolysed.

What is the main product formed at the positive electrode (anode)?

A chlorine

B hydrogen

C oxygen

D sodium

33 Concentrated aqueous sodium chloride can be electrolysed.

Which statement is correct?

A Hydrogen gas is formed at the anode, and chlorine gas is formed at the cathode.

B Hydrogen gas is formed at the cathode, and chlorine gas is formed at the anode.

C Sodium metal is formed at the anode, and chlorine gas is formed at the cathode.

D Sodium metal is formed at the cathode, and chlorine gas is formed at the anode.

34 Which products are 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

35 Which statement about electrolysis is correct?

A Electrons move through the electrolyte from the cathode to the anode.

B Electrons move towards the cathode in the external circuit.

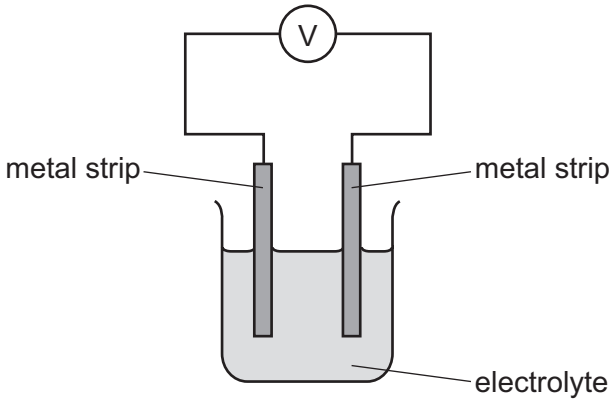
C Negative ions move towards the anode in the external circuit.

D Positive ions move through the electrolyte towards the anode during electrolysis.

36 The reactivity series for a number of different metals is shown.

most reactive →					least reactive
magnesium	Zinc	iron	copper	silver	platinum

The diagram shows different metal strips dipped into an electrolyte.



Which pair of metals produces the highest voltage?

A copper and magnesium

B magnesium and platinum

C magnesium and zinc

D silver and platinum

37 Three substances have the properties shown.

- X conducts electricity when solid and when molten.
- Y is soluble in water and the solution conducts electricity.
- Z only conducts electricity when molten.

What are X, Y and Z?

	X	Y	Z
A	Ca	MgO	NaOH
B	Ca	NaOH	MgO
C	MgO	Ca	NaOH
D	MgO	NaOH	Ca

38 Four substances are electrolysed.

The substances are concentrated aqueous sodium chloride, concentrated hydrochloric acid, molten lead(II) bromide and molten sodium oxide.

Which statement about these electrolysis reactions is correct?

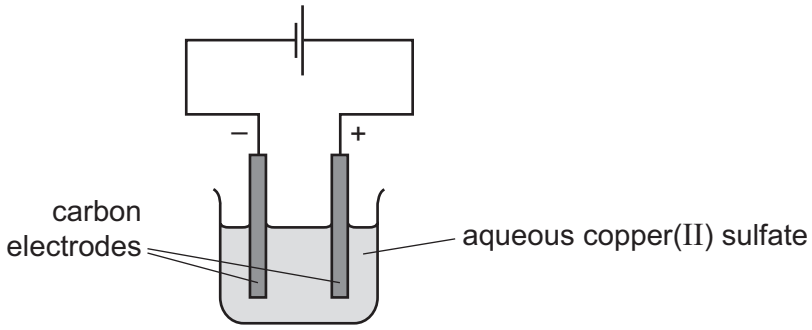
A A colourless gas is formed at the anode when molten sodium oxide is electrolysed.

B A green gas is formed at the cathode when concentrated hydrochloric acid is electrolysed.

C A metal is formed at the anode when molten lead(II) bromide is electrolysed.

D A metal is formed at the cathode when concentrated aqueous sodium chloride is electrolysed.

39 The diagram shows the electrolysis of aqueous copper(II) sulfate.



Which statement is correct?

A Copper metal is deposited at the positive electrode.

B In the external circuit the electrons move from positive to negative.

C In the solution the electrons move from negative to positive.

D Oxygen gas is produced at the positive electrode.

40 Four solutions are separately electrolysed.

experiment	Solution	electrodes
1	dilute aqueous sodium chloride	carbon
2	aqueous copper(II) sulfate	copper
3	concentrated hydrochloric acid	carbon
4	dilute sulfuric acid	carbon

In which two experiments is a colourless gas evolved at the anode?

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