

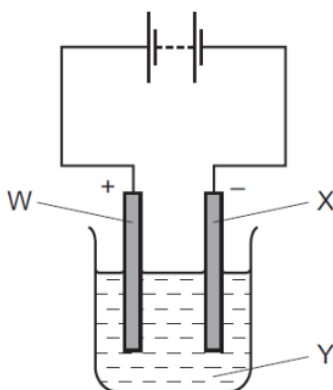
Fahad H. Ahmad



Scan: free demo class

MCQs - ELECTROLYSIS (iGCSE 0620)

12 In the electrolysis shown, chlorine is produced at W and sodium at X.



Which labels are correct?

	W	X	Y
A	anode	cathode	NaCl (l)
B	anode	cathode	NaCl (aq)
C	cathode	anode	NaCl (l)
D	cathode	anode	NaCl (aq)

0620_w/14/qp11

11 A student wishes to electroplate an object with copper.

Which row is correct?

	object is made the	a suitable electrolyte is
A	anode	CuO(s)
B	anode	$\text{CuSO}_4\text{(aq)}$
C	cathode	CuO(s)
D	cathode	$\text{CuSO}_4\text{(aq)}$

0620_w/14/qp11

- 12 Which products are formed at the electrodes when a concentrated solution of sodium chloride is electrolysed?

	cathode (–)	anode (+)
A	hydrogen	chlorine
B	hydrogen	oxygen
C	sodium	chlorine
D	sodium	oxygen

0620_w/14/qp11

- 11 Which metal could **not** be used for electroplating by using an aqueous solution?

- A** chromium
B copper
C silver
D sodium

0620_w/14/qp11

- 11 One molten compound and two aqueous solutions were electrolysed.

The table gives the compounds electrolysed and the electrodes used.

	substance electrolysed	electrodes
1	concentrated hydrochloric acid	carbon
2	concentrated sodium chloride	platinum
3	molten lead bromide	platinum

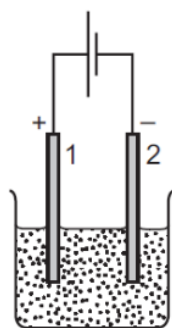
In which experiments is a gas evolved at the cathode?

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

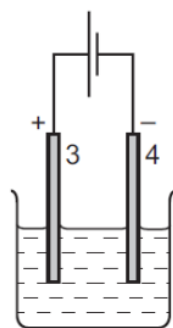
0620_w/13/qp13

10 Two electrolysis experiments were carried out as shown in the diagram below.

The graphite electrodes are labelled 1-4.



molten
sodium chloride



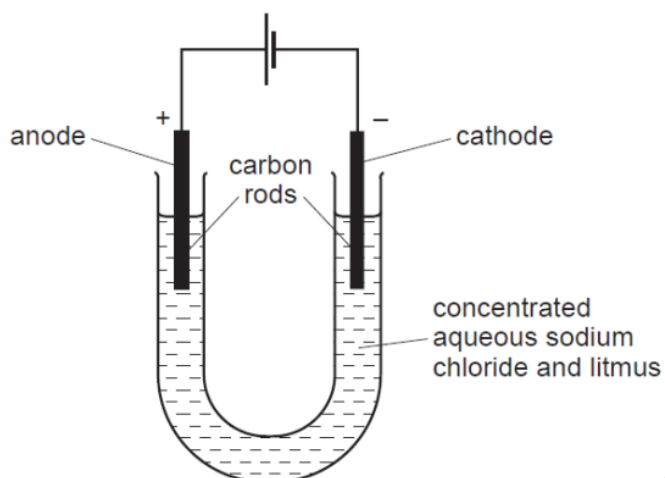
concentrated aqueous
sodium chloride

Which row describes the products at the electrodes in these experiments?

	electrode 1	electrode 2	electrode 3	electrode 4
A	chlorine	hydrogen	chlorine	hydrogen
B	chlorine	sodium	chlorine	hydrogen
C	chlorine	sodium	hydrogen	chlorine
D	sodium	chlorine	sodium	chlorine

0620_w/13/qp13

12 The diagram shows the electrolysis of concentrated aqueous sodium chloride.

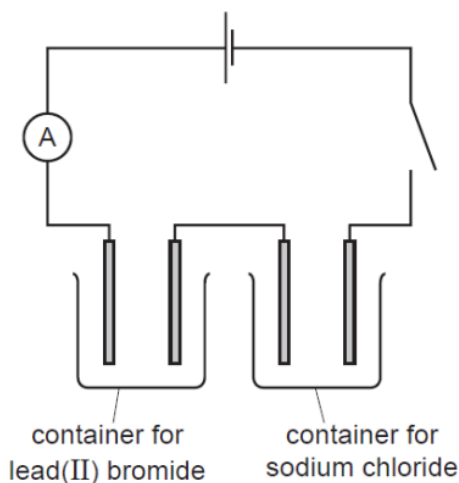


What is the colour of the litmus at each electrode after five minutes?

	colour at anode	colour at cathode
A	blue	red
B	red	blue
C	red	colourless
D	colourless	blue

0620_w/13/qp11

- 11 The diagram shows the circuit for electrolysis of lead(II) bromide and sodium chloride to liberate the metal.



In what form are these salts electrolysed for liberating the metal?

	lead(II) bromide	sodium chloride
A	concentrated solution	concentrated solution
B	concentrated solution	molten
C	molten	concentrated solution
D	molten	molten

0620_w/13/qp11

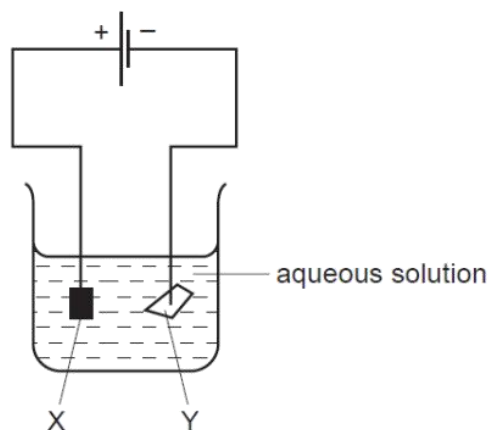
- 9 In separate experiments, electricity was passed through concentrated aqueous sodium chloride and molten lead bromide.

What would happen in **both** experiments?

- A** A halogen would be formed at the anode.
- B** A metal would be formed at the cathode.
- C** Hydrogen would be formed at the anode.
- D** Hydrogen would be formed at the cathode.

0620_w/12/qp13

10 The diagram shows an electrolysis experiment using metals X and Y as electrodes.



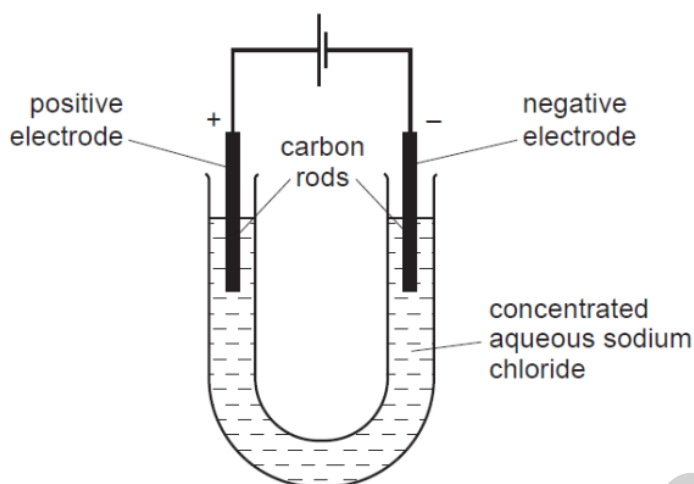
One of the metals becomes coated with copper.

Which metal becomes coated and which aqueous solution is used?

	metal	aqueous solution
A	X	CrCl_3
B	X	CuCl_2
C	Y	CrCl_3
D	Y	CuCl_2

0620_w/12/qp11

- 9 The diagram shows the electrolysis of concentrated aqueous sodium chloride.



What is produced at each of the electrodes?

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

0620_w/12/qp11

- 11 Concentrated aqueous potassium bromide solution is electrolysed using inert electrodes.

The ions present in the solution are K^+ , Br^- , H^+ and OH^- .

To which electrodes are the ions attracted during this electrolysis?

	attracted to anode	attracted to cathode
A	Br^- and K^+	H^+ and OH^-
B	Br^- and OH^-	H^+ and K^+
C	H^+ and K^+	Br^- and OH^-
D	H^+ and OH^-	Br^- and K^+

0620_w/11/qp11

10 Metals could be extracted from their molten chlorides using electrolysis.

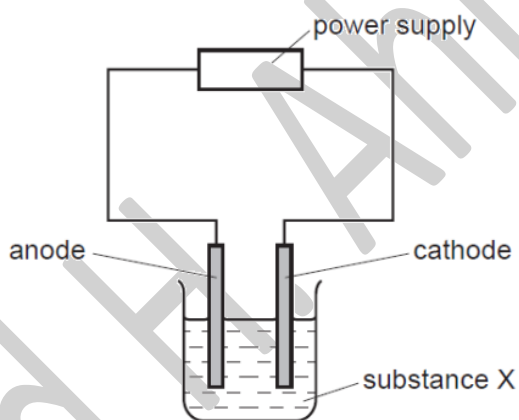
Which substances are formed at each electrode?

	anode	cathode
A	chlorine	hydrogen
B	chlorine	metal
C	hydrogen	metal
D	metal	chlorine

0620_w/11/qp11

13 Substance X was electrolysed in an electrolytic cell.

A coloured gas was formed at the anode and a metal was formed at the cathode.

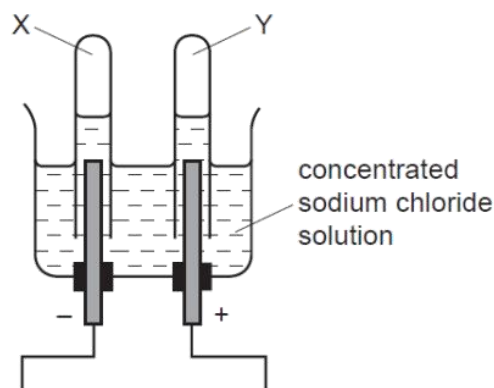


What is substance X?

- A** aqueous sodium chloride
- B** molten lead bromide
- C** molten zinc oxide
- D** solid sodium chloride

0620_w/10/qp11

12 When concentrated sodium chloride solution is electrolysed, elements X and Y are formed.

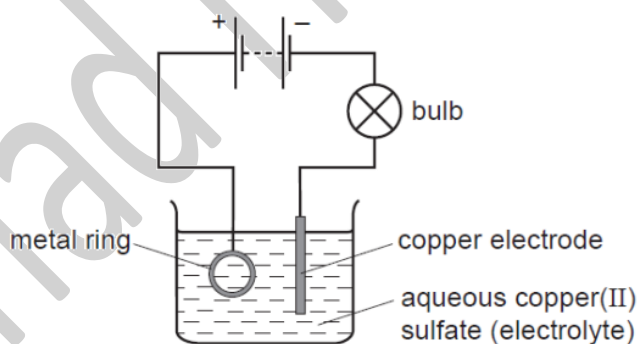


What are X and Y?

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

0620_w/10/qp11

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



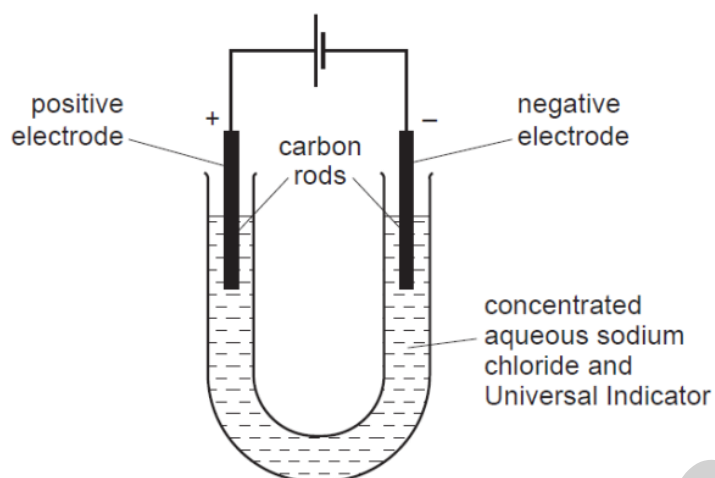
The experiment did not work.

What 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 by a carbon electrode.
- D** Reverse the connections to the battery.

0620_w/10/qp11

13 The diagram shows the electrolysis of concentrated aqueous sodium chloride.

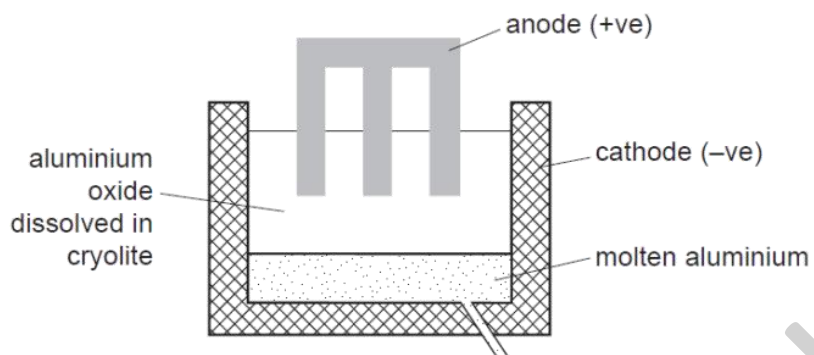


What is the colour of the Universal Indicator at each electrode after five minutes?

	colour at anode (+ electrode)	colour at cathode (- electrode)
A	blue/purple	red
B	red	blue/purple
C	red	colourless
D	colourless	blue/purple

0620_w/09/qp11

12 The diagram shows how aluminium is manufactured by electrolysis.



What are the anode and cathode made of?

	anode	cathode
A	aluminium	aluminium
B	aluminium	graphite
C	graphite	aluminium
D	graphite	graphite

0620_w/09/qp11

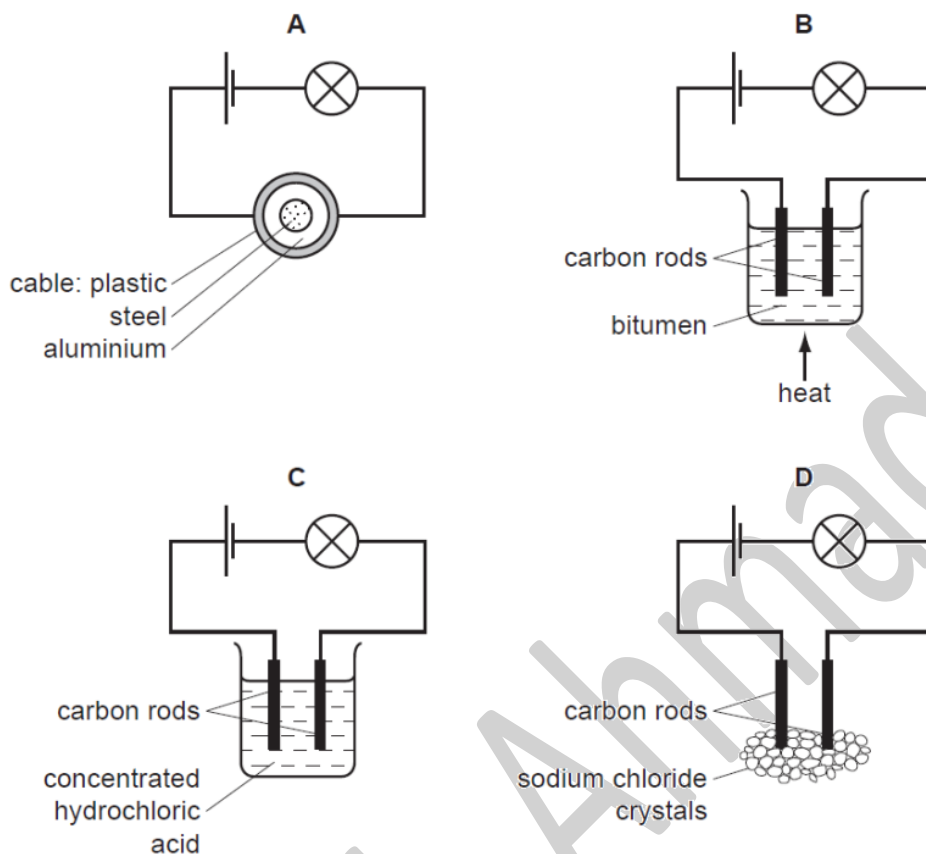
14 Copper and hydrogen can each be formed by electrolysis.

At which electrodes are these elements formed?

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

0620_w/08/qp1

12 Which diagram shows an experiment in which the bulb lights?



0620_w/08/qp1

13 Metal X is low in the reactivity series and it is liberated by electrolysis of its bromide.

Metal X is1..... and the bromide is2..... .

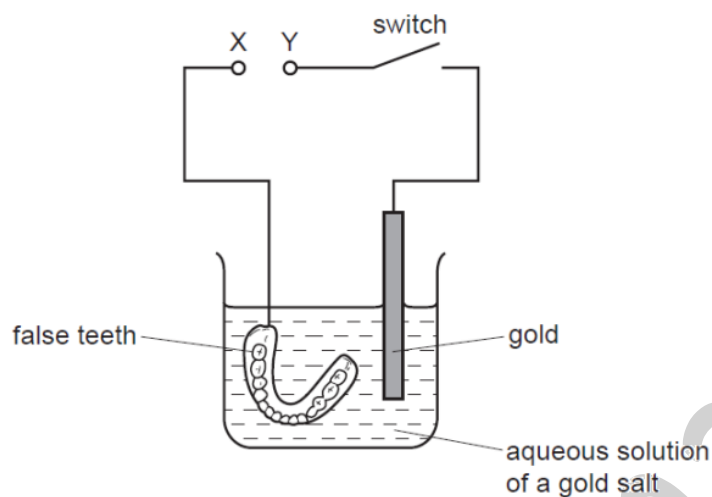
Which words correctly complete gaps 1 and 2?

	1	2
A	lead	in solution
B	lead	molten
C	sodium	in solution
D	sodium	molten

0620_w/08/qp1

10 Winston Churchill, a British Prime Minister, had his false teeth electroplated with gold.

The teeth were coated with a thin layer of carbon and were then placed in the apparatus shown.

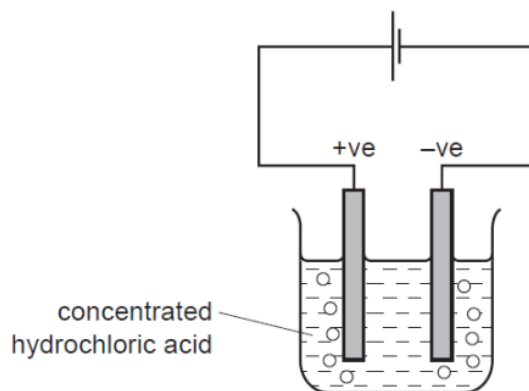


Which row is correct?

	terminal X is	the carbon powder could be
A	negative	diamond
B	negative	graphite
C	positive	diamond
D	positive	graphite

0620_s/12/qp11

- 11 The diagram shows that two gases are formed when concentrated hydrochloric acid is electrolysed using inert electrodes.

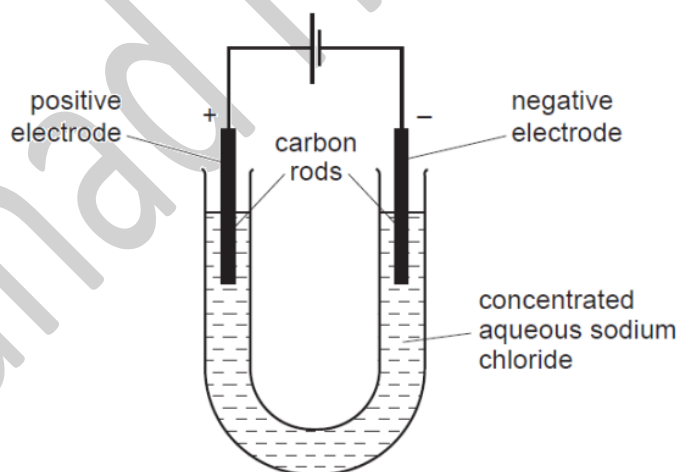


Which row correctly describes the colours of the gases at the electrodes?

	anode (+ve)	cathode (-ve)
A	colourless	colourless
B	colourless	yellow-green
C	yellow-green	colourless
D	yellow-green	yellow-green

0620_s/12/qp11

- 11 Electricity is passed through concentrated aqueous sodium chloride, as shown.



What is the test for the gas formed at the positive electrode?

- A** bleaches damp litmus paper
- B** 'pops' with a lighted splint
- C** relights a glowing splint
- D** turns damp red litmus paper blue

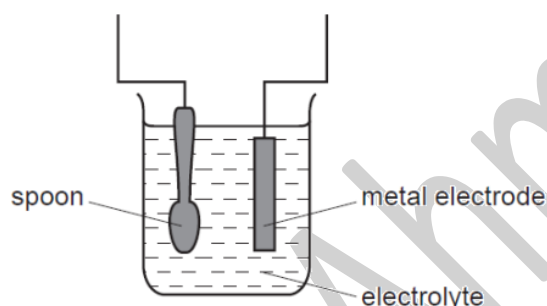
0620_s/11/qp11

10 Which statement about the electrolysis of molten lead(II) bromide is correct?

- A A colourless gas is seen at the cathode.
- B A grey metal is seen at the anode.
- C A red/brown gas is seen at the anode.
- D A red/brown metal is seen at the cathode.

0620_s/11/qp11

11 The diagram shows apparatus for plating a spoon with silver.



Which statement is **not** correct?

- A Silver would stick to the spoon because it is a very reactive metal.
- B The electrolyte would be a silver salt dissolved in water.
- C The metal electrode would be made from silver.
- D The spoon would be connected to the negative of the power supply.

0620_s/10/qp11

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

Copper(II) ions (Cu^{2+}), hydrogen ions (H^+), hydroxide ions (OH^-) and sulfate ions (SO_4^{2-}) are present in the solution.

To which electrodes are the ions attracted during this electrolysis?

	attracted to anode	attracted to cathode
A	Cu^{2+} and H^+	OH^- and SO_4^{2-}
B	Cu^{2+} and SO_4^{2-}	H^+ and OH^-
C	H^+ and OH^-	Cu^{2+} and SO_4^{2-}
D	OH^- and SO_4^{2-}	Cu^{2+} and H^+

0620_s/10/qp11

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

The electrolytes are listed below.

- cell 1 aqueous sodium chloride
cell 2 concentrated hydrochloric acid
cell 3 molten lead(II) bromide

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

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

0620_s/10/qp11

12 Aluminium is extracted from its oxide by electrolysis.

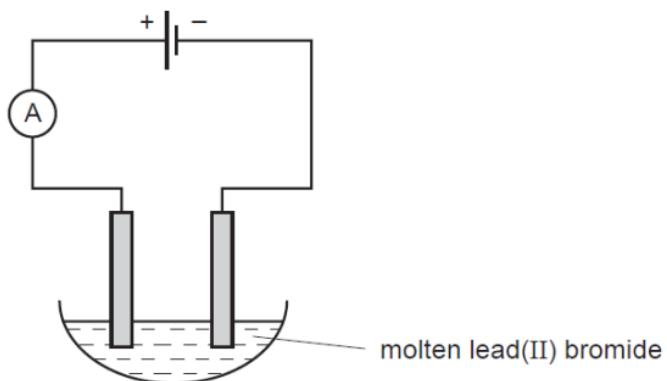
The oxide is dissolved in1..... cryolite and aluminium is deposited at the2.....

Which words correctly complete gaps 1 and 2?

	1	2
A	aqueous	cathode
B	aqueous	anode
C	molten	cathode
D	molten	anode

0620_s/09/qp11

13 Molten lead(II) bromide is electrolysed as shown.



Which ions are discharged at each electrode?

	positive electrode	negative electrode
A	Pb^+	Br^{2-}
B	Pb^{2+}	Br^-
C	Br^{2-}	Pb^+
D	Br^-	Pb^{2+}

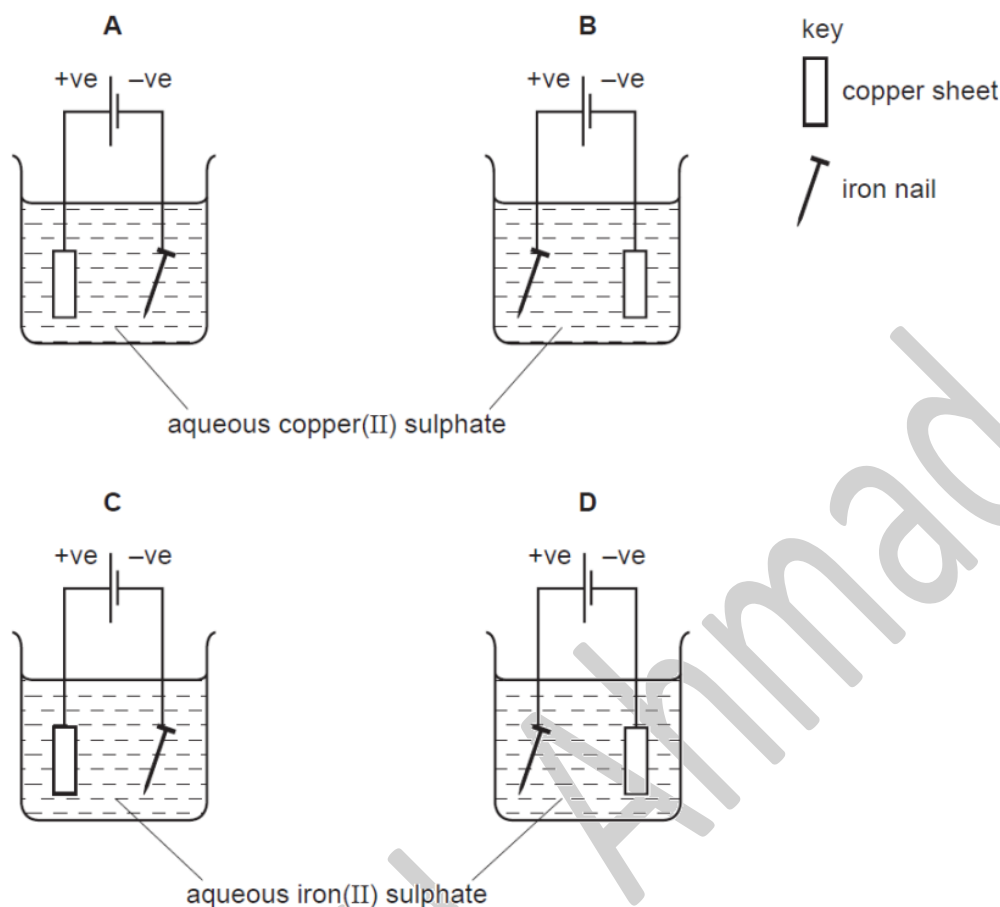
0620_s/09/qp11

14 Which of these elements could be formed at the anode when a molten salt is electrolysed?

- A** copper
- B** iodine
- C** lithium
- D** strontium

0620_s/09/qp11

12 Which apparatus could be used to electroplate an iron nail with copper?



0620_s/08/qp1

13 Two elements X and Y form ionic compounds, XBr_2 and Y_2O_3 . The compounds are separately melted and electricity is passed through the liquids.

What are the products at the cathodes?

- A bromine and oxygen
- B bromine and Y
- C oxygen and X
- D X and Y

0620_s/08/qp1

14 Which change can take place during electrolysis?

- A lead(IV) oxide $\rightarrow$ lead(II) oxide + oxygen
- B concentrated hydrochloric acid $\rightarrow$ hydrogen + chlorine
- C sodium hydroxide + nitric acid $\rightarrow$ sodium nitrate + water
- D lead(II) nitrate + sulphuric acid $\rightarrow$ lead(II) sulphate + nitric acid

0620_s/08/qp1

- 12** A molten compound is electrolysed. Two atoms of X are deposited at the negative electrode at the same time as three atoms of Y are deposited at the positive electrode.

These results show that:

X is a ...1...;

Y is a ...2...;

the formula of the compound is ...3... .

How are gaps 1, 2 and 3 correctly completed?

	1	2	3
A	metal	non-metal	X_3Y_2
B	metal	non-metal	X_2Y_3
C	non-metal	metal	X_3Y_2
D	non-metal	metal	X_2Y_3

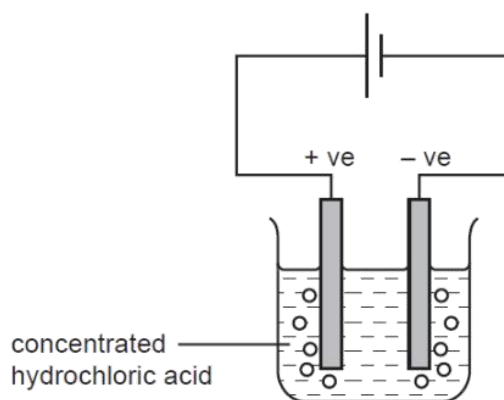
0620_s/07/qp1

- 13** In which electrolyses are chlorine, hydrogen and sodium hydroxide all produced?

	aqueous sodium chloride	molten sodium chloride
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

0620_s/07/qp1

- 10 The diagram shows that two gases are formed when concentrated hydrochloric acid is electrolysed between inert electrodes.

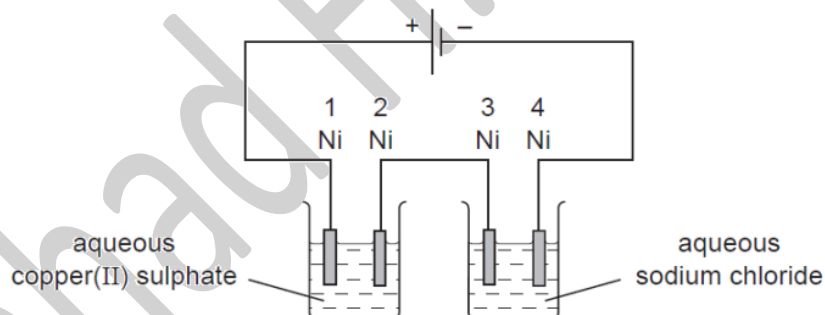


Which line correctly describes the colours of the gases at the electrodes?

	anode (+ve)	cathode (-ve)
A	colourless	colourless
B	colourless	yellow-green
C	yellow-green	colourless
D	yellow-green	yellow-green

0620_s/06/qp1

- 11 The diagram shows an electrolysis experiment to electroplate nickel with a different metal.

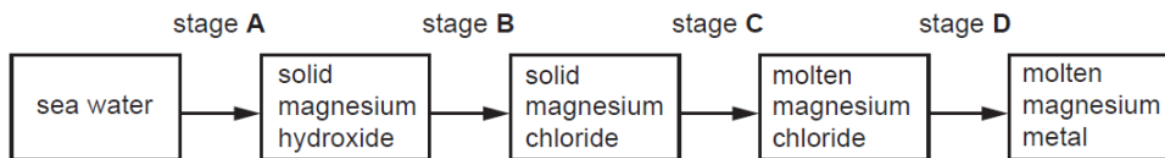


Which nickel electrodes are plated with a metal?

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

0620_s/06/qp1

11 At which stage in the manufacture of magnesium from sea-water can electrolysis be used?



0620_s/05/qp1

12 Metallic and non-metallic elements can both be extracted by electrolysis.

Which element is produced at the negative electrode (cathode)?

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

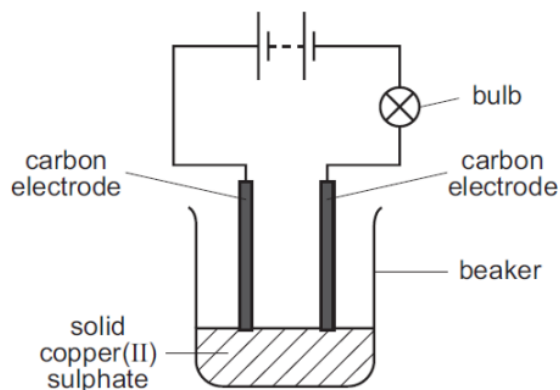
0620_s/05/qp1

13 Which product is manufactured by electrolysis?

- A aluminium
- B copper(II) sulphate
- C sodium chloride
- D steel

0620_s/05/qp1

12 In the circuit shown the bulb does not light.

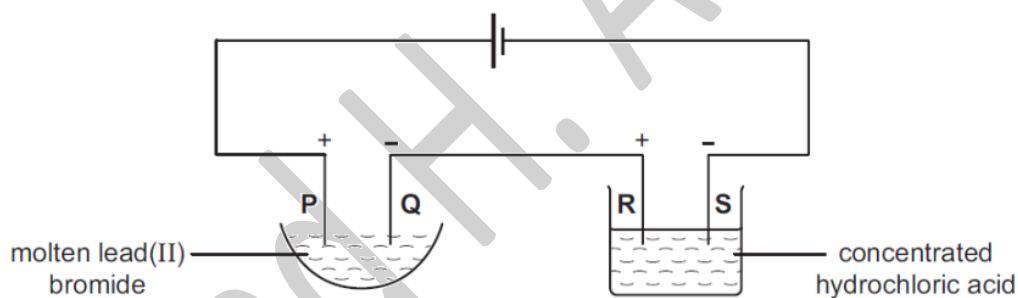


Which change would cause the bulb to light?

- A add more solid copper(II) sulphate to the beaker
- B add water to dissolve the copper(II) sulphate
- C replace the carbon electrodes with copper electrodes
- D reverse the connections to the electrodes

0620_s/04/qp1

13 The following electrolysis circuit is set up, using inert electrodes P, Q, R and S.

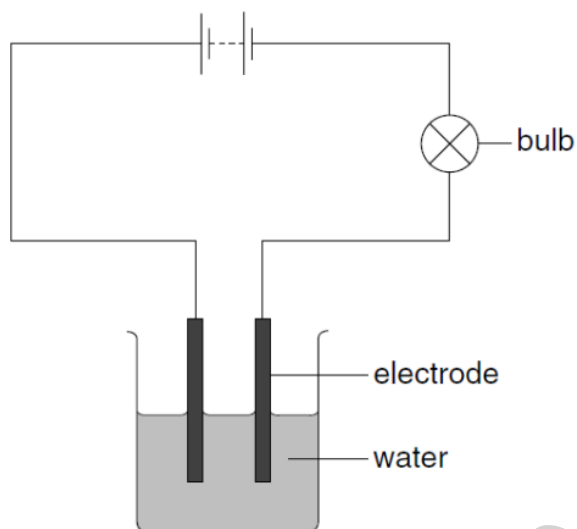


At which of the electrodes is a Group VII element produced?

- A P only
- B P and R
- C Q only
- D Q and S

0620_s/04/qp1

13 A student sets up the apparatus shown. The bulb does not light.



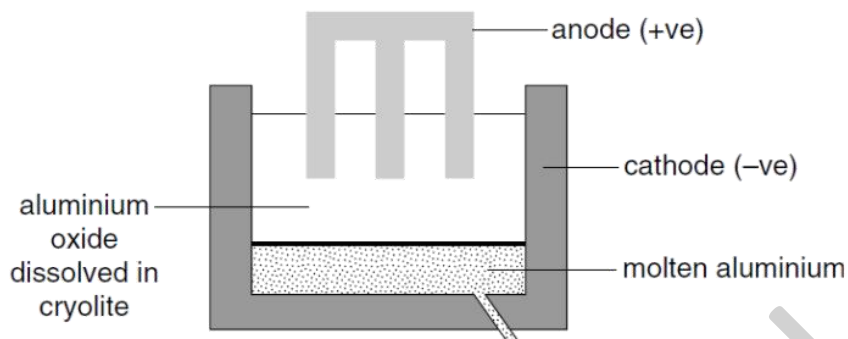
After the student adds substance **X** to the water, the bulb lights.

What is **X**?

- A calcium carbonate
- B carbon
- C copper(II) sulphate
- D ethanol

0620_s/03/qp1

12 The diagram shows how aluminium is manufactured by electrolysis.

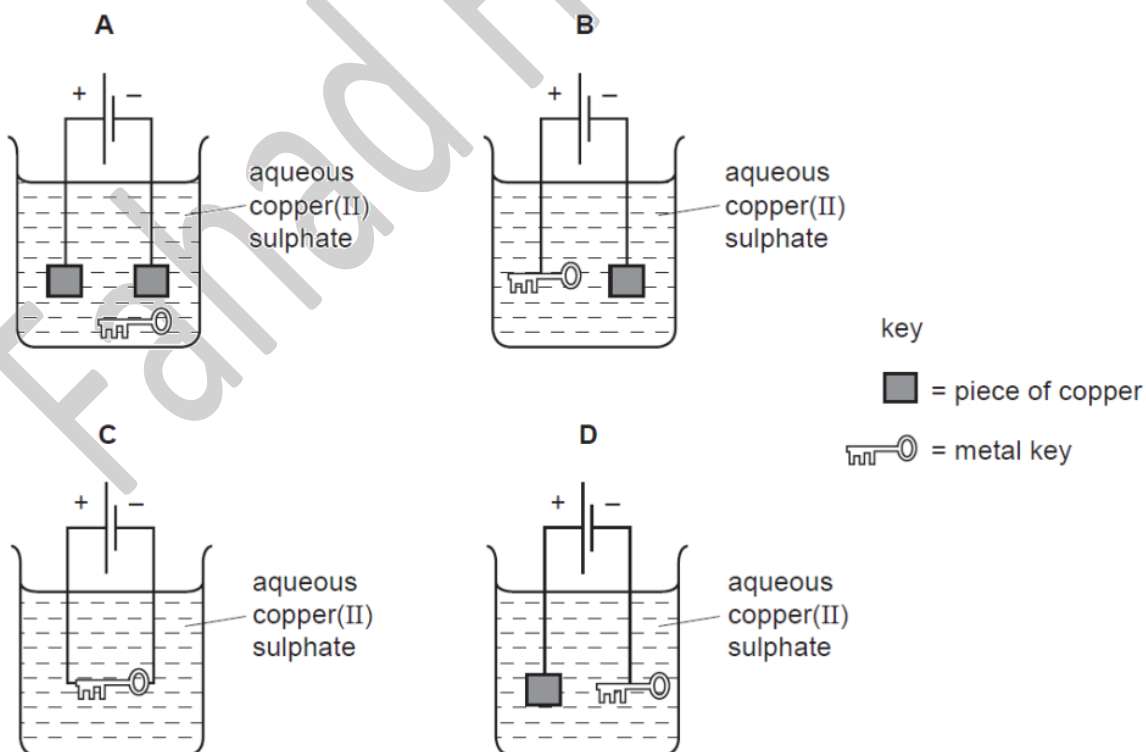


What are the anode and cathode made of?

	anode	cathode
A	aluminium	aluminium
B	aluminium	graphite
C	graphite	aluminium
D	graphite	graphite

0620_s/03/qp1

14 In which set of apparatus is the metal key electroplated with copper?



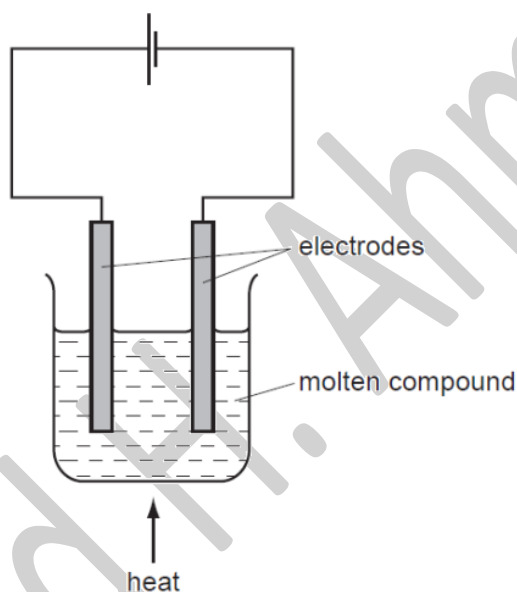
0620_w/07/qp1

12 What is the charge on an anode and the type of element formed at such an electrode?

	charge on anode	type of element formed
A	negative	metal
B	negative	non-metal
C	positive	metal
D	positive	non-metal

0620_w/07/qp1

13 The diagram shows how to cause a chemical change in a molten compound.

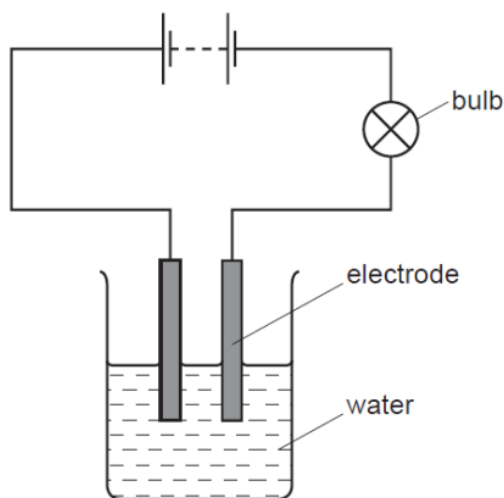


What is this process used for?

- A extraction of metal from its ore
- B neutralisation of industrial waste
- C production of fertilisers
- D removal of oxides from metals

0620_w/07/qp1

- 9 A student sets up the apparatus shown. The bulb does not light.



After the student adds substance **X** to the water, the bulb lights.

What could **X** be?

- A barium sulphate
- B carbon (or diamond)
- C copper (or graphite)
- D potassium sulphate

0620_w/07/qp1

- 11 The electrolysis of concentrated aqueous sodium chloride makes three products.

Which products are shown at the correct electrodes?

	anode (+ve)	cathode (-ve)
A	chlorine	sodium hydroxide
B	sodium hydroxide	chlorine
C	hydrogen	sodium
D	sodium	hydrogen

0620_w/06/qp1

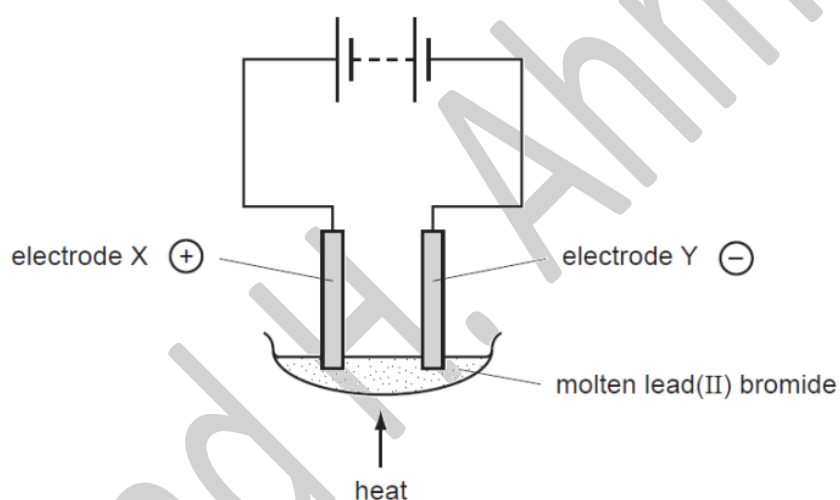
12 Aluminium is extracted from its oxide by electrolysis. To do so, the oxide is dissolved.

Which substance is used to dissolve aluminium oxide and where is aluminium deposited during the electrolysis?

	substance used to dissolve aluminium oxide	where aluminium is deposited
A	cryolite	anode (+ve)
B	cryolite	cathode (-ve)
C	water	anode (+ve)
D	water	cathode (-ve)

0620_w/06/qp1

10 The diagram shows the electrolysis of molten lead(II) bromide.

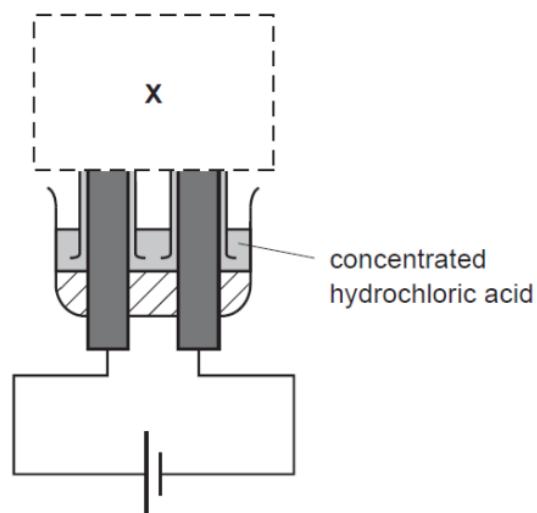


What is seen at each electrode?

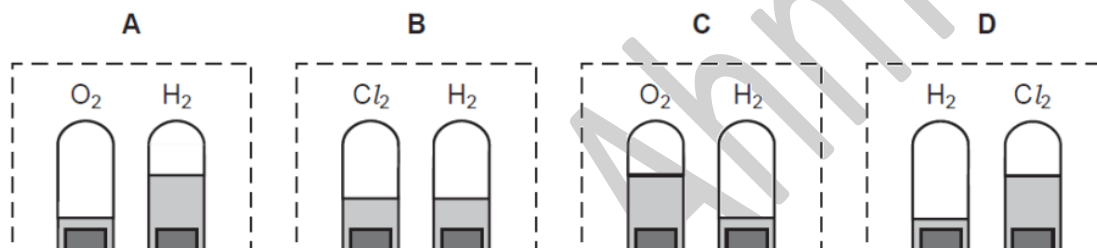
	electrode X	electrode Y
A	brown gas	silvery metal
B	brown metal	green gas
C	green gas	brown metal
D	silvery metal	brown gas

0620_w/05/qp1

11 The diagram shown is not complete.

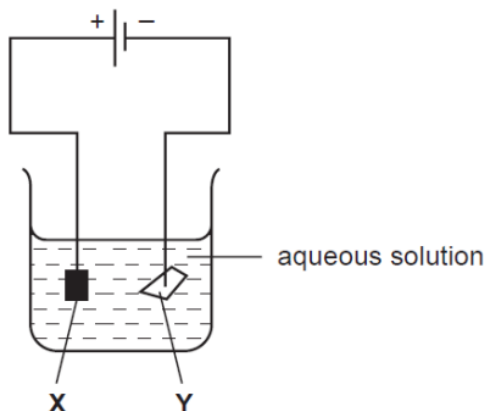


What should be shown at **X** when the solution has been electrolysed for some time?



0620_w/05/qp1

13 The diagram shows an electrolysis experiment using metals **X** and **Y** as electrodes.



One of the metals becomes coated with copper.

Which metal becomes coated and which aqueous solution is used?

	metal	aqueous solution
A	X	CrCl_3
B	X	CuCl_2
C	Y	CrCl_3
D	Y	CuCl_2

0620_w/04/qp1

12 Aluminium is extracted from its oxide by electrolysis.

Which words correctly complete the spaces?

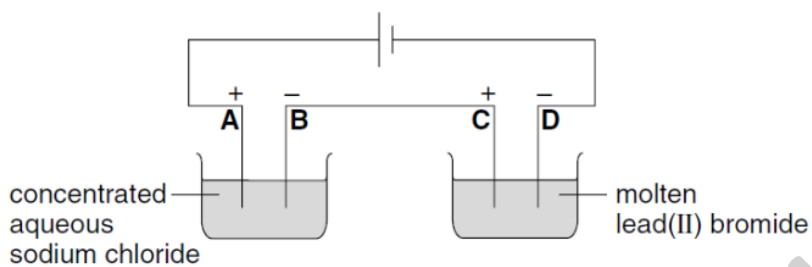
The oxide is dissolved in1..... cryolite and aluminium is deposited at the2.....

	space 1	space 2
A	aqueous	negative cathode
B	aqueous	positive anode
C	molten	negative cathode
D	molten	positive anode

0620_w/04/qp1

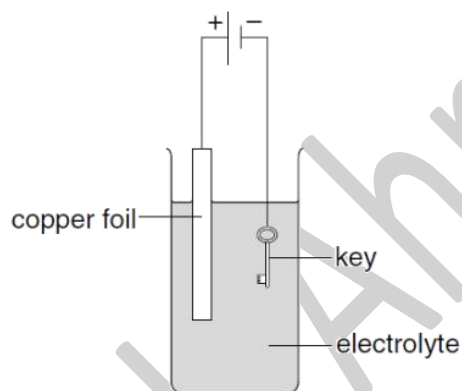
12 The following electrolysis circuit is set up, using inert electrodes.

At which electrode is a metal deposited?



0620_w/03/qp1

13 The diagram shows a method used to electroplate a key with copper.

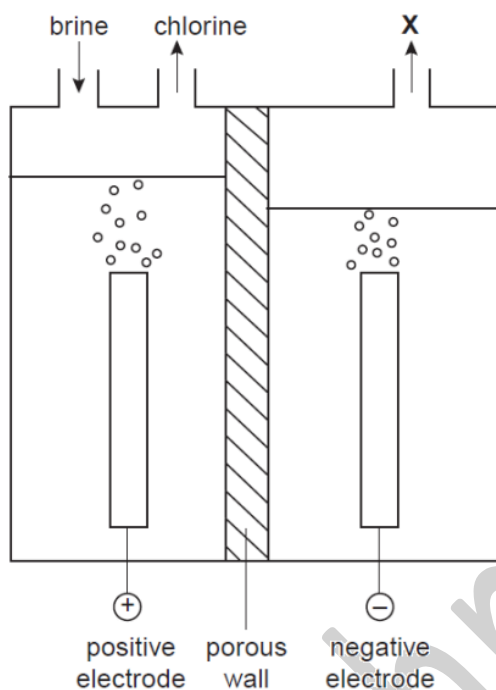


Which aqueous solution is most suitable for the electrolyte?

- A copper(II) sulphate
- B ethanol
- C sodium hydroxide
- D sulphuric acid

0620_w/03/qp1

12 The diagram represents the electrolysis of brine (aqueous sodium chloride).



What are products **X** and **Y**?

	X	Y
A	hydrogen	aqueous sodium hydroxide
B	hydrogen	hydrochloric acid
C	oxygen	aqueous sodium hydroxide
D	oxygen	hydrochloric acid

0620_w/02/qp1

11 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

0620_s/14/qp12

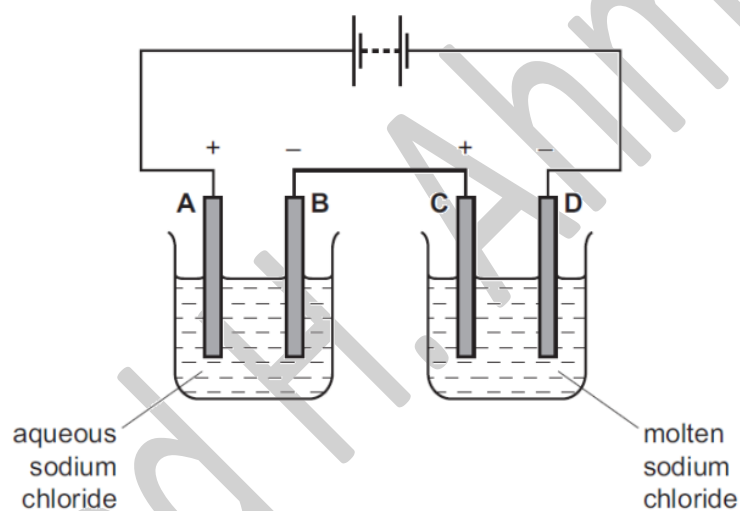
- 12 Which products are formed at the anode and cathode when electricity is passed through molten lead(II) bromide?

	anode (+)	cathode (-)
A	bromide ions	lead ions
B	bromine molecules	lead atoms
C	lead atoms	bromine molecules
D	lead ions	bromide ions

0620_s/14/qp11

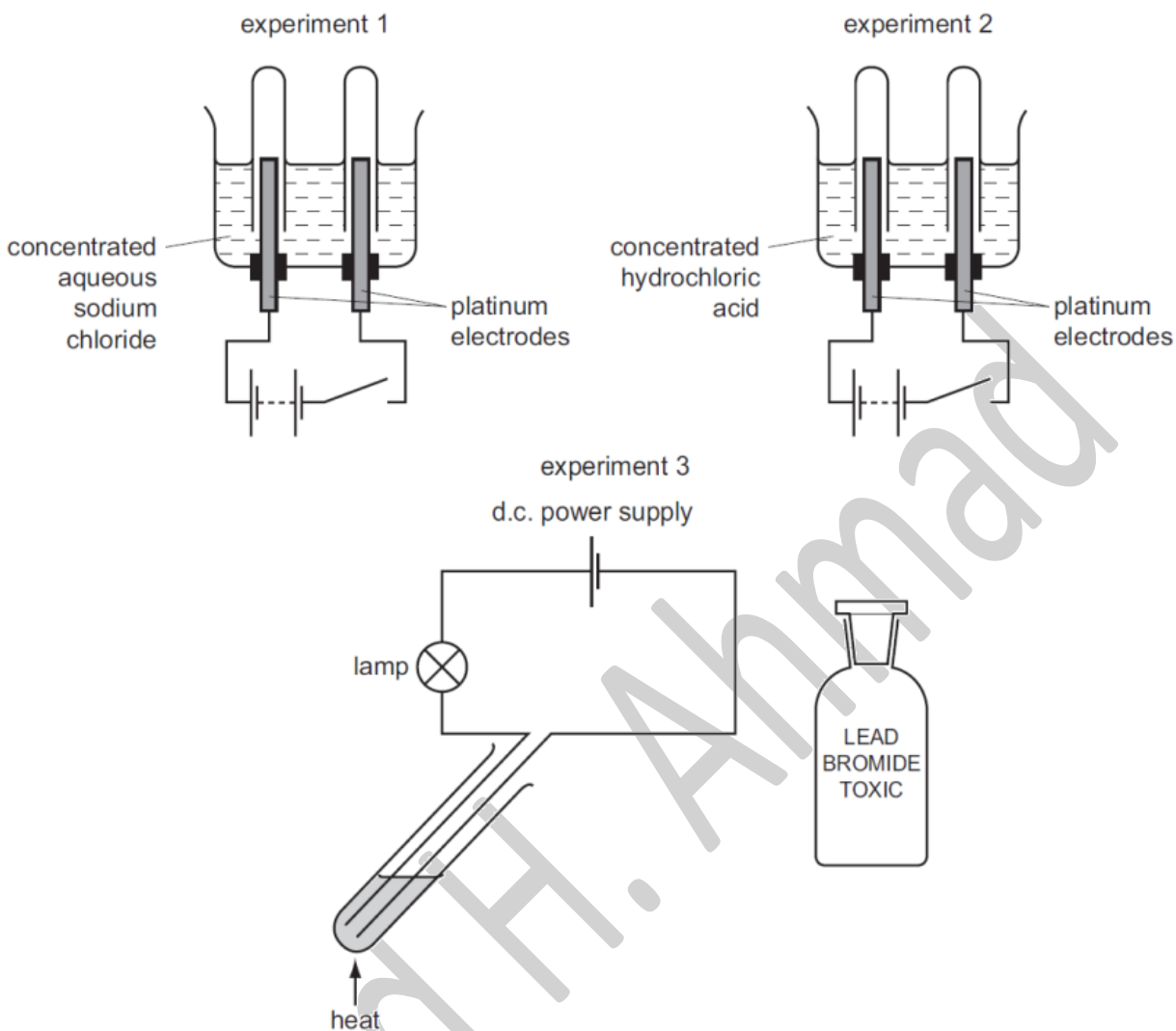
- 12 The diagram shows an electrolysis circuit.

At which electrode is hydrogen formed?



0620_s/13/qp11

- 18 Concentrated aqueous sodium chloride, concentrated hydrochloric acid and molten lead bromide were separately electrolysed in experiments 1, 2 and 3.

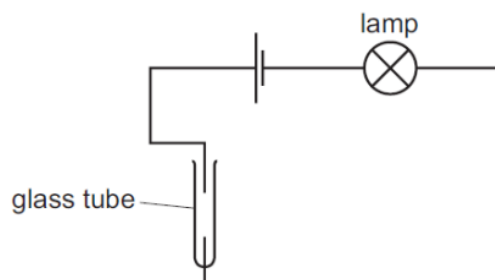


Which statement about the electrode products is correct?

- A Gases were given off at the anode in experiments 2 and 3 only.
- B Gases were given off at the cathode in experiments 1 and 2 only.
- C Metals were formed at the anode in experiments 1 and 3 only.
- D Metals were formed at the cathode in experiments 1 and 3 only.

0620_s/13/qp12

9 The diagram shows an incomplete circuit.



Which substance causes the lamp to light when added to the glass tube?

- A aqueous sodium chloride
- B aqueous sugar
- C solid sodium chloride
- D solid sugar

0620_s/13/qp12

THEORY – ELECTROLYSIS (iGCSE 0620)

(b) The ions present in aqueous sodium chloride are $\text{Na}^+(\text{aq})$, $\text{Cl}^-(\text{aq})$, $\text{H}^+(\text{aq})$ and $\text{OH}^-(\text{aq})$.

The electrolysis of concentrated aqueous sodium chloride forms three products. They are hydrogen, chlorine and sodium hydroxide.

(i) Explain how these **three** products are formed. Give ionic equations for the reactions at the electrodes.

.....

.....

.....

.....

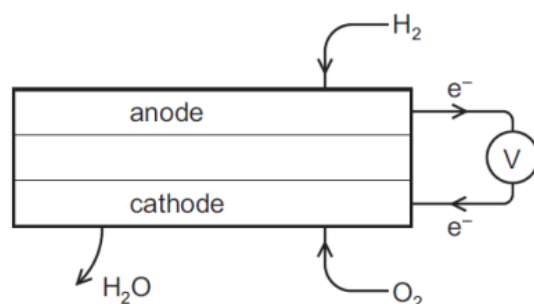
..... [4]

(ii) If the solution of the electrolyte is stirred, chlorine reacts with sodium hydroxide to form sodium chlorate(I), sodium chloride and water. Write an equation for this reaction.



0620/w14/qp33

- 4 A fuel cell produces electrical energy by the oxidation of a fuel by oxygen. The fuel is usually hydrogen but methane and methanol are two other fuels which may be used. A diagram of a hydrogen fuel cell is given below.



- (a) When the fuel is hydrogen, the only product is water.
What additional product would be formed if methane was used?

..... [1]

- (b) Write the equation for the chemical reaction that takes place in a hydrogen fuel cell.

..... [1]

- (c) (i) At which electrode does oxidation occur? Explain your choice.

..... [1]

- (ii) Write an ionic equation for the reaction at this electrode.

..... [2]

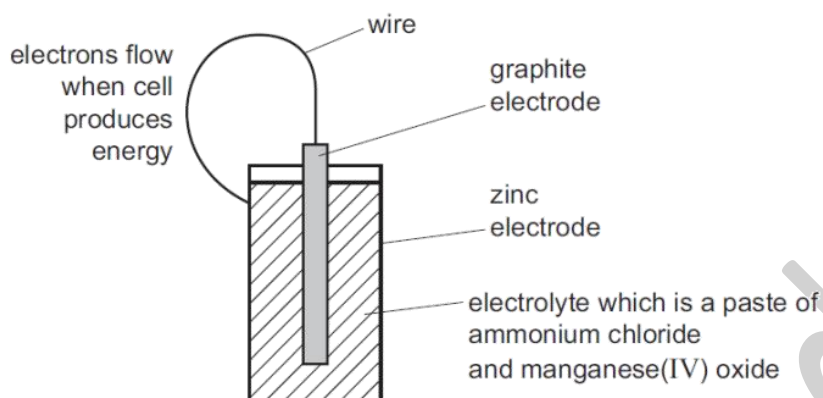
- (d) Fuel cells are used to propel cars.
Give **two** advantages of a fuel cell over a gasoline-fuelled engine.

..... [2]

[Total: 7]

0620/w14/qp33

- (d) A dry cell (battery) has a central rod, usually made of graphite. This is the positive electrode which is surrounded by the electrolyte, typically a paste of ammonium chloride and manganese(IV) oxide, all of which are in a zinc container which is the negative electrode.



- (i) Draw an arrow on the diagram to indicate the direction of electron flow. [1]

- (ii) Suggest why the electrolyte is a paste. [1]

- (iii) The following changes occur in a dry cell.
For each change, decide if it is oxidation or reduction and give a reason for your choice.

Zn to Zn^{2+}

.....

manganese(IV) oxide to manganese(III) oxide

.....

[2]

0620/w14/qp32

(c) Zinc can be obtained from zinc oxide in a two step process. Aqueous zinc sulfate is made from zinc oxide and then this solution is electrolysed with inert electrodes. The electrolysis is similar to that of copper(II) sulfate with inert electrodes.

(i) Name the reagent which will react with zinc oxide to form zinc sulfate.

..... [1]

(ii) Complete the following for the electrolysis of aqueous zinc sulfate.

Write the equation for the reaction at the negative electrode.

.....

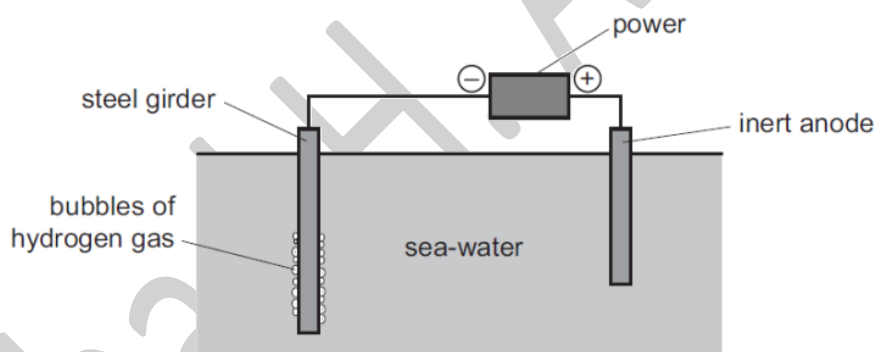
Name the product at the positive electrode.

.....

The electrolyte changes from zinc sulfate to [3]

0620/w14/qp32

The second method is to make the steel article the cathode in a circuit for electrolysis.



(ii) Mark on the diagram the direction of the electron flow. [1]

(iii) The steel girder does not rust because it is the cathode. Reduction takes place at the cathode. Give the equation for the reduction of hydrogen ions.

..... [2]

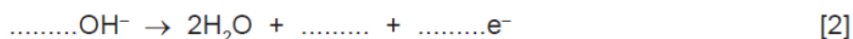
0620/w14/qp31

- (c) The solution of zinc sulfate is electrolysed using inert electrodes.
This electrolysis is similar to that of copper(II) sulfate with inert electrodes.

(i) Write the equation for the reaction at the negative electrode (cathode).

..... [1]

(ii) Complete the equation for the reaction at the positive electrode (anode).



(iii) The electrolyte changes from zinc sulfate to

..... [1]

0620/w13/qp33

- (iii) A method being developed to produce iron with lower emissions of carbon dioxide is by electrolysis. Hematite, Fe_2O_3 , is dissolved in molten lithium carbonate and electrolysed. The ore is split into its constituent elements.

Write an equation for the reaction at the negative electrode (cathode).

.....

Complete the equation for the reaction at the positive electrode (anode).



0620/w13/qp32

- (iv) Describe how zinc metal can be obtained from zinc sulfate solution by electrolysis. A labelled diagram is acceptable. Include all the products of this electrolysis. The electrolysis is similar to that of copper(II) sulfate solution with inert electrodes.

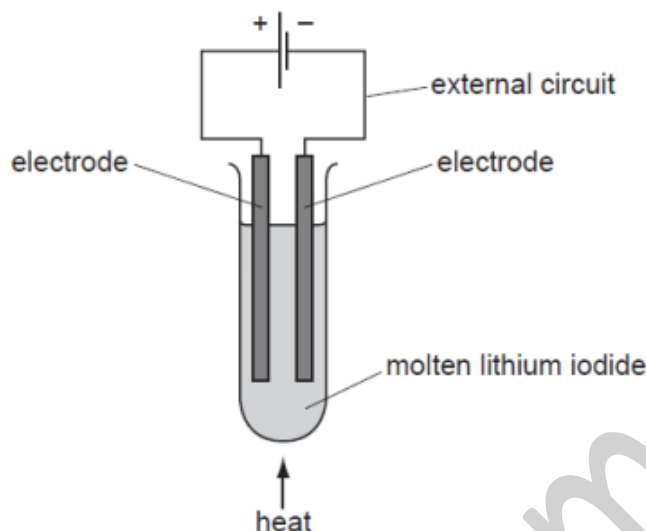
[4]

0620/w12/qp33

Fahad H. Ahmad

- 6 During electrolysis, ions move in the electrolyte and electrons move in the external circuit. Reactions occur at the electrodes.

(a) The diagram shows the electrolysis of molten lithium iodide.



- (i) Draw an arrow on the diagram to show the direction of the electron flow in the external circuit. [1]

- (ii) Electrons are supplied to the external circuit. How and where is this done?

..... [2]

- (iii) Explain why solid lithium iodide does not conduct electricity but when molten it is a good conductor.

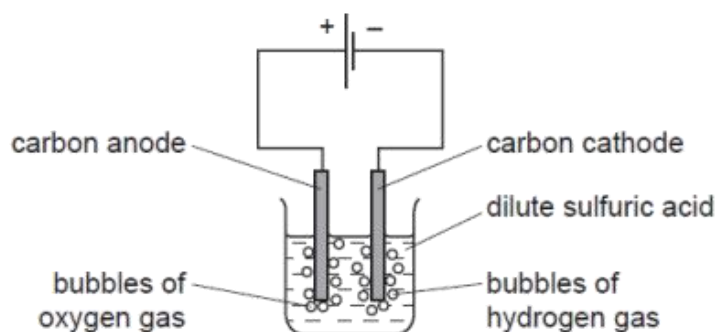
..... [1]

(b) The results of experiments on electrolysis are shown in the following table. Complete the table. The first line has been done as an example.

electrolyte	electrodes	product at cathode	product at anode	change to electrolyte
molten lithium iodide	carbon	lithium	iodine	used up
aqueous copper(II) sulfate	platinum		oxygen	
concentrated aqueous potassium chloride	carbon		chlorine	

[4]

- (c) The diagram below shows the electrolysis of dilute sulfuric acid. Hydrogen is formed at the negative electrode (cathode) and oxygen at the positive electrode (anode) and the concentration of sulfuric acid increases.



The ions present in the dilute acid are $\text{H}^+(\text{aq})$, $\text{OH}^-(\text{aq})$ and $\text{SO}_4^{2-}(\text{aq})$.

- (i) Write an equation for the reaction at the negative electrode (cathode).

..... [2]

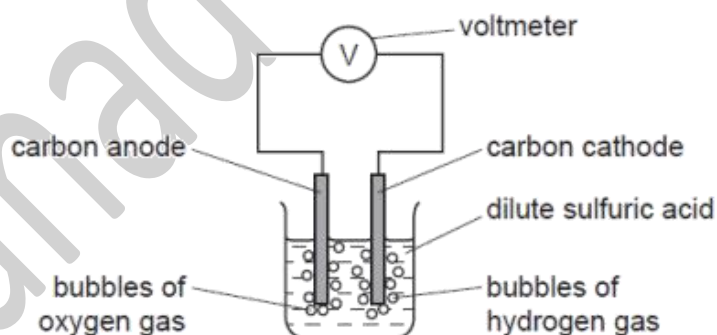
- (ii) Complete the equation for the reaction at the positive electrode (anode).



- (iii) Suggest an explanation of why the concentration of the sulfuric acid increases.

..... [1]

- (d) In the apparatus used in (c), the power supply is removed and immediately replaced by a voltmeter.



A reading on the voltmeter shows that electrical energy is being produced. Suggest an explanation for how this energy is produced.

.....

 [3]

[Total: 15]

0620/w12/qp32

(b) The purification of bauxite uses large amounts of sodium hydroxide.

(i) Describe the chemistry of how sodium hydroxide is made from concentrated aqueous sodium chloride. The description must include at least one ionic equation.

.....

.....

.....

.....

..... [5]

(ii) Making sodium hydroxide from sodium chloride produces two other chemicals. Name these two chemicals and state one use of each chemical.

chemical

use

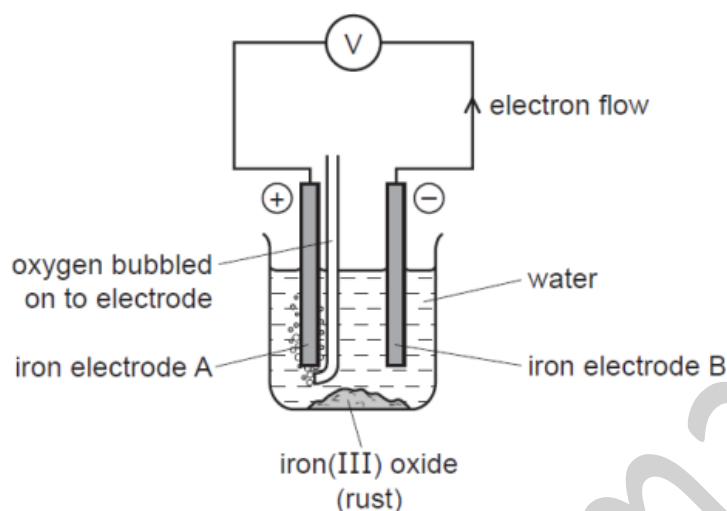
chemical

use [2]

0620/s12/qp32

8 Iron and steel rust when exposed to water and oxygen. Rust is hydrated iron(III) oxide.

(a) The following cell can be used to investigate rusting.



(i) What is a cell?

..... [2]

(ii) Which electrode will be oxidised and become smaller? Explain your choice.

..... [3]

(iii) What measurements would you need make to find the rate of rusting of the electrode you have chosen in (ii)?

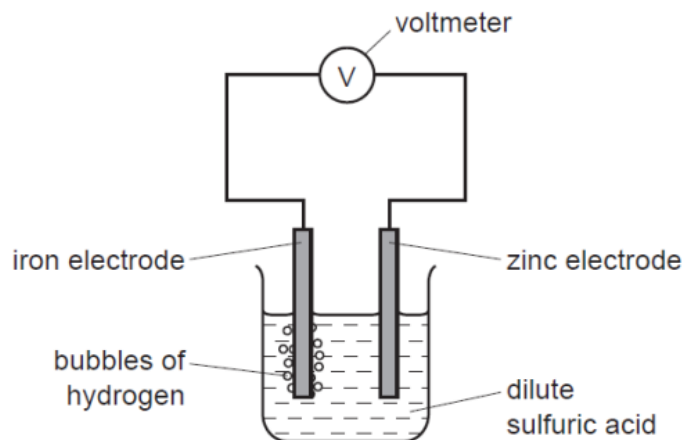
..... [2]

(iv) Suggest an explanation why the addition of salt to the water increases the rate of rusting.

..... [1]

0620/s12/qp31

5 The diagram shows a simple cell.



(a) Write an equation for the overall reaction occurring in the cell.

..... [2]

(b) Explain why all cell reactions are exothermic and redox.

.....

 [3]

(c) Which electrode, zinc or iron, is the negative electrode? Give a reason for your choice.

.....
 [2]

(d) Suggest **two** ways of increasing the voltage of this cell.

.....
 [2]

[Total: 9]

0620/s11/qp32

(b) Aqueous tin(II) sulfate is electrolysed using carbon electrodes. This electrolysis is similar to that of aqueous copper(II) sulfate using carbon electrodes.

(i) What is the product at the negative electrode (cathode)?

..... [1]

(ii) Write the equation for the reaction at the positive electrode (anode).

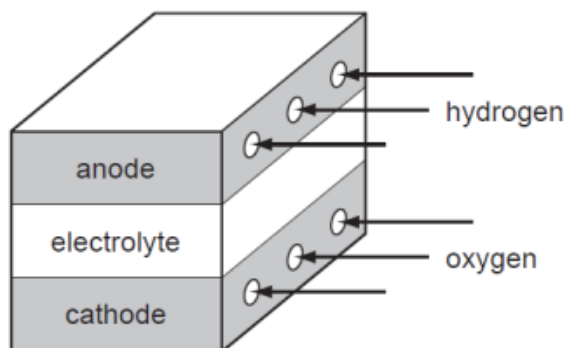
..... [2]

(iii) Name the acid formed in this electrolysis.

..... [1]

0620/s11/qp32

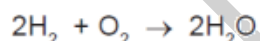
5 Fuel cells are used in spacecraft to produce electrical energy.



(a) How is oxygen obtained from liquid air?

.....
 [2]

(b) Hydrogen and oxygen react to form water.



(i) Give an example of bond breaking in the above reaction.

..... [1]

(ii) Give an example of bond forming in the above reaction.

..... [1]

(iii) Is the change given in (i) exothermic or endothermic?

..... [1]

(c) (i) Give **two** reasons why hydrogen may be considered to be the ideal fuel for the future.

.....

 [2]

(ii) Suggest a reason why hydrogen is not widely used at the moment.

.....
 [1]

[Total: 8]

0620/s10/qp32

- 2 The results of experiments on electrolysis using inert electrodes are given in the table.

Complete the table; the first line has been completed as an example.

electrolyte	change at negative electrode	change at positive electrode	change to electrolyte
molten lead(II) bromide	lead formed	bromine formed	used up
.....	potassium formed	iodine formed	used up
dilute aqueous sodium chloride			
aqueous copper(II) sulfate			
.....	hydrogen formed	bromine formed	potassium hydroxide formed

[Total: 8]

0620/s09/qp31

- 3 Copper is purified by electrolysis.

(a) Complete the following.

The positive electrode (anode) is made from

The negative electrode (cathode) is made from

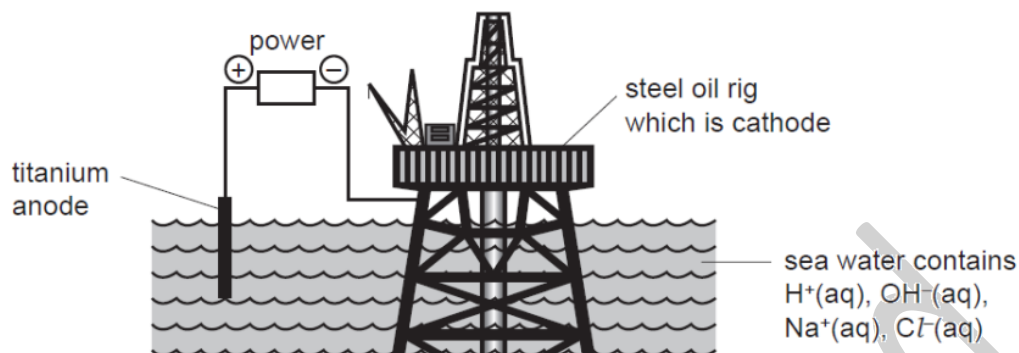
The electrolyte is aqueous [3]

(b) Write an ionic equation for the reaction at the positive electrode (anode).

..... [2]

0620/s08/qp31

- (b) Titanium is very resistant to corrosion. One of its uses is as an electrode in the cathodic protection of large steel structures from rusting.



- (i) Define oxidation in terms of electron transfer.

[1]

- (ii) The steel oil rig is the cathode. Name the gas formed at this electrode.

[1]

- (iii) Name the **two** gases formed at the titanium anode.

[2]

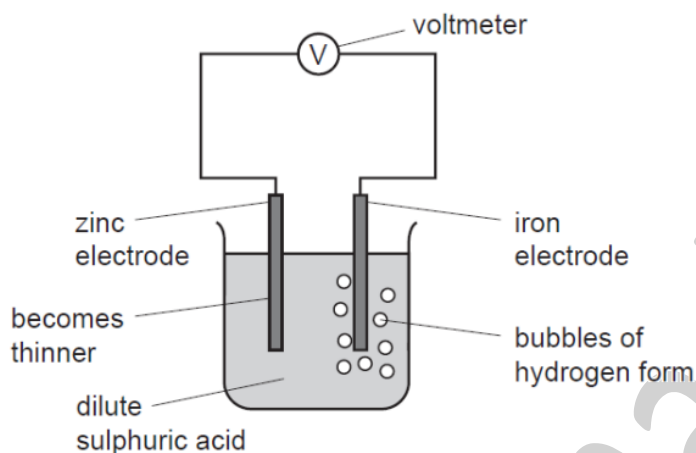
- (iv) Explain why the oil rig does not rust.

[2]

0620/s07/qp3

(c) Cell reactions are both exothermic and redox. They produce electrical energy as well as heat energy.

(i) The diagram shows a simple cell.



Which substance in this cell is the reductant and which ion is the oxidant?

reductant

oxidant [2]

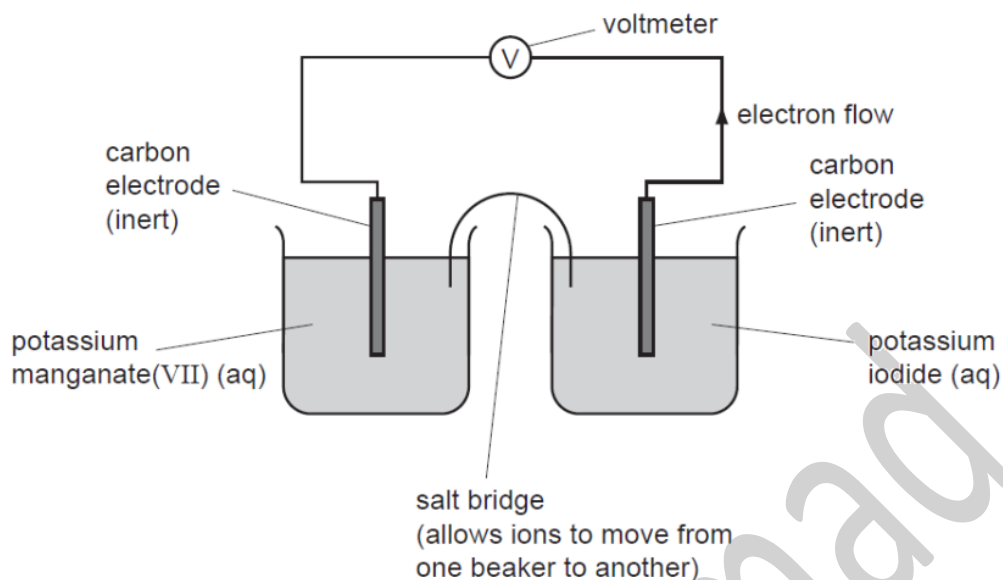
(ii) How could the voltage of this cell be increased?

..... [1]

(iii) What is the important large scale use, relating to iron and steel, of this type of cell reaction?

..... [1]

(d) Cells can be set up with inert electrodes and the electrolytes as oxidant and reductant.



The potassium manganate(VII) is the oxidant and the potassium iodide is the reductant.

(i) Describe the colour change that would be observed in the left hand beaker.

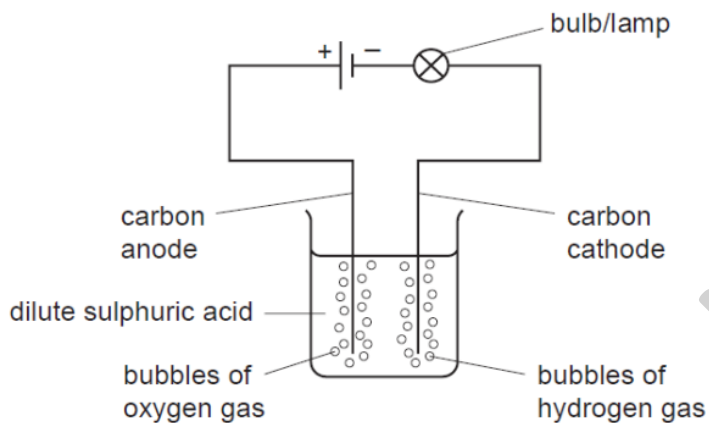
..... [2]

(ii) Write an ionic equation for the reaction in the right hand beaker.

..... [2]

0620/s06/qp3

- (b) The following apparatus was set up to investigate the electrical conductivity of dilute acids.



Dilute sulphuric acid is a strong acid. If it was replaced by a weak acid, what **two** differences in the observations would you expect to make?

.....

.....

..... [2]

0620/s06/qp3

- 5 (a) Copper has the structure of a typical metal. It has a lattice of positive ions and a “sea” of mobile electrons. The lattice can accommodate ions of a different metal.

Give a **different** use of copper that depends on each of the following.

- (i) the ability of the ions in the lattice to move past each other

..... [1]

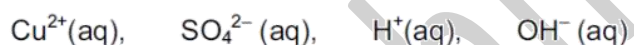
- (ii) the presence of mobile electrons

..... [1]

- (iii) the ability to accommodate ions of a different metal in the lattice

..... [1]

- (b) Aqueous copper(II) sulphate solution can be electrolysed using carbon electrodes. The ions present in the solution are as follows.



- (i) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

- (ii) A colourless gas was given off at the positive electrode (anode) and the solution changes from blue to colourless.

Explain these observations.

..... [2]

- (c) Aqueous copper(II) sulphate can be electrolysed using copper electrodes. The reaction at the negative electrode is the same but the positive electrode becomes smaller and the solution remains blue.

- (i) Write a word equation for the reaction at the positive electrode.

..... [1]

- (ii) Explain why the colour of the solution does not change.

..... [2]

- (iii) What is the large scale use of this electrolysis?

..... [1]

0620/s04/qp3

5 The first three elements in Period 6 of the Periodic Table of the Elements are caesium, barium and lanthanum.

(a) How many **more** protons, electrons and neutrons are there in one atom of lanthanum than in one atom of caesium. Use your copy of the Periodic Table of the Elements to help you.

number of protons

number of electrons

number of neutrons [3]

(b) All three metals can be obtained by the electrolysis of a molten halide. The electrolysis of the aqueous halides does not produce the metal.

(i) Complete the equation for the reduction of lanthanum ions at the negative electrode (cathode).



(ii) Name the **three** products formed by the electrolysis of aqueous caesium bromide.

.....

.....[4]

0620/s03/qp3

(c) The remaining zinc oxide reacts with sulphuric acid to give aqueous zinc sulphate. This is electrolysed with inert electrodes (the electrolysis is the same as that of copper(II) sulphate with inert electrodes).

ions present: $\text{Zn}^{2+}(\text{aq})$ $\text{SO}_4^{2-}(\text{aq})$ $\text{H}^+(\text{aq})$ $\text{OH}^-(\text{aq})$

(i) Zinc forms at the negative electrode (cathode). Write the equation for this reaction.

..... [1]

(ii) Write the equation for the reaction at the positive electrode (anode).

..... [2]

(iii) The electrolyte changes from aqueous zinc sulphate to

..... [1]

0620/w07/qp3

(b) Impure copper is extracted from the ore. This copper is refined by electrolysis.

- (i) Name;
the material used for the positive electrode (anode),

.....

the material used for the negative electrode (cathode),

.....

a suitable electrolyte.

..... [3]

- (ii) Write an ionic equation for the reaction at the negative electrode.

..... [1]

- (iii) One use of this pure copper is electrical conductors, another is to make alloys. Name the metal that is alloyed with copper to make brass.

..... [1]

0620/w06/qp3

(c) The major ore of strontium is its carbonate, SrCO_3 . Strontium is extracted by the electrolysis of its molten chloride.

- (i) Name the reagent that will react with the carbonate to form the chloride.

..... [1]

- (ii) The electrolysis of molten strontium chloride produces strontium metal and chlorine. Write ionic equations for the reactions at the electrodes.

negative electrode (cathode)

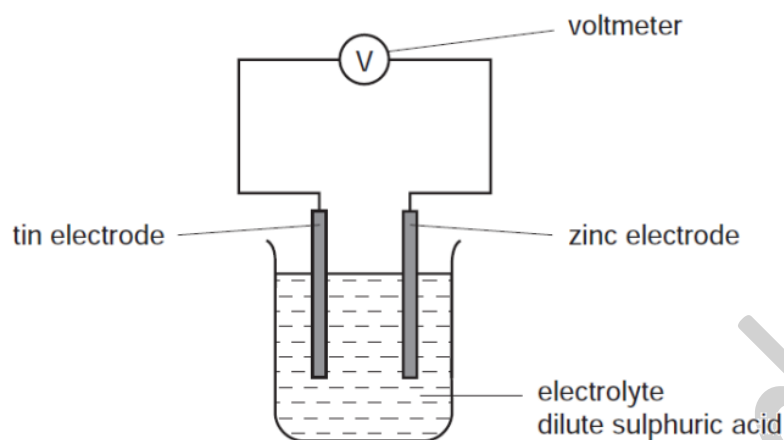
positive electrode (anode) [2]

- (iii) One of the products of the electrolysis of concentrated aqueous strontium chloride is chlorine. Name the other two.

..... [2]

0620/w05/qp3

(b) The following diagram shows a simple cell.



- (i) Predict how the voltage of the cell would change if the tin electrode was replaced with a silver one.

[1]

- (ii) Which electrode would go into the solution as positive ions? Give a reason for your choice.

[1]

- (iii) State how you can predict the direction of the electron flow in cells of this type.

[1]

0620/w04/qp3

(b) Copper is refined by the electrolysis of aqueous copper(II) sulphate using copper electrodes. Describe the change that occurs at the electrodes.

(i) cathode (pure copper)[1]

(ii) anode (impure copper)[1]

(iii) Write an ionic equation for the reaction at the cathode.[1]

(iv) If carbon electrodes are used, a colourless gas is given off at the anode and the electrolyte changes from a blue to a colourless solution.

The colourless gas is

The solution changes into [2]

(c) Electrolysis and cells both involve chemical reactions and electricity.

What is the essential difference between them?

.....[2]

0620/w02/qp3

(iii) Name the other **two** products of the electrolysis of concentrated aqueous sodium chloride and give a use of each one.

product use

product use [4]

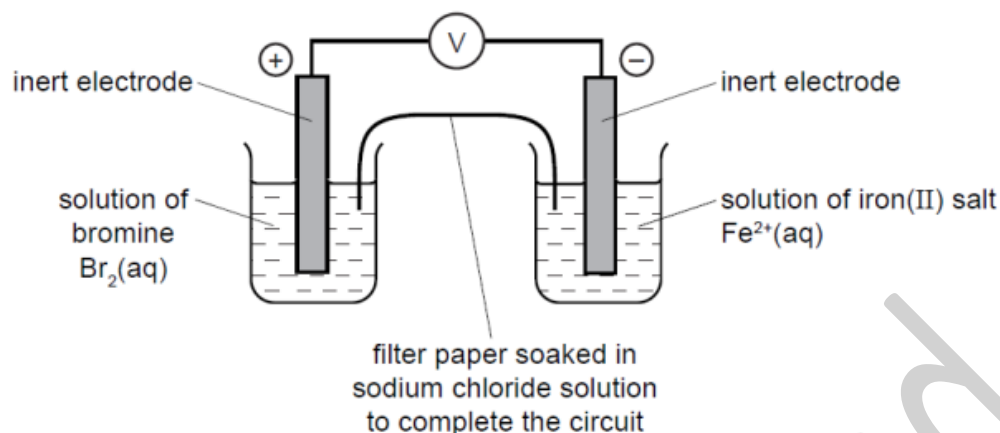
0620/s13/qp32

- (iv) Suggest another method of refining nickel. Give a brief description of the method which you have suggested. A labelled diagram is acceptable.

[4]

0620/w11/qp33

- 3 The diagram shows a cell. This is a device which produces electrical energy. The reaction in a cell is a redox reaction and involves electron transfer.



- (i) Complete the sentence.

A cell will change energy into electrical energy. [1]

- (ii) Draw an arrow on the diagram to show the direction of the electron flow. [1]

- (iii) In the left hand beaker, the colour changes from brown to colourless.
Complete the equation for the reaction.



- (iv) Is the change in (iii) oxidation or reduction? Give a reason for your choice.

.....
..... [1]

- (v) Complete the following description of the reaction in the right hand beaker.

Fe^{2+} changes into [1]

- (vi) When a solution of bromine is replaced by a solution of chlorine, the voltage increases. When a solution of bromine is replaced by a solution of iodine, the voltage decreases.

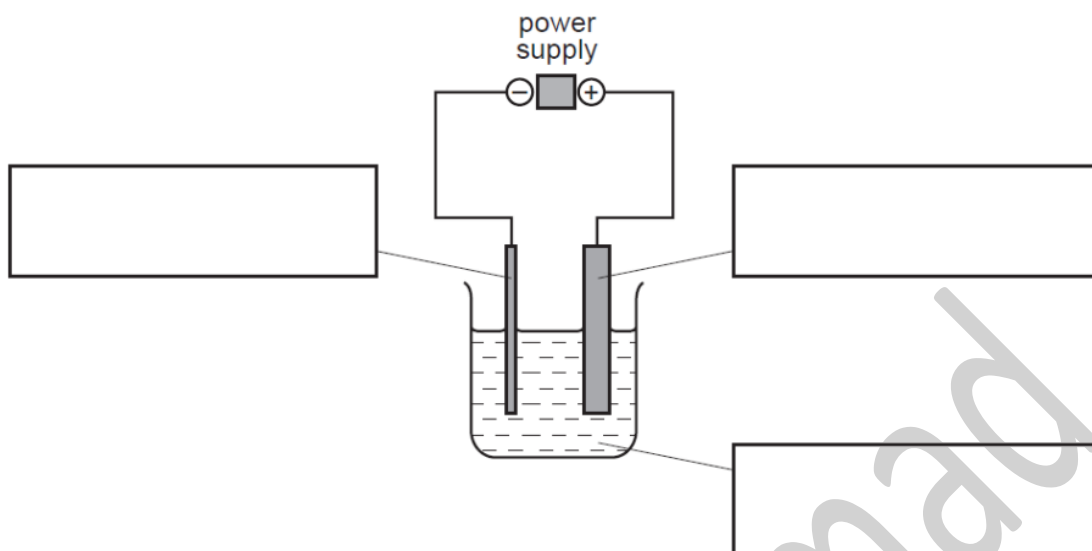
Suggest an explanation for this difference.

.....
..... [1]

[Total: 7]

0620/w10/qp31

- (iii) Copper oxide is reduced to copper which is then refined by electrolysis. Label the diagram of the apparatus which could be used to refine copper.



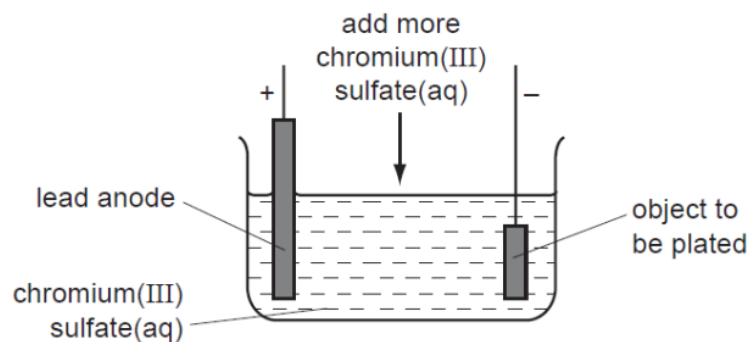
[3]

- (iv) Give **one** use of copper, other than making alloys.

[1]

0620/w10/qp31

- (b) Chromium is used to electroplate steel objects. The diagram shows how this could be done.



- (i) Give **two** reasons why steel objects are plated with chromium.

..... [2]

- (ii) The formula of the chromium(III) ion is Cr^{3+} and of the sulfate ion is SO_4^{2-} . Give the formula of chromium(III) sulfate.

..... [1]

- (iii) Write the equation for the reaction at the negative electrode (cathode).

..... [2]

- (iv) A colourless gas, which relights a glowing splint, is formed at the positive electrode (anode). Name this gas.

..... [1]

- (v) During electrolysis, it is necessary to add more chromium(III) sulfate but during copper-plating using a copper anode, it is not necessary to add more copper(II) sulfate. Explain.

..... [2]

0620/w10/qp32

- 4 The electrolysis of concentrated aqueous sodium chloride, between inert electrodes, is used to make four important chemicals.

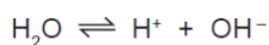
hydrogen
chlorine
sodium hydroxide
sodium chlorate(I)

(a) The ions present in the electrolyte are Na^+ , H^+ , Cl^- and OH^- .

- (i) Hydrogen ions are discharged at the negative electrode (cathode).
Write an equation for this reaction.

..... [2]

- (ii) The hydrogen ions are from the water.



Suggest an explanation why the concentration of hydroxide ions increases.

..... [2]

- (iii) When a dilute solution of sodium chloride is used, chlorine is not formed at the positive electrode (anode), a different gas is produced. Name this gas.

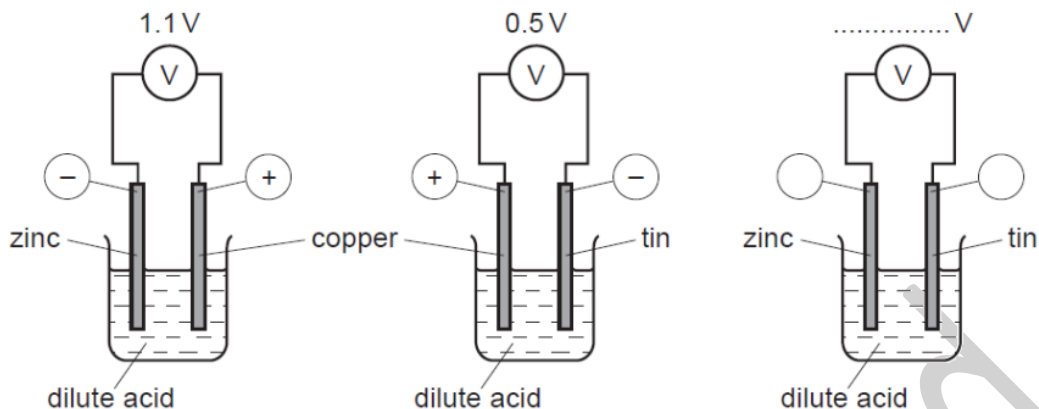
..... [1]

- (iv) State an example of an inert electrode.

..... [1]

0620/w10/qp33

- (c) A cell consists of two different metal electrodes in an electrolyte. Three possible cells are shown below.



- (i) Why is the more reactive metal the negative electrode?

.....
 [2]

- (ii) How can you deduce that zinc is more reactive than tin?

..... [1]

- (iii) How could you change the zinc/copper cell to have a voltage greater than 1.1 V?

..... [1]

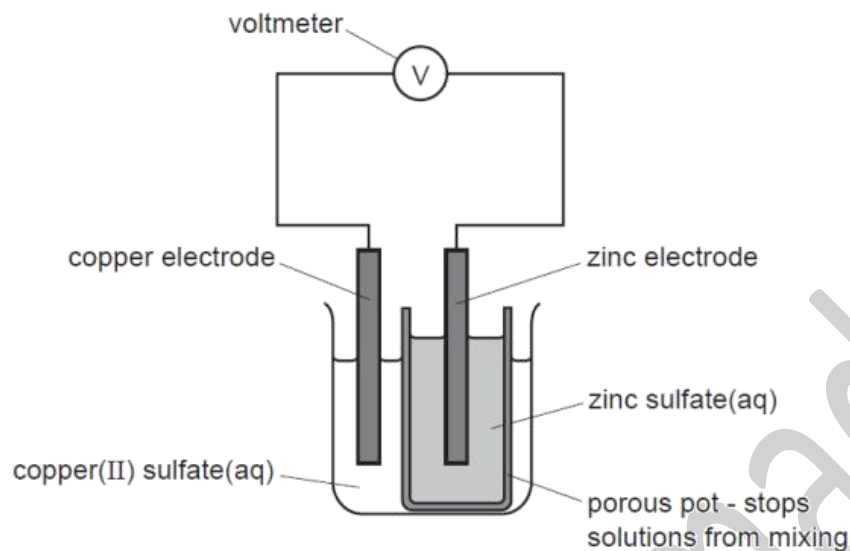
- (iv) Complete the labelling of the zinc/tin cell.

[2]

[Total: 14]

0620/w10/qp33

- (c) Zinc electrodes have been used in cells for many years, one of the first was the Daniel cell in 1831.



- (i) Give an explanation for the following in terms of atoms and ions.

observation at zinc electrode – *the electrode becomes smaller*

explanation

[1]

observation at copper electrode – *the electrode becomes bigger*

explanation

[1]

- (ii) When a current flows, charged particles move around the circuit.

What type of particle moves through the electrolytes?

[1]

Which particle moves through the wires and the voltmeter?

[1]

[Total: 10]

0620/w09/qp31

5 The electrolysis of concentrated aqueous sodium chloride produces three commercially important chemicals hydrogen, chlorine and sodium hydroxide.

(a) The ions present are $\text{Na}^+(\text{aq})$, $\text{H}^+(\text{aq})$, $\text{Cl}^-(\text{aq})$ and $\text{OH}^-(\text{aq})$.

(i) Complete the ionic equation for the reaction at the negative electrode (cathode).



(ii) Complete the ionic equation for the reaction at the positive electrode (anode).



(iii) Explain why the solution changes from sodium chloride to sodium hydroxide.

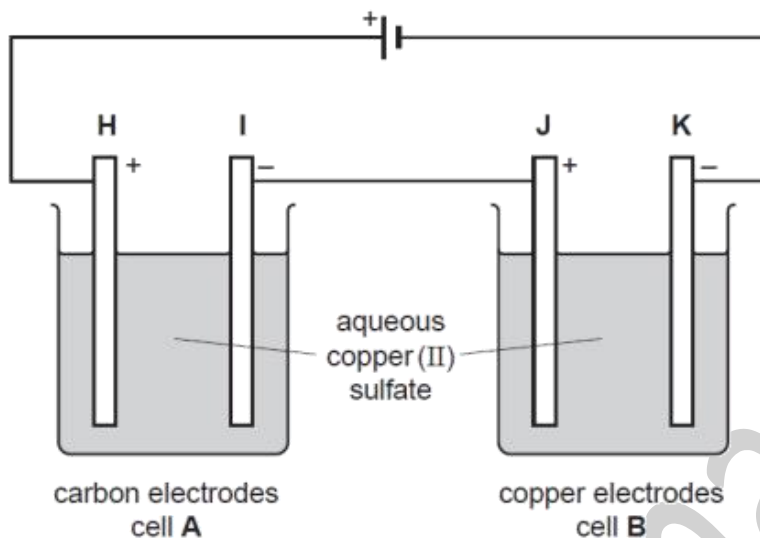
..... [1]

0620/w08/qp3

ATP - ELECTROLYSIS (GCE 5070)

Fahad H. Ahmad

- 2 The apparatus below is used to compare the results of passing a current through aqueous copper(II) sulfate using different electrodes.



- (a) What colour is aqueous copper(II) sulfate?
..... [1]
- (b) (i) In which cell, **A** or **B**, is a colour change **not** seen in the solution?
..... [1]
- (ii) Describe what is seen at each electrode in this cell, as the electrolysis proceeds?
.....
..... [2]
- (iii) Explain why a colour change is **not** seen in the solution in this cell.
..... [1]
- (c) (i) What colour change is seen in the solution in the other cell?
..... [1]
- (ii) At which electrode **H**, **I**, **J** or **K** is a gas produced?
..... [1]
- (iii) Name this gas.
..... [1]
- Give a test for this gas
test
observation [1]

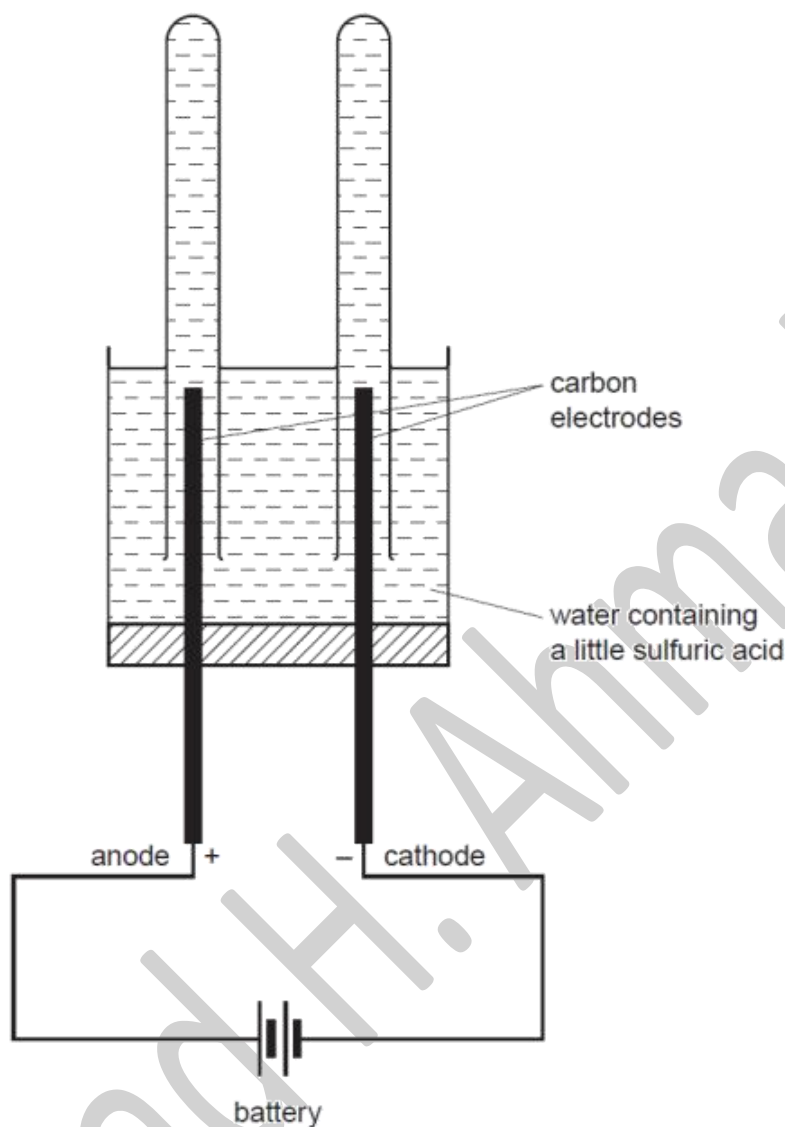
(iv) What is seen at the other electrode in this cell?

.....[1]

[Total: 10]

s/11/qp42

3 The apparatus below is used to electrolyse water.



(a) Why is a small volume of sulfuric acid added to the water?

..... [1]

(b) (i) Name the gas collected at the anode.

gas [1]

(ii) Give a test for this gas.

test

observation [1]

(iii) Write the ionic equation for the reaction taking place at the anode.

..... [2]

(c) (i) Name the gas collected at the cathode.

gas [1]

(ii) Give a test for this gas.

test

observation [1]

(iii) Write the ionic equation for the reaction taking place at the cathode.

..... [1]

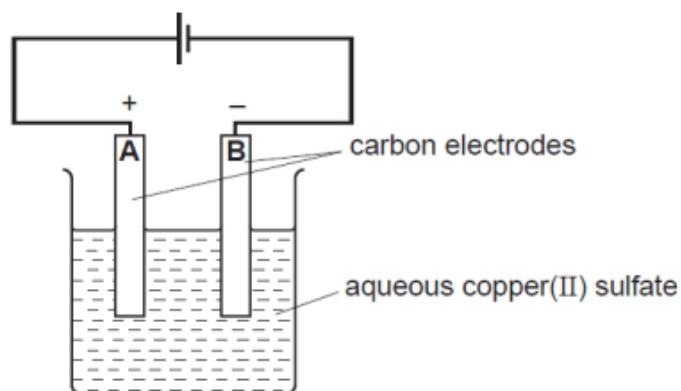
(d) When 20 cm^3 of gas has been collected at the anode, what volume of gas will have been collected at the cathode?

..... cm^3 [1]

[Total: 9]

s/11/qp41

- 2 A student electrolysed aqueous copper(II) sulfate, using carbon electrodes. The apparatus is shown below.



After a few minutes, a pink solid was deposited on one electrode and a gas was evolved at the other electrode.

- (a) (i) At which electrode, **A** or **B**, was the pink solid deposited? Explain your answer.

.....
 [1]

- (ii) Name the pink solid.

..... [1]

Eventually, no more pink solid was formed. Instead, a gas was produced at this electrode.

- (b) (i) Name this gas.

..... [1]

- (ii) Give a positive test for this gas.

..... [1]

- (c) (i) Name the gas evolved at the other electrode.

..... [1]

- (ii) Give a positive test for this gas.

..... [1]

- (d) (i) How does the colour of the electrolyte change during the electrolysis?

The colour changes from to [1]

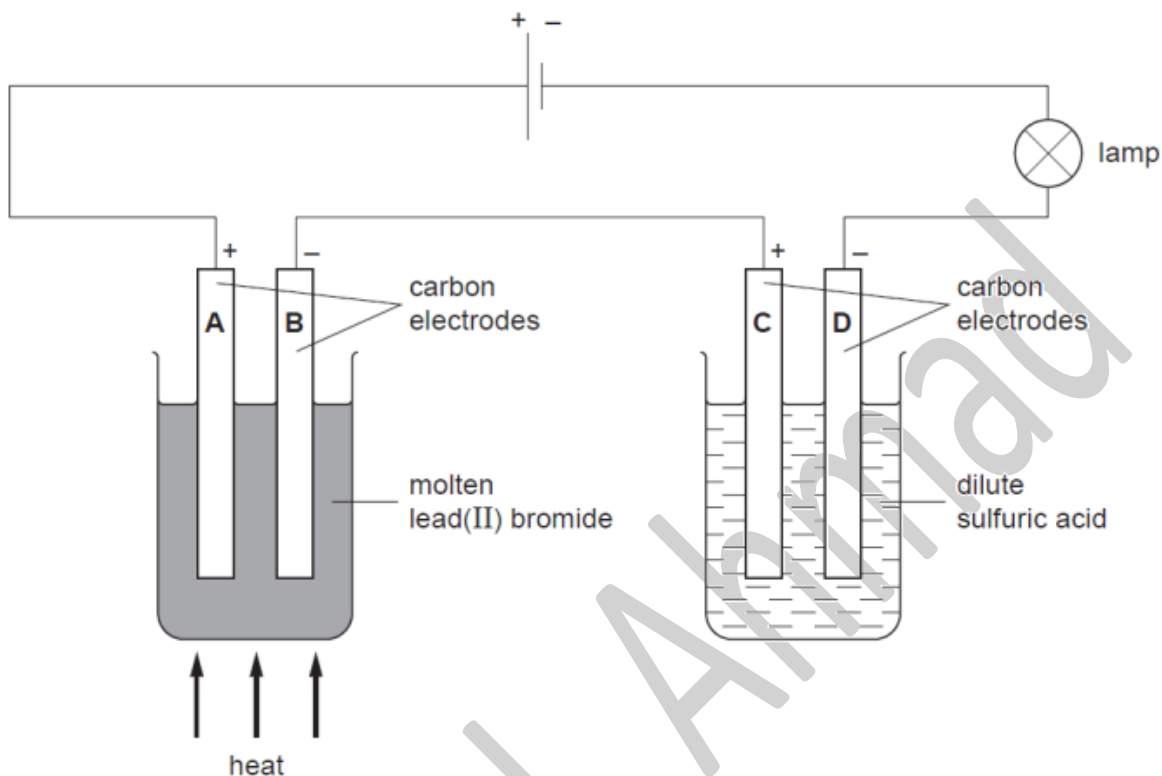
- (ii) Explain why this colour change takes place.

..... [1]

[Total: 8]

s/10/qp41/qp42

- 2 A student electrolysed molten lead(II) bromide and dilute sulfuric acid in the apparatus shown below.



- (a) What was produced at the electrodes A, B, C and D?

A
 B
 C
 D [4]

- (b) What, if anything, happened to the brightness of the lamp when the following changes were made to the experiment?

(i) Water was added to the dilute sulfuric acid.
 [1]

- (ii) The heating was stopped and the apparatus was left to cool. Explain your answer.

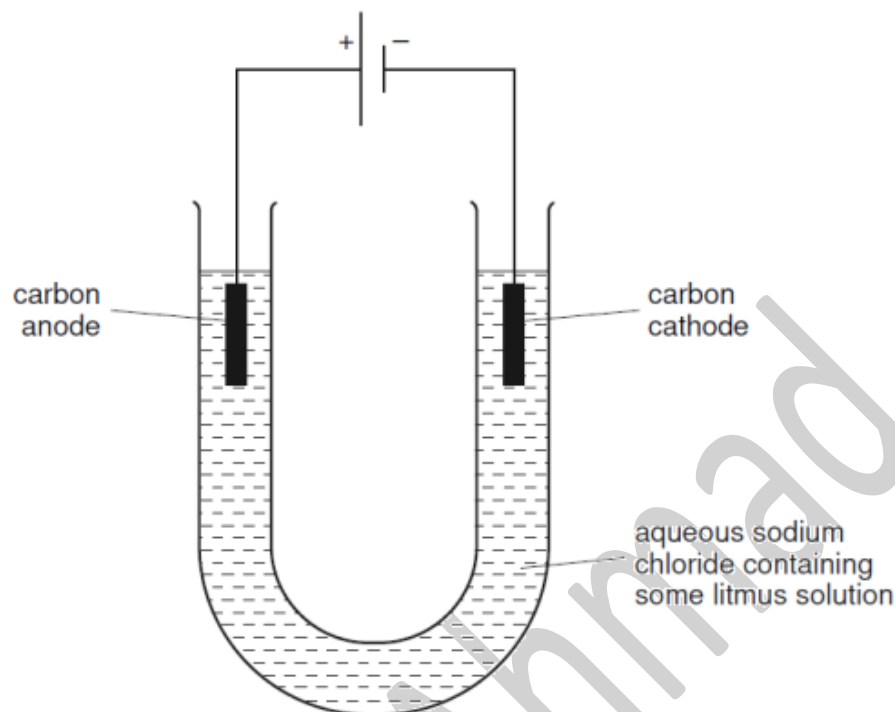
.....
 [2]

[Total: 7]

s/09/qp4

Fahad H. Ahmad

- 3 A student electrolysed concentrated aqueous sodium chloride using the apparatus below. The solution also contained litmus solution.



- (a) (i) Name the gas produced at the anode (positive electrode).
[1]
- (ii) Suggest what happened to the colour of the solution around the anode as the electrolysis proceeded.
[1]
- (iii) Why did this change take place?
[1]
- (b) (i) Name the gas produced at the cathode (negative electrode).
[1]
- (ii) Give a test for this gas.
[1]
- (iii) What happened to the colour of the solution around the cathode as the electrolysis proceeded?
[1]
- (iv) Why did this change take place?
[1]

- (c) The solution was replaced by a dilute solution of an acid. Suggest which acid would produce the same gases as those produced with concentrated aqueous sodium chloride.

.....[1]

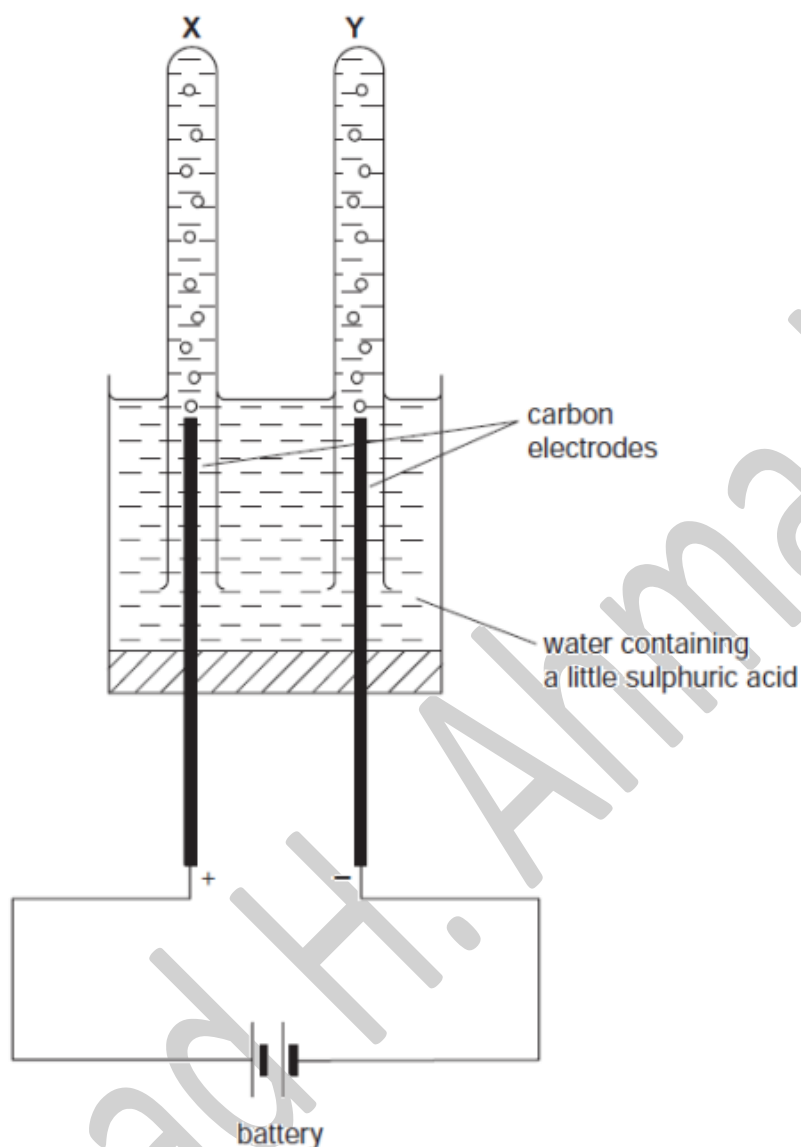
- (d) Under what conditions does the electrolysis of sodium chloride produce sodium at one of the electrodes?

.....[1]

[Total: 9]

s/08/qp4

2 The apparatus below was used to electrolyse water.



(a) (i) Why was a small volume of sulphuric acid added to the water?

.....

(ii) Name the gas collected in tube X and give a test for this gas.

gas

test

(iii) Name the gas collected in tube Y and give a test for this gas.

gas

test

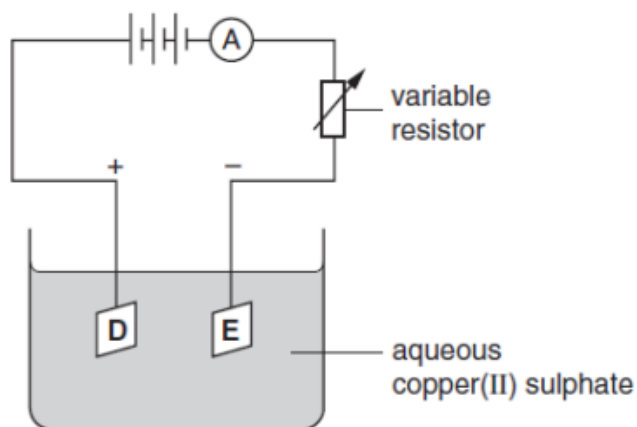
[5]

- (b) State how the volume of gas collected in tube X compares with the volume of gas collected in tube Y.

..... [1]

s/06/qp4

- 10 A constant current was passed through aqueous copper(II) sulphate using inert electrodes as shown in the diagram below. Copper was deposited at one of the electrodes.



- (a) Name a suitable material for the inert electrodes.

.....

[1]

- (b) At which electrode was copper deposited, D or E?

.....

[1]

- (c) What was seen at the other electrode?

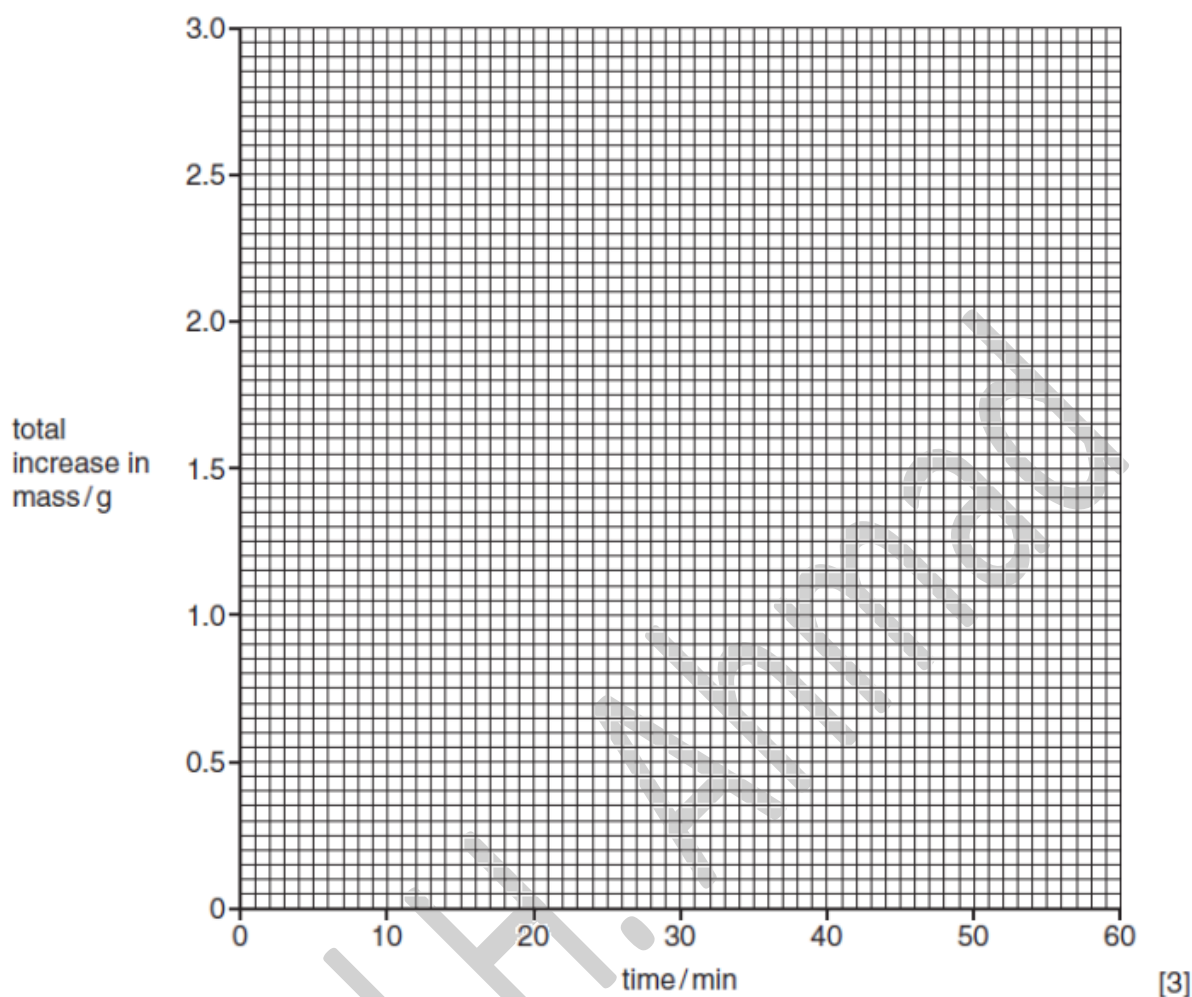
.....[1]

The electrode at which copper was deposited was removed at intervals, washed, dried and weighed. The results are shown in the table below.

time / mins	mass of cathode / g	total increase in mass / g
0	7.55	0.00
10	8.00	0.45
20	8.45	0.90
30	8.90	
40	9.35	
50	9.80	
60	9.80	

- (d) (i) Complete the table by calculating the total increase in mass after each 10 minute interval. [2]

(ii) Plot a graph of the data given in the table.



(iii) How long did it take for 1.60 g of copper to be deposited?

..... minutes [1]

(iv) Suggest why the last two readings were the same.

.....[1]

(e) What was the colour of the electrolyte

(i) at the start of the experiment,

.....

(ii) at the end of the experiment?

.....

[2]

The experiment was repeated with aqueous copper sulphate of the same concentration as before, but this time using copper electrodes. The same current was passed for the same length of time.

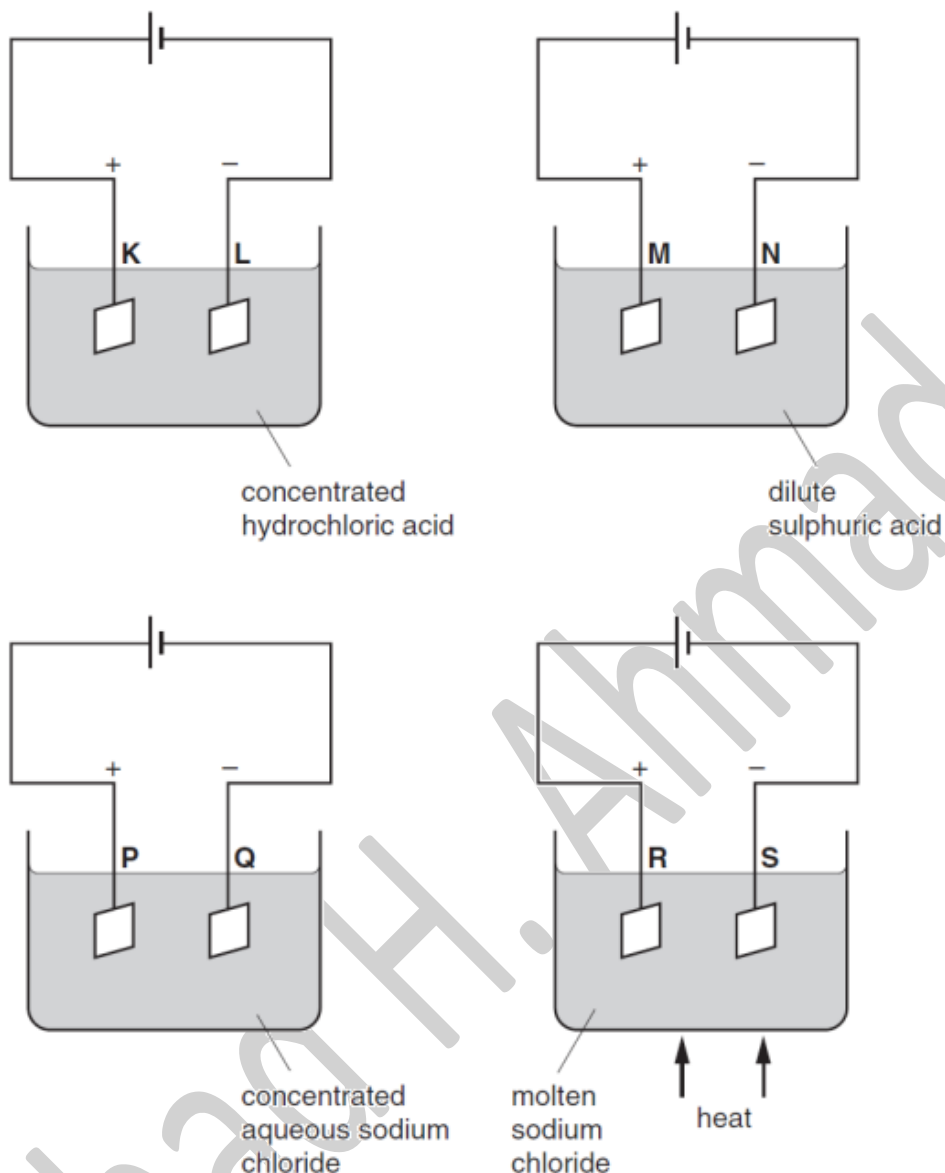
(f) Draw a line on your graph, labelled M, to show the result you would expect for this second experiment. [1]

(g) What was the colour of the electrolyte at the end of the experiment?

.....[1]

s/03/qp4

3 A student did four electrolysis experiments, each time using carbon electrodes.



Answer the following questions by writing the appropriate letter or letters.

(a) At which electrode(s) was hydrogen evolved?

.....

(b) At which electrode(s) was oxygen evolved?

.....

(c) At which electrode(s) was sodium produced?

.....

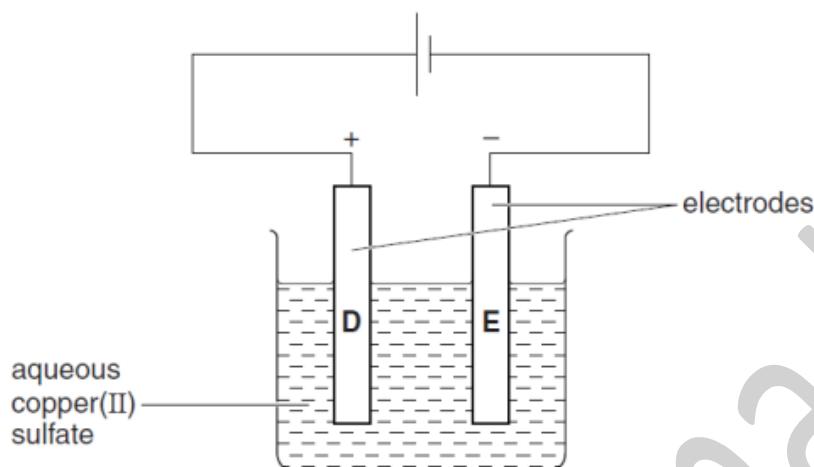
(d) At which electrode(s) was chlorine evolved?

.....[6]

w/03/qp4

- 9 A constant current is passed through aqueous copper(II) sulfate using inert electrodes as shown in the diagram below.

Copper is deposited at one of the electrodes.



- (a) Name a suitable material for the inert electrodes.

..... [1]

- (b) At which electrode is copper deposited?

..... [1]

- (c) What is seen at the other electrode?

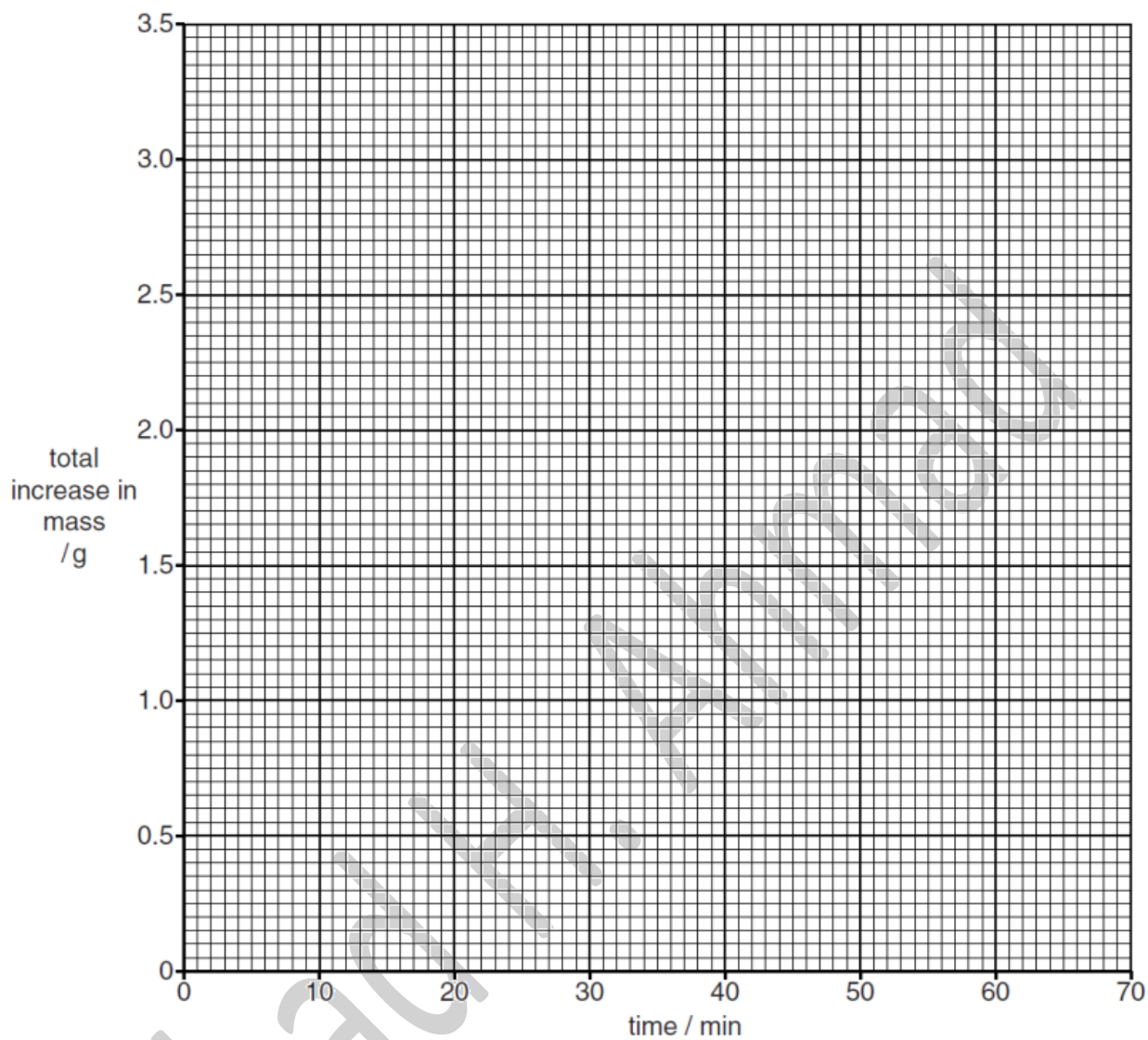
..... [1]

- (d) (i) The electrode at which copper is deposited is removed at 10 minute intervals, washed, dried and weighed. The results are shown in the table below. Complete the table by calculating the total increase in mass after each 10 minute interval.

time / min	mass of cathode / g	total increase in mass / g
0	7.55	0.00
10	8.05	0.50
20	8.55	1.00
30	9.05	
40	9.55	
50	9.80	
60	9.80	
70	9.80	

[1]

- (ii) Plot these results on the grid below.
Draw two intersecting straight lines through the points.



[3]

- (iii) How long does it take for 1.60 g of copper to be deposited?

..... min [1]

- (iv) How long does it take for all the copper to be deposited?

..... min [1]

(e) What is the colour of the electrolyte

(i) at the start of the experiment,

.....

[1]

(ii) at the end of the experiment?

.....

[1]

(f) The experiment is repeated using aqueous copper(II) sulfate of the same concentration as before but this time using copper electrodes.
The same current is passed for the same length of time.

Draw a line on your graph, labelled **S**, to show the result you would expect for this second experiment. [1]

(g) State and explain the colour of the electrolyte at the end of the experiment.

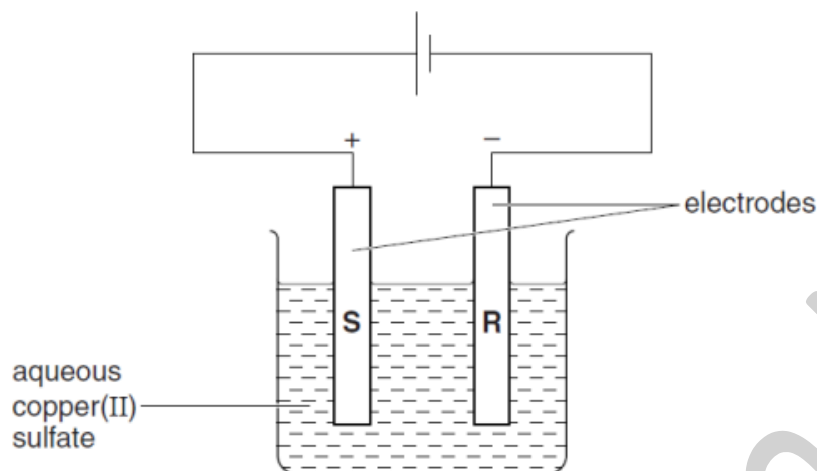
.....

..... [2]

[Total: 14]

w/13/qp42

- 2 (a) A student investigates the electrolysis of aqueous copper(II) sulfate using graphite electrodes and the apparatus shown below.



- (i) What is observed at electrode **R**?
[1]
- (ii) Construct the equation for the reaction taking place at electrode **R**.
[1]
- (iii) When graphite electrodes are used a colour change is seen in the solution.
 What is this colour change? Explain why it happens.

[2]
- (iv) When graphite electrodes are used, a gas is evolved at one of the electrodes.
 Name the gas and give a test for the gas.
 name
 test[2]
- (v) If the graphite electrodes are replaced with copper electrodes, no colour change is seen on electrolysis of the solution. Explain why.

[1]

- (b) The student does more experiments using the apparatus in (a) with **graphite** electrodes but, in each case, using a different electrolyte.

Complete the table below.

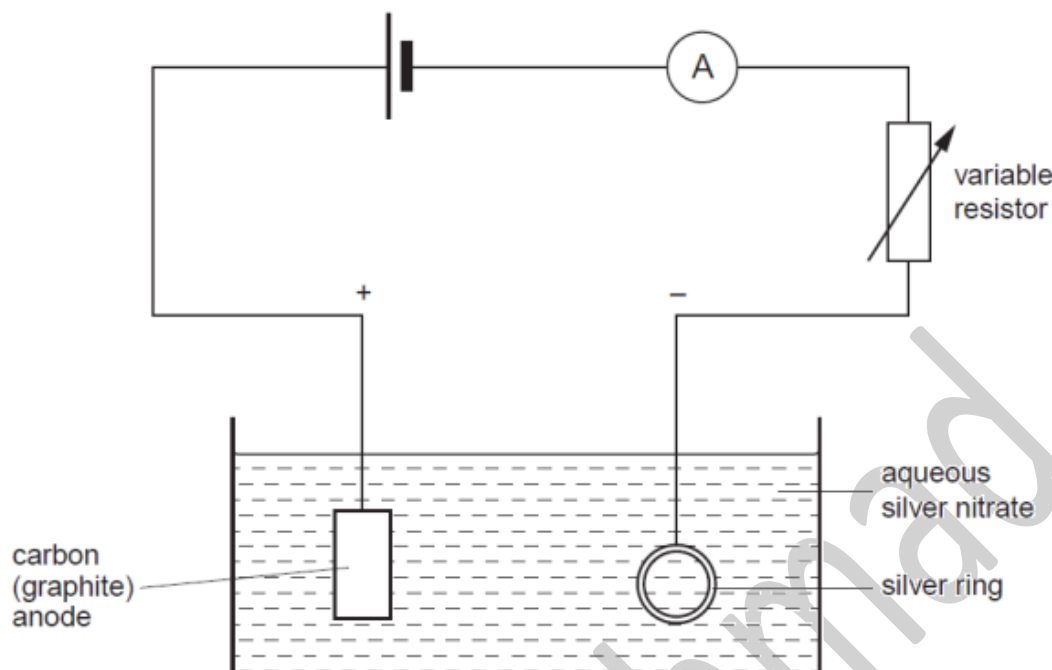
electrolyte	product at the anode (+ electrode)	observations at the anode (+ electrode)	product at the cathode (– electrode)	observations at the cathode (– electrode)
(i) dilute sulfuric acid		bubbles of colourless gas		
(ii) concentrated aqueous potassium iodide				bubbles of colourless gas
(iii) molten lead bromide				silvery grey liquid

[9]

[Total: 16]

w/13/qp41

10 A student plated a silver ring using the apparatus shown below.



The ring, which was the cathode, was weighed before it was placed in the aqueous silver nitrate. The circuit was completed and a current of 1.0 A was allowed to flow.

The ring was removed every ten minutes, washed, dried and weighed before being returned to the solution and reconnected to the circuit.

This was experiment 1.

The experiment was repeated using a current of 1.5 A. This was experiment 2.

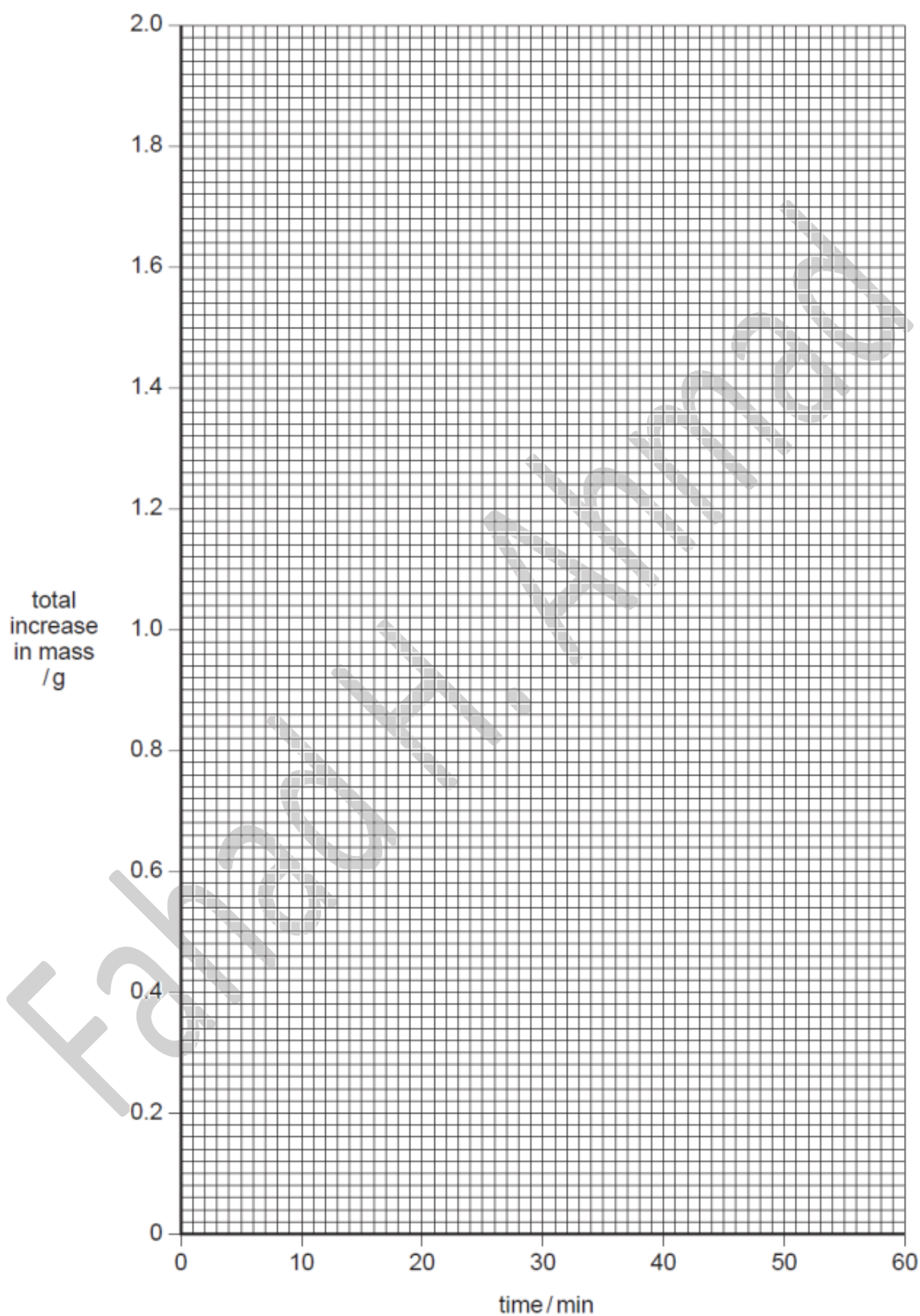
The results from both experiments are shown in the table below.

(a) Complete the table by calculating the total increase in mass after each ten minute period in both experiments.

	experiment 1		experiment 2	
	current 1.0 A		current 1.5 A	
time / mins	mass of ring / g	total increase in mass / g	mass of ring / g	total increase in mass / g
0	8.80	0.00	8.80	0.00
10	9.10	0.30	9.20	0.40
20	9.40	0.60	9.60	
30	9.70		10.00	
40	10.00		10.40	
50	10.30		10.40	

[1]

- (b) Plot the two sets of results on the grid below. Join the points in experiment 1 by a straight line and the points in experiment 2 by two intersecting straight lines. Label the lines 1 and 2 corresponding to the two experiments.



[4]

(c) What was the time taken to deposit 1.00g of silver in each experiment?

1 mins [1]

2 mins [1]

(d) Calculate how much more silver was deposited after 35 minutes in experiment 2 than in experiment 1.

mass of silver deposited in 35 minutes in 2 g

mass of silver deposited in 35 minutes in 1 g

difference in mass = g [2]

(e) The results for experiment 2 indicate that all the silver had been deposited after 40 minutes. By extending your line for experiment 1 suggest, after how many minutes, all the silver had been deposited in this experiment.

..... mins [1]

(f) Suggest what change should be made to the experiment so that more silver could be deposited on the ring.

..... [1]

[Total: 11]

w/10/qp42/43