

**1** Aluminium is manufactured by the electrolysis of molten aluminium oxide.

(a) Predict the products of the electrolysis of molten aluminium oxide at:

the positive electrode .....

the negative electrode. .... [2]

[Total: 2]

**2** Concentrated hydrochloric acid is electrolysed using graphite electrodes.

(a) Name the products of this electrolysis at:

the positive electrode .....

the negative electrode. .... [2]

(b) Suggest **one** observation that is made at the negative electrode.

..... [1]

[Total: 3]

**3** This question is about solids, liquids and gases.

(a) The list gives the names of nine substances which are solids at room temperature.

**a ceramic**

**aluminium**

**anhydrous cobalt(II) chloride**

**anhydrous copper(II) sulfate**

**calcium oxide**

**graphite**

**iodine**

**iron**

**sodium**

Answer the following questions about these substances.

Each substance may be used once, more than once or not at all.

State which substance:

(a) turns pink when water is added to it

..... [1]

(b) is a non-metal which is used as a lubricant

..... [1]

(c) is used to neutralise acidic industrial waste

..... [1]

(d) is extracted from bauxite

..... [1]

(e) is used as an electrical insulator.

..... [1]

[Total: 5]

**4** Magnesium is manufactured by the electrolysis of molten magnesium chloride.

The negative electrode is made of iron.

Suggest a non-metal which could be used for the positive electrode.  
Give a reason for your answer.

.....

..... [2]

[Total: 2]

**5** Predict the products of the electrolysis of molten magnesium chloride at:

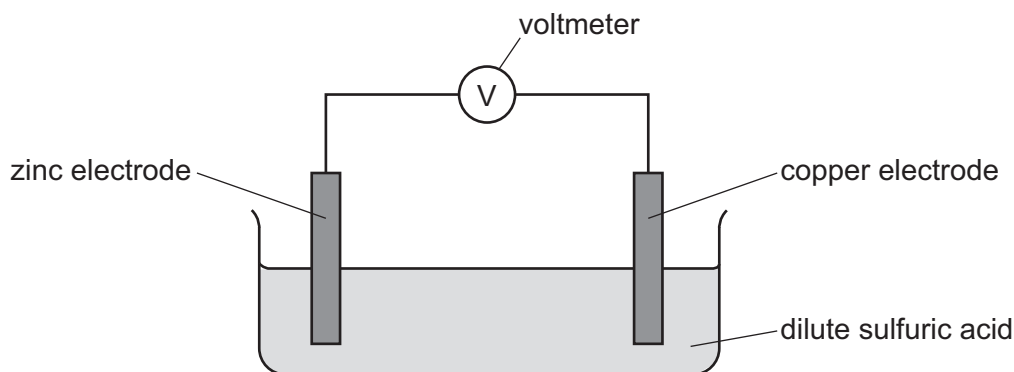
the positive electrode .....

the negative electrode. .... [2]

[Total: 2]

**6** 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  $-0.46\text{ V}$ .

Suggest why the sign of the voltmeter reading became negative.

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

[Total: 4]

- 7 A sample of concentrated hydrobromic acid,  $\text{HBr(aq)}$ , was electrolysed using platinum electrodes.  
The concentration of the hydrobromic acid was  $8.89\text{ mol/dm}^3$ .

- (a) Calculate the concentration of the  $\text{HBr(aq)}$  in  $\text{g/dm}^3$ .

concentration of the  $\text{HBr(aq)}$  = .....  $\text{g/dm}^3$  [1]

(b) Explain why concentrated  $\text{HBr(aq)}$  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  $\text{HBr(aq)}$  is electrolysed.

.....

[1]

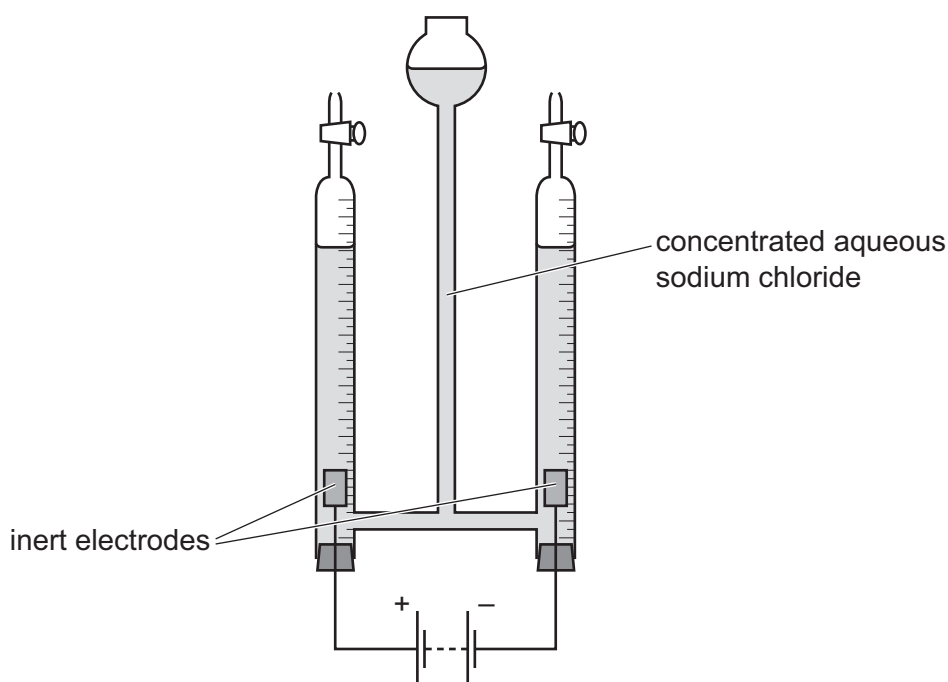
(e) Write the ionic half-equation for the reaction occurring at the cathode.

.....

[2]

[Total: 7]

- 8 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]

9 Aluminium oxide is a compound present in aluminium ore.

(a) Name an ore which contains aluminium oxide.

..... [1]

(b) Predict the products of the electrolysis of molten aluminium oxide at:

the positive electrode .....

the negative electrode ..... [2]

(c) Suggest why aluminium is extracted by electrolysis and **not** by reduction with carbon.

..... [1]

[Total: 4]

10 Molten sodium iodide is electrolysed.

Predict the product at the positive electrode.

..... [1]

[Total: 1]

11 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.

.....

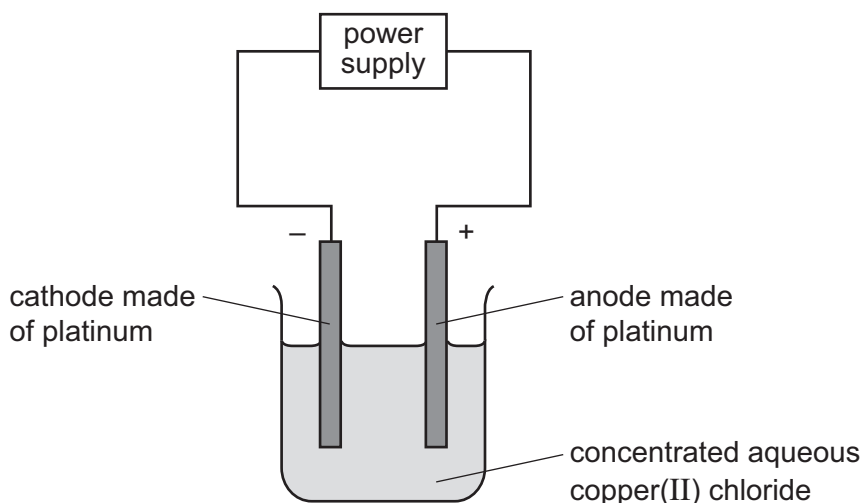
.....

[1]

[Total: 5]

**12** 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.

negative electrode:  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$

positive electrode:  $2\text{Cl}^{-}(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^{-}$

(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 .....

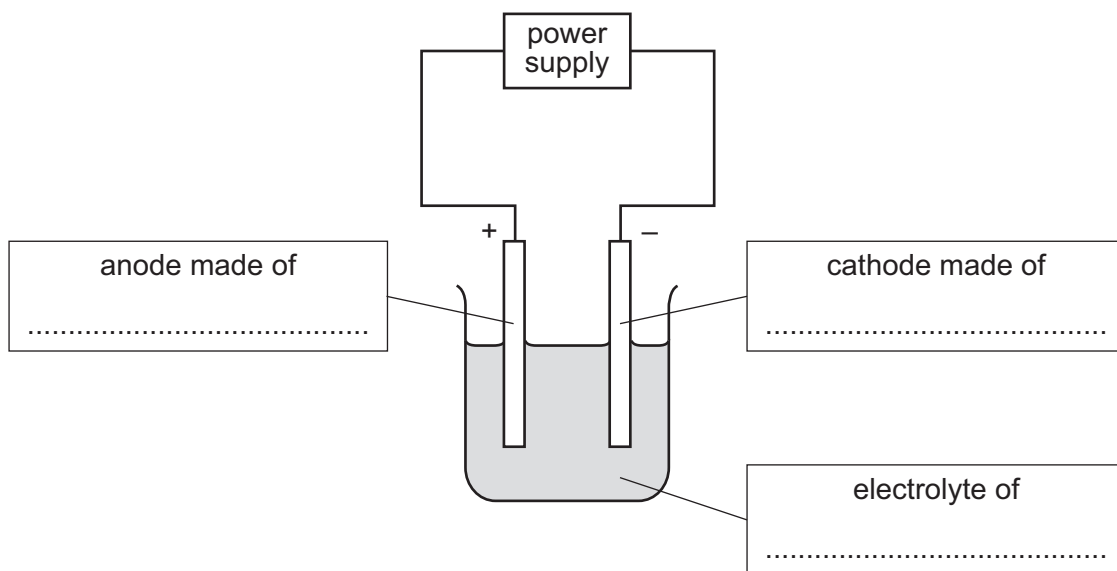
..... [2]

[Total: 8]

- 13 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]

- 14 This question is about chromium and chromium compounds.

- (a) Suggest why chromium is manufactured by electrolysis and **not** by the reduction of chromium(VI) oxide,  $\text{CrO}_3$ , with carbon.

..... [1]

- (b) Suggest the products of electrolysis of molten chromium(VI) oxide at:

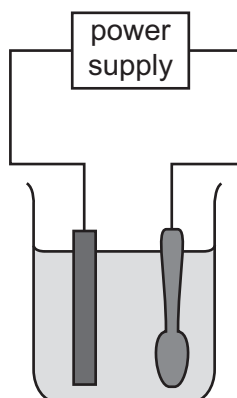
the positive electrode.....

the negative electrode. .... [2]

[Total: 3]

**15** Chromium is a silver-coloured metal.

The diagram shows how a copper spoon can be electroplated with chromium.



- (a) On the diagram, label:

- the cathode
- the electrolyte.

[2]

- (b) Give **one** observation that is made during the electroplating process.

..... [1]

- (c) Suggest **one** reason why metal objects are electroplated.

..... [1]

[Total: 4]

**16** 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]

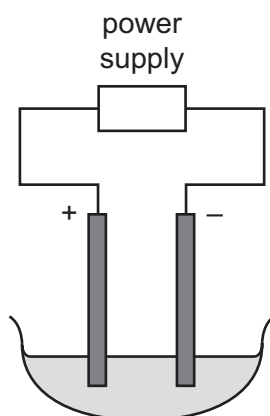
[Total: 2]

17 What is meant by the term *electrolysis*?

..... [2]

[Total: 2]

18 Molten potassium bromide can be electrolysed using the apparatus shown.



(a) On the diagram, label:

- the anode
- the electrolyte.

[2]

(b) Predict the products of this electrolysis at:

the positive electrode .....

the negative electrode..... [1]

(c) Give **one** observation that is made at the positive electrode.

..... [1]

(d) Suggest why the electrodes are made of graphite and **not** of magnesium.

..... [1]

[Total: 5]

- 19** Name the type of particle responsible for the conduction of electricity during electrolysis in:

the metal wires .....

the electrolyte..... [2]

[Total: 2]

- 20** Sodium hydroxide is manufactured by the electrolysis of sodium chloride.

After electrolysis,  $1000\text{ cm}^3$  of solution contains 750 g of sodium hydroxide.

What mass of sodium hydroxide is present in  $200\text{ cm}^3$  of this solution?

..... [1]

[Total: 1]

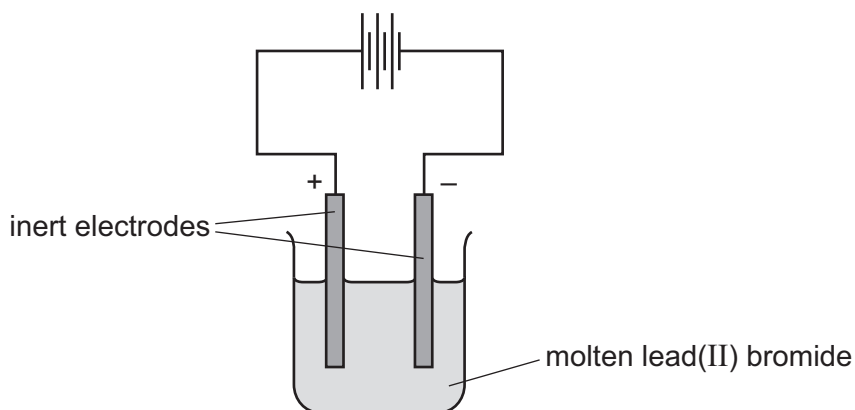
- 21** Predict the products of the electrolysis of molten zinc iodide at:

the negative electrode .....

the positive electrode ..... [2]

[Total: 2]

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



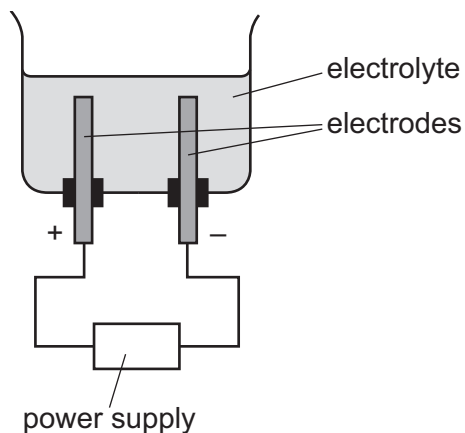
The negative electrode is called the cathode.

State the name of the positive electrode.

..... [1]

[Total: 1]

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



Give the name of a suitable element to use as the electrodes in this electrolysis.

..... [1]

[Total: 1]

- 24 Concentrated aqueous potassium bromide is an electrolyte.

What is meant by the term *electrolyte*?

.....  
..... [2]

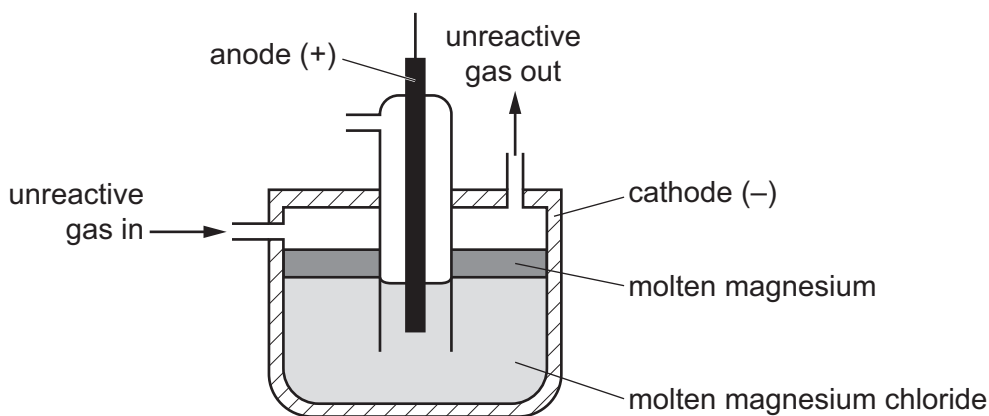
[Total: 2]

- 25 Give the name of the process that is used to produce lead from molten lead(II) bromide.

..... [1]

[Total: 1]

- 26 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]

**27** Molten calcium iodide can be electrolysed.

Predict the products of this electrolysis at:

the positive electrode (anode) .....

the negative electrode (cathode). ..... [2]

[Total: 2]

**28** 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]

