

- 1 Name the type of particle responsible for the conduction of electricity during electrolysis in:
 the metal wires
 the electrolyte..... [2]

[Total: 2]

- 2 Complete the sentence about electrolysis using words from the list.

breakdown compound electricity electroplating

element gaseous heat molten

Electrolysis is the of an ionic when
 or in aqueous solution by the passage of

[4]

[Total: 4]

- 3 Predict the main products of the electrolysis of concentrated aqueous sodium chloride at:

the negative electrode.....
 the positive electrode..... [2]

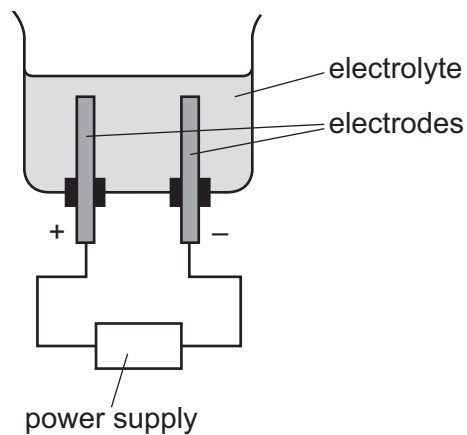
[Total: 2]

- 4 Predict the products of the electrolysis of molten zinc iodide at:

the negative electrode
 the positive electrode [2]

[Total: 2]

- 5 Electrolysis of concentrated aqueous sodium chloride can be done using the apparatus shown.



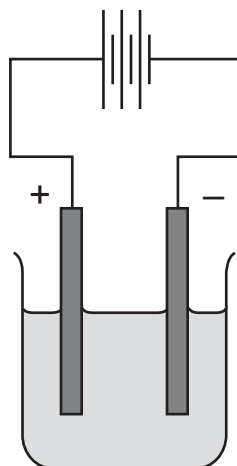
During electrolysis, a gas is produced at each electrode.

Complete the diagram to show how the gases can be collected.

[1]

[Total: 1]

- 6 Molten zinc iodide can be electrolysed using the apparatus shown.

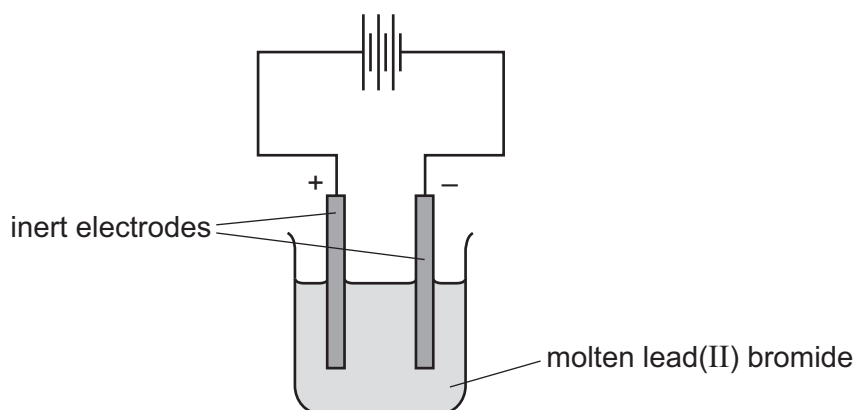


Why are the electrodes made of graphite?

..... [1]

[Total: 1]

- 7 Molten lead(II) bromide can be electrolysed using the apparatus shown.



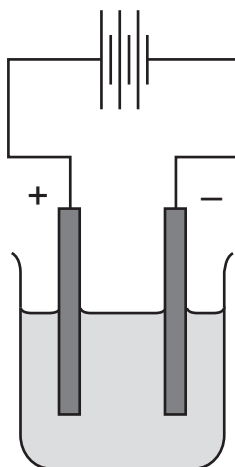
Predict the products of the electrolysis of molten lead(II) bromide at:

the negative electrode

the positive electrode. [2]

[Total: 2]

- 8 Molten zinc iodide can be electrolysed using the apparatus shown.



On the diagram, label:

- the anode
- the cathode
- the electrolyte.

[2]

[Total: 2]

- 9 Potassium bromide exists as an ionic lattice.

Explain why potassium bromide does **not** conduct electricity when solid but does conduct electricity when molten .

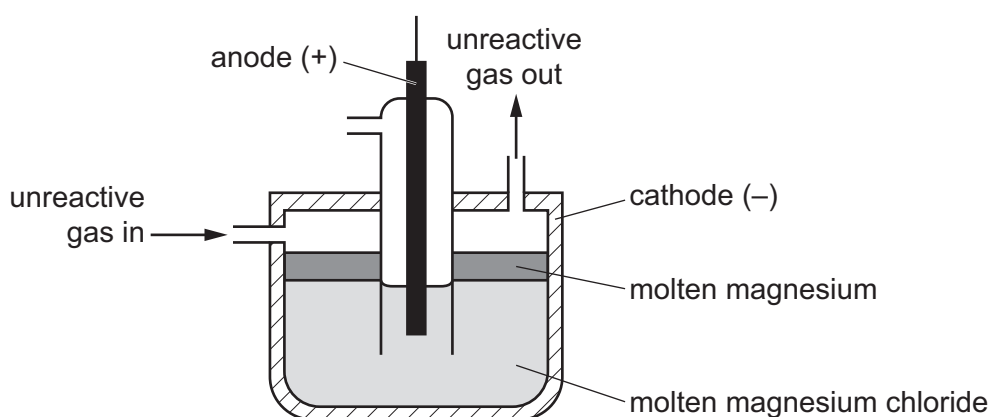
.....

.....

..... [2]

[Total: 2]

- 10 Magnesium is manufactured by the electrolysis of molten magnesium chloride.



- (a) What information in the diagram shows that molten magnesium is less dense than molten magnesium chloride?

..... [1]

- (b) One of the products of this electrolysis is magnesium.

State the name of the other product.

..... [1]

An unreactive gas is blown over the surface of the molten magnesium.

- (c) Suggest why an unreactive gas and **not** air is blown over the surface of the molten magnesium.

..... [1]

- (d) Suggest the name of an unreactive gas which could be used.

..... [1]

[Total: 4]

11 Molten calcium iodide can be electrolysed.

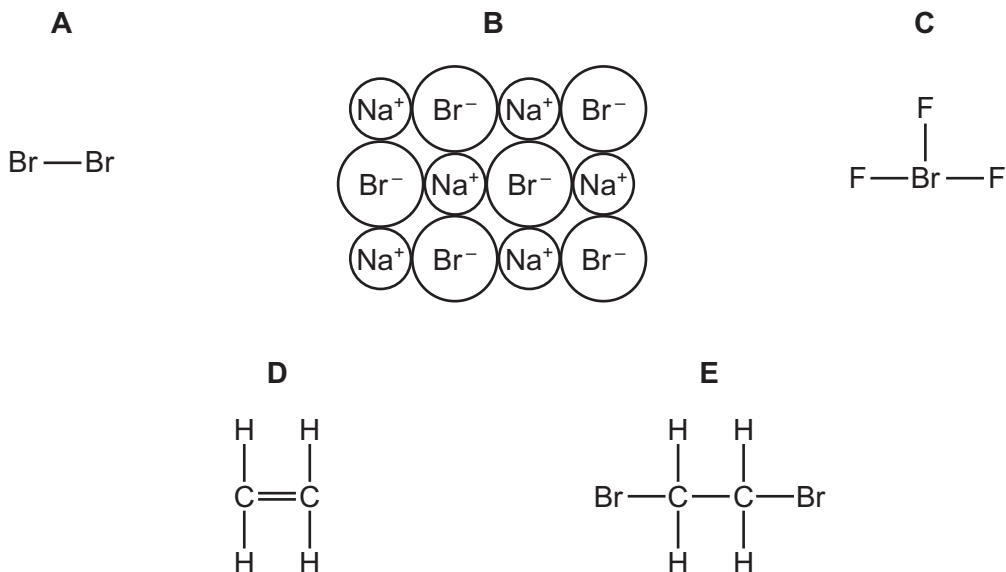
Predict the products of this electrolysis at:

the positive electrode (anode)

the negative electrode (cathode). [2]

[Total: 2]

12 The diagram shows the structures of five substances, **A**, **B**, **C**, **D** and **E**.



Which structure, **A**, **B**, **C**, **D** or **E**, conducts electricity when molten?

..... [1]

[Total: 1]

13 Molten potassium bromide can be electrolysed.

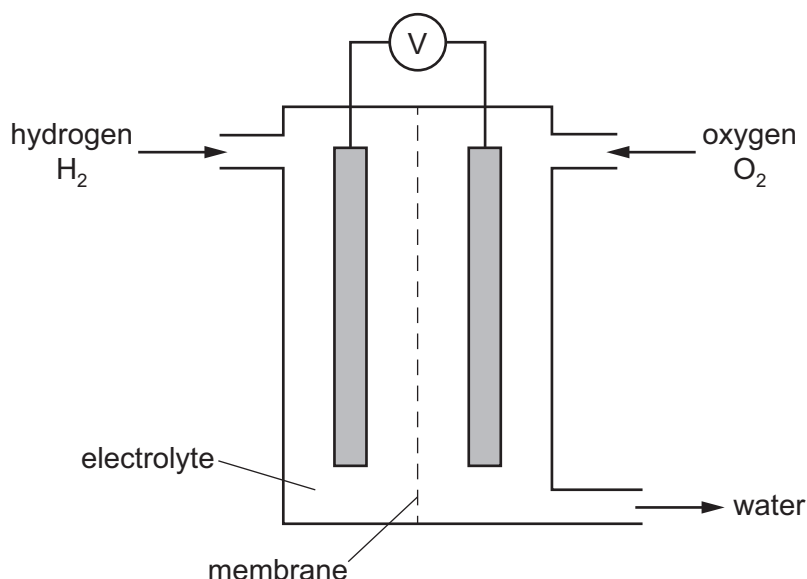
Predict the products of this electrolysis at

the positive electrode (anode)

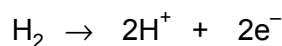
the negative electrode (cathode). [2]

[Total: 2]

14 Hydrogen and oxygen react together in a hydrogen fuel cell. A hydrogen fuel cell is shown in the diagram.



- (a) In a hydrogen fuel cell, the hydrogen molecules are converted into hydrogen ions, H^+ , according to the ionic half-equation shown.



What type of reaction does this ionic half-equation represent?

..... [1]

- (b) What **type** of substance reacts by donating hydrogen ions, H^+ ?

..... [1]

[Total: 2]

- 15 Name the process occurring when electrical energy is used to break down an ionic compound.

..... [1]

[Total: 1]

- 16 Molten calcium chloride can be electrolysed using inert electrodes.

Predict the products of this electrolysis at

the negative electrode (cathode),

the positive electrode (anode). [2]

[Total: 2]

- 17 Molten calcium bromide can be electrolysed using inert electrodes.

(a) Predict the products of this electrolysis at:

the negative electrode (cathode).....

the positive electrode (anode). [2]

(b) Graphite electrodes are inert.

Give the name of one **other** substance that can be used to make an inert electrode.

..... [1]

[Total: 3]

18 Molten potassium bromide can be electrolysed using inert electrodes.

Predict the products of this electrolysis at:

the negative electrode (cathode)

the positive electrode (anode). [2]

[Total: 2]

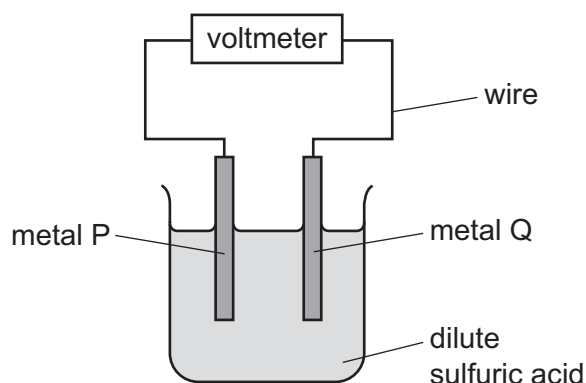
19 What are the products at the electrodes when dilute sulfuric acid is electrolysed using inert electrodes?

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

[1]

[Total: 1]

20 The diagram shows a simple cell.



Which pair of metals produces the largest voltage?

	metal P	metal Q
A	iron	copper
B	magnesium	copper
C	magnesium	zinc
D	zinc	copper

[1]

[Total: 1]

21 Many fertilisers contain potassium chloride.

When molten potassium chloride is electrolysed, two products are formed.

Complete the table below to show the name of the electrodes and the products formed.

charge on the electrode	name of the electrode	product formed at the electrode
positive		
negative		

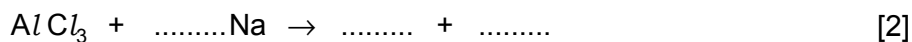
[3]

[Total: 3]

22 Aluminium is obtained by the reduction of aluminium ions to aluminium atoms.

The original method of extracting aluminium involved the reduction of aluminium chloride using the reactive metal sodium. Aluminium obtained by this method was very expensive due to the high cost of extracting sodium from sodium chloride.

- (a) Complete the equation for this reduction.

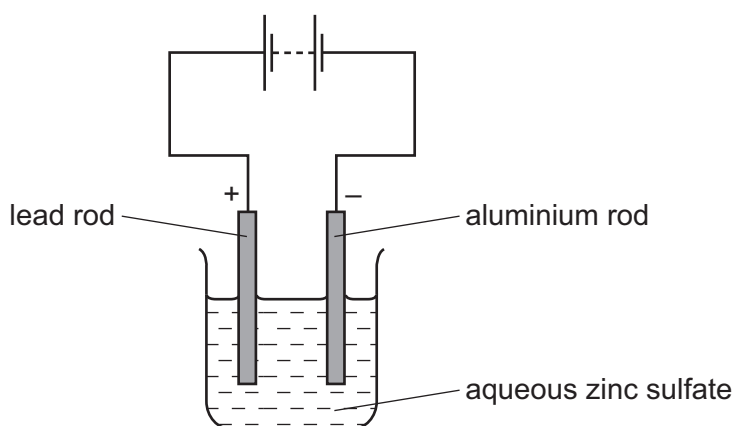


- (b) How can sodium metal be obtained from sodium chloride?

.....
 [2]

[Total: 4]

- 23 Zinc is extracted from zinc sulfate by electrolysis using the cell shown below.



- (a) Which word best describes the aluminium rod?
 Put a ring around the correct answer.

anion **anode** **cathode** **cation** **electrolyte** **product**

[1]

- (b) Suggest which statement about this electrolysis is completely correct.
 Tick **one** box.

Zinc is formed at the positive electrode and hydrogen at the negative electrode.

Zinc is formed at the positive electrode and oxygen at the negative electrode.

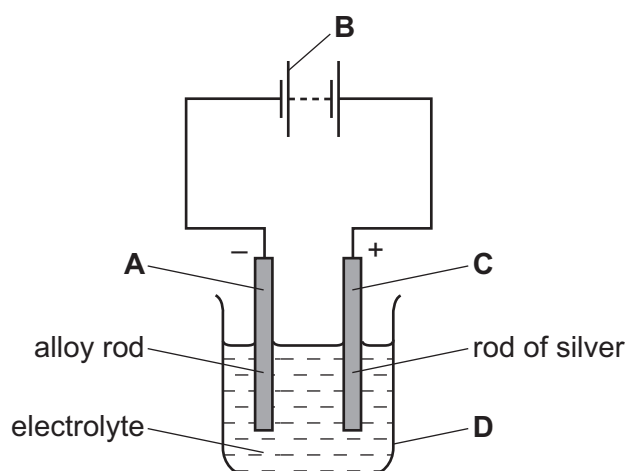
Zinc is formed at the negative electrode and hydrogen at the positive electrode.

Zinc is formed at the negative electrode and oxygen at the positive electrode;

[1]

[Total: 2]

24 Items can be electroplated with silver using the apparatus shown below.



(a) On the diagram, which letter, **A**, **B**, **C** or **D**, is the cathode?

..... [1]

(b) What would you observe during the experiment at the:

positive electrode,

.....

negative electrode?

.....

[2]

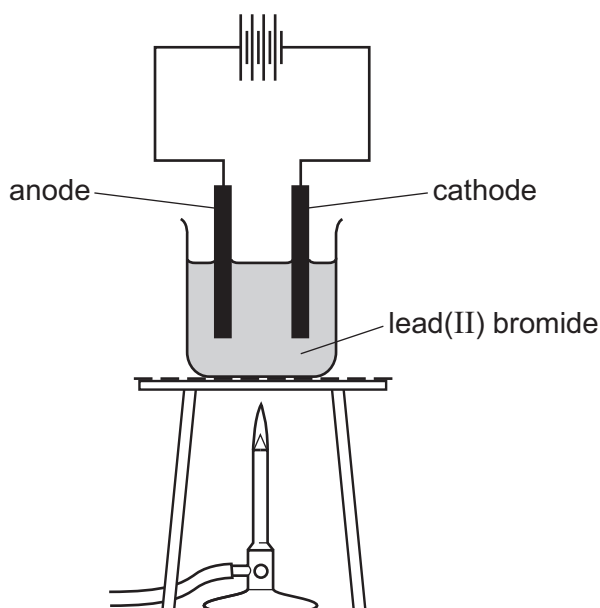
(c) The electrolyte used is aqueous silver cyanide, AgCN .

Calculate the relative formula mass of silver cyanide.
You must show all your working.

[2]

[Total: 5]

25 A student electrolysed lead(II) bromide in a fume cupboard using the apparatus shown below.



(a) Why is heat needed for this electrolysis?

..... [1]

(b) Suggest the name of a substance that could be used for the electrodes.

..... [1]

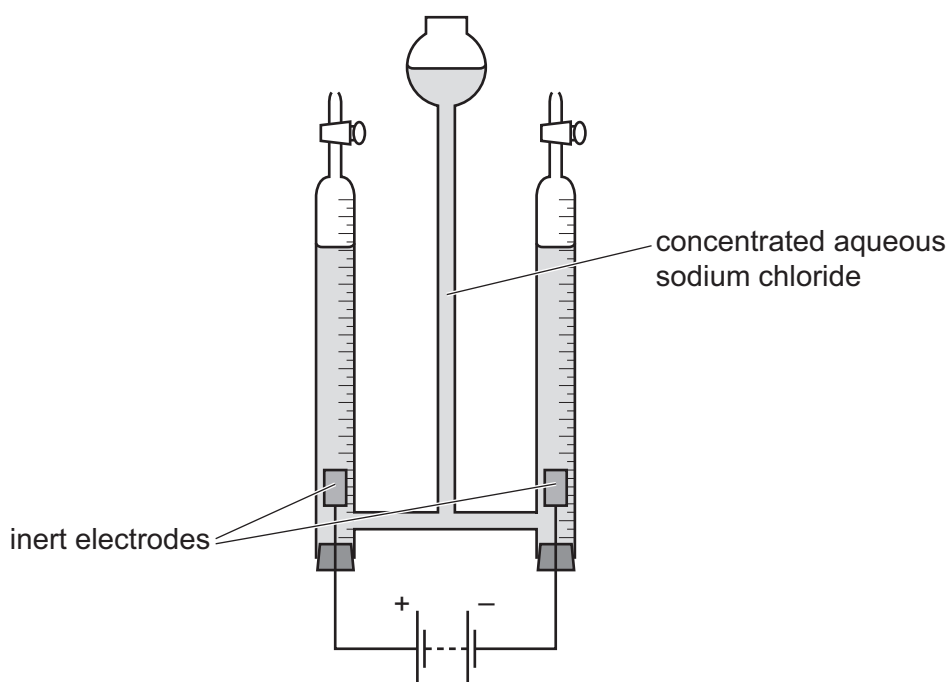
(c) Suggest the name of a substance that could be used for the electrodes.

the anode,

the cathode. [1]

[Total: 3]

26 A student used the following apparatus to electrolyse concentrated aqueous sodium chloride using inert electrodes.



(a) Suggest the name of a metal which could be used as the inert electrodes.

..... [1]

(b) Name the gas formed at the positive electrode.

..... [1]

(c) Write an ionic half-equation for the reaction occurring at the negative electrode. Include state symbols.

..... [3]

(d) How, if at all, does the pH of the solution change during the electrolysis? Explain your answer.

.....

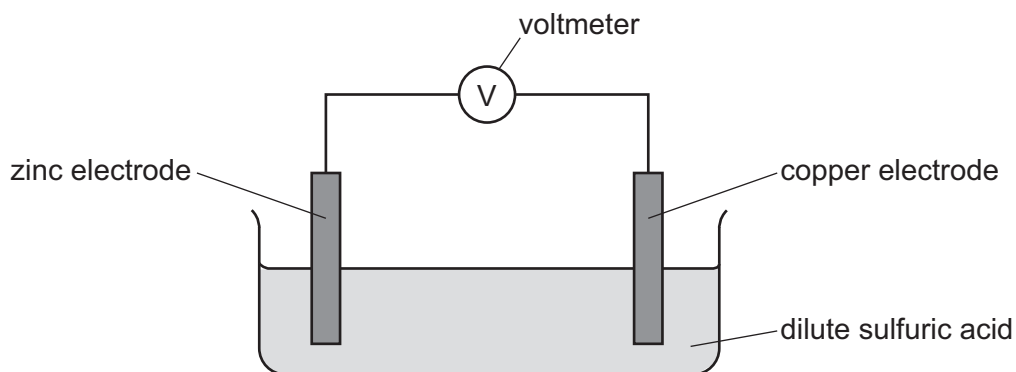
.....

..... [3]

[Total: 8]

27 A student used the following electrochemical cell.

The reading on the voltmeter was +1.10 V.



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

- (b) Suggest the change, if any, in the voltmeter reading if the zinc electrode was replaced with an iron electrode.
Explain your answer.

.....
 [2]

- (c) The zinc electrode was replaced with a silver electrode. The reading on the voltmeter was -0.46 V .

Suggest why the sign of the voltmeter reading became negative.

.....
 [1]

[Total: 4]

- 28 A sample of concentrated hydrobromic acid, HBr(aq) , was electrolysed using platinum electrodes.

The concentration of the hydrobromic acid was 8.89 mol/dm^3 .

- (a) Calculate the concentration of the HBr(aq) in g/dm^3 .

concentration of the HBr(aq) = g/dm^3 [1]

(b) Explain why concentrated HBr(aq) can conduct electricity.

.....

.....

..... [2]

(c) Magnesium is **not** a suitable material from which to make the electrodes.

Explain why.

.....

..... [1]

(d) Predict the product formed at the anode when concentrated HBr(aq) is electrolysed.

..... [1]

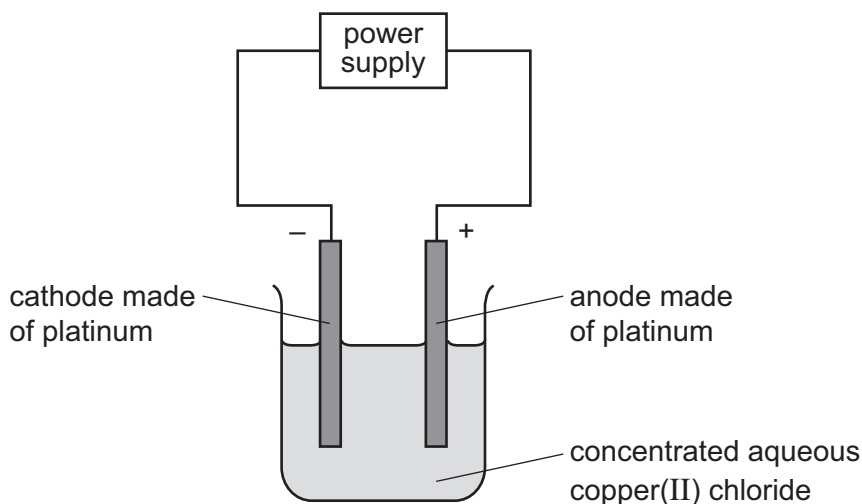
(e) Write the ionic half-equation for the reaction occurring at the cathode.

..... [2]

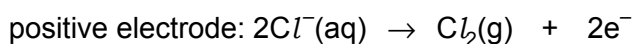
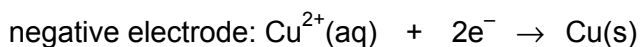
[Total: 7]

29 Solutions of ionic compounds can be broken down by electrolysis.

Concentrated aqueous copper(II) chloride was electrolysed using the apparatus shown.



The ionic half-equations for the reactions at the electrodes are shown.



- (a) Platinum is a solid which is a good conductor of electricity.

State **one** other property of platinum which makes it suitable for use as electrodes.

.....
 [1]

- (b) State what would be **seen** at the positive electrode during this electrolysis.

.....
 [1]

- (c) State and explain what would happen to the mass of the negative electrode during this electrolysis.

.....

 [2]

- (d) The concentrated aqueous copper(II) chloride electrolyte is green.

Suggest what would happen to the colour of the electrolyte during this electrolysis.
 Explain your answer.

.....

 [2]

- (e) Identify the species that is oxidised during this electrolysis.
 Explain your answer.

species that is oxidised

explanation

..... [2]

[Total: 8]

- 30 Metal objects can be electroplated with silver.

(a) Describe how a metal spoon can be electroplated with silver.

Include:

- what to use as the positive electrode and as the negative electrode
- what to use as the electrolyte
- an ionic half-equation to show the formation of silver.

You may include a diagram in your answer.

.....
.....
.....

ionic half-equation [4]

(b) Give **one** reason why metal spoons are electroplated with silver.

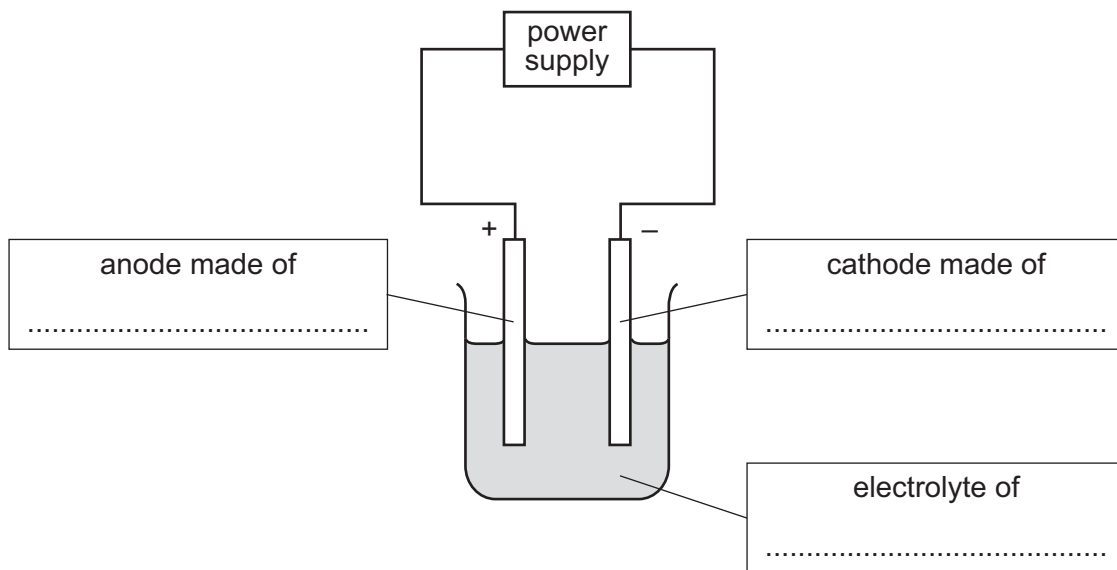
.....
..... [1]

[Total: 5]

31 Copper is refined (purified) by electrolysis. Nickel can be refined using a similar method.

(a) The diagram shows the refining of nickel by electrolysis.

Complete the labels in the boxes.



[3]

(b) Indicate, by writing **N** on the diagram, where nickel is produced.

[1]

[Total: 4]

32 Magnesium cannot be produced by electrolysis of aqueous magnesium chloride using inert electrodes.

(a) Name the product formed at the negative electrode (cathode) during the electrolysis of aqueous magnesium chloride.

..... [1]

(b) Suggest how magnesium can be produced from magnesium chloride by electrolysis.

..... [1]

[Total: 2]

33 The table gives information about the products of the electrolysis of two electrolytes. Platinum electrodes are used in each case.

(a) Give **two** reasons why platinum is suitable to use as an electrode.

1.....

2..... [2]

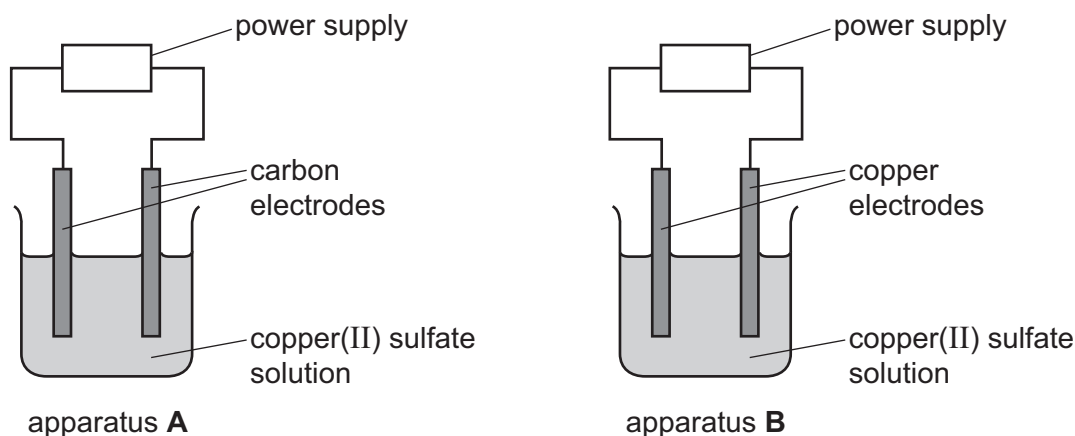
(b) Complete the table.

electrolyte	observation at the anode (+)	name of product at the anode (+)	observation at the cathode (-)	name of product at the cathode (-)
concentrated aqueous potassium chloride			bubbles of colourless gas	
aqueous copper(II) sulfate	bubbles of colourless gas			

[6]

[Total: 8]

34 A student electrolysed copper(II) sulfate solution using the two sets of apparatus shown.



In apparatus **A** the student used carbon electrodes.
 In apparatus **B** the student used copper electrodes.

The student made the following observations.

apparatus A	apparatus B
The mass of the negative electrode increased.	The mass of the negative electrode increased.
The mass of the positive electrode stayed the same.	The mass of the positive electrode decreased.
Bubbles were seen at the positive electrode.	No bubbles were seen at the positive electrode.

Suggest what happens to the colour of the solution in apparatus **A** and apparatus **B** as the electrolysis progresses.
 Explain your answer.

colour of the solution in apparatus **A**.....

colour of the solution in apparatus **B**.....

explanation.....

.....

..... [3]

[Total: 3]

35 Concentrated aqueous potassium bromide is an electrolyte.

(a) Describe the electrolysis of concentrated aqueous potassium bromide.

Include:

- an ionic half-equation for the reaction at the cathode
- the name of the product at the anode
- the name of the potassium compound formed.

.....

.....

.....

.....

[4]

(b) When molten potassium bromide is electrolysed, the product at the cathode is different.

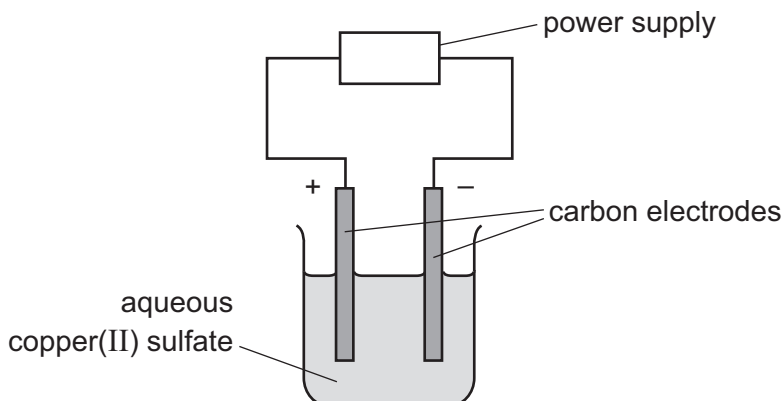
Name the product at the cathode when molten potassium bromide is electrolysed.

.....

[1]

[Total: 5]

36 A student electrolyses aqueous copper(II) sulfate using the apparatus shown.



Oxygen gas forms at the positive electrode (anode).

(a) Describe what the student observes at the negative electrode.

.....

[1]

(b) Give **two other** observations which the student makes during the electrolysis.

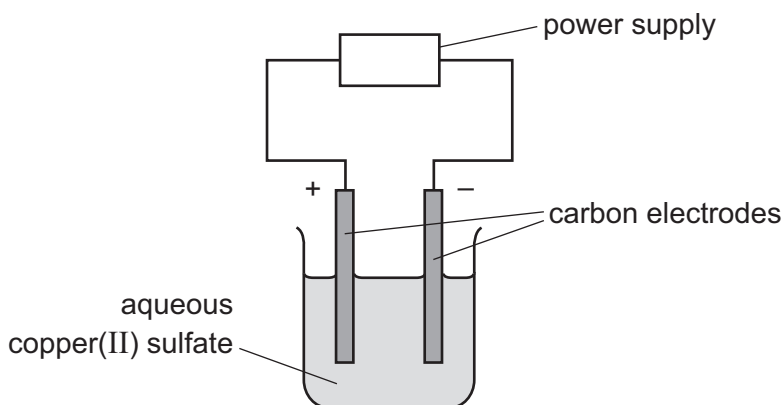
1.....

2.....

[2]

[Total: 3]

- 37 A student electrolyses aqueous copper(II) sulfate using the apparatus shown.



Oxygen gas forms at the positive electrode (anode).

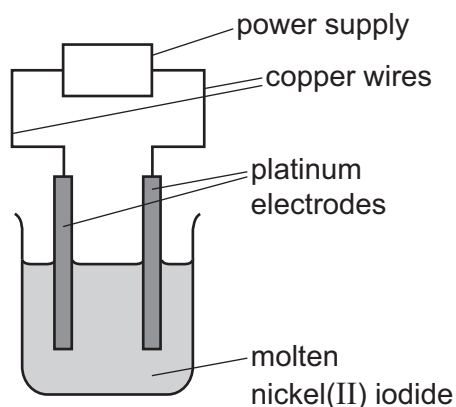
What difference would the student observe at the positive electrode if the aqueous copper(II) sulfate were replaced by concentrated aqueous copper(II) chloride?

.....

[1]

[Total: 1]

- 38 Molten nickel(II) iodide can be electrolysed using the apparatus shown.



During electrolysis, charge is transferred through the copper wires and through the molten nickel(II) iodide.

- (a) Name the type of particles which transfer charge through the copper wires.

..... [1]

- (b) Name the type of particles which transfer charge through the molten nickel(II) iodide.

..... [1]

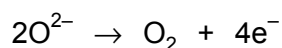
- (c) Predict the products of the electrolysis of molten nickel(II) iodide. Write an ionic half-equation for the formation of **one** of these products.

products.....

ionic half-equation..... [3]

[Total: 5]

- 39 The reaction at the anode during the extraction of aluminium by electrolysis is shown.



Is this process oxidation or reduction?

Give a reason for your answer.

.....

..... [1]

[Total: 1]

- 40 During the extraction of aluminium by electrolysis, carbon dioxide is formed at the anode.

Explain how carbon dioxide is formed at the anode.

.....

..... [2]

[Total: 2]