

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2003



**SCIENCE: DOUBLE AWARD (MODULAR)
CHEMISTRY (MODULAR)
Metals (Module 05)**

346005

Thursday 27 November 2003 Morning Session

In addition to this paper you will require:

- a black ball-point pen;
- an answer sheet.

You may use a calculator.

Time allowed: 30 minutes

Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title “Metals” printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only. Rough work may be done on the question paper.

Instructions for recording answers

- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about what metals are used for.

Match words from the list with the numbers **1 – 4** in the table.

aluminium

chromium

copper

iron

Metal	What the metal is used for
1	it is a structural metal made stronger by mixing with magnesium
2	it is a structural metal used to make bridges
3	it is mixed with iron to make the alloy, stainless steel
4	it is used to make electrical cables

QUESTION TWO

The drawing shows how aluminium is extracted from aluminium oxide.

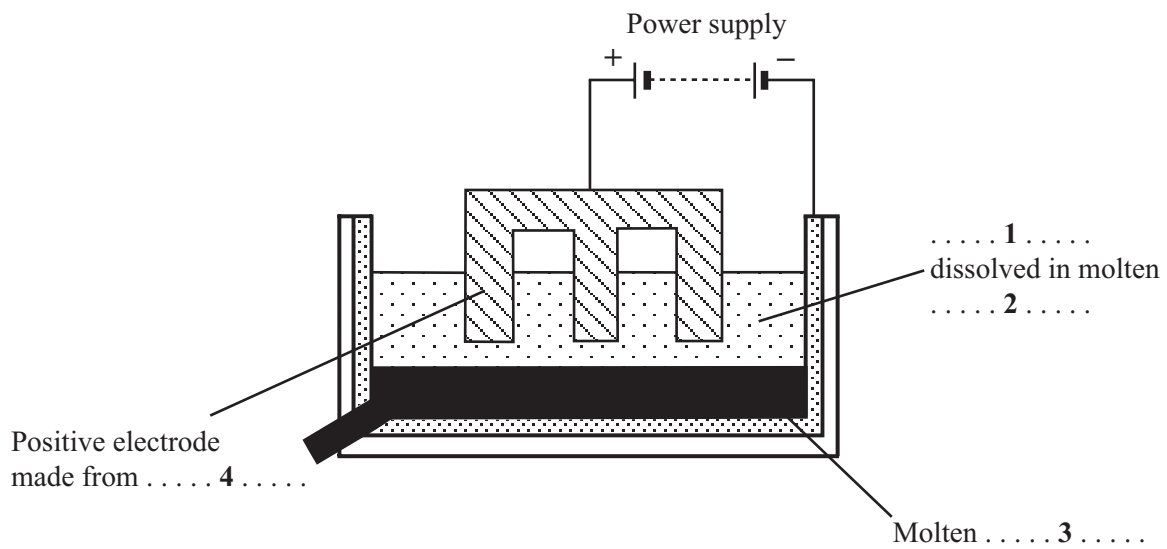
Match words from the list with the labels 1 – 4 on the diagram.

aluminium

aluminium oxide

carbon

cryolite



TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

These sentences are about elements and compounds.

Match words from the list with the spaces **1 – 4** in the sentences.

atoms

ions

metals

ores

The elements can be arranged in order of the relative mass of their **1** to produce a periodic table.

More than $\frac{3}{4}$ of the elements in the periodic table are **2**

Molten metal compounds conduct electricity because their **3** are free to move.

Rocks containing enough of a metal compound to be economic to mine are called **4**

QUESTION FOUR

The flow chart shows the stages in making a salt.

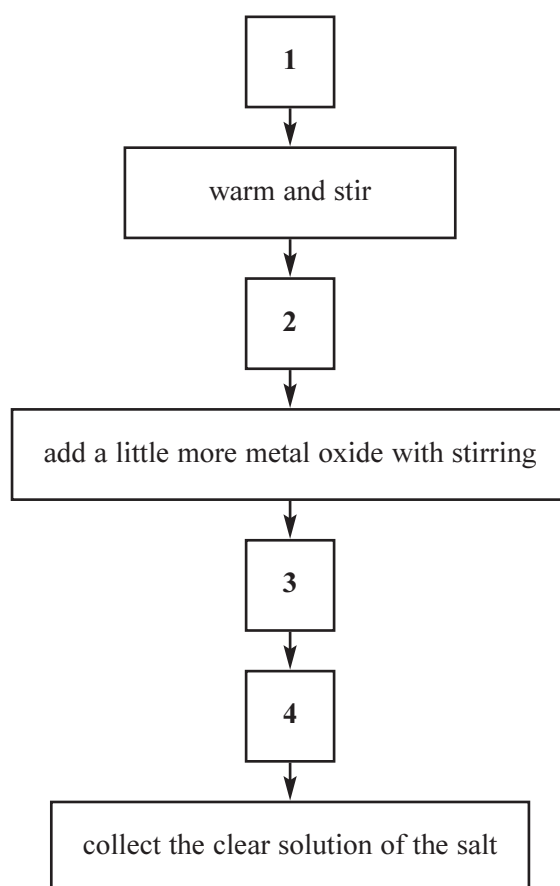
Match words from the list with the spaces **1 – 4** to explain how to make the salt.

add a little metal oxide to the acid

continue to add metal oxide until no more will react

filter to remove excess metal oxide

metal oxide begins to react with acid to produce a solution of the salt



Turn over ►

QUESTION FIVE

This question is about the positions of four metals, **W**, **X**, **Y** and **Z** in the reactivity series.

You can displace Metal **W** from its oxide by heating with hydrogen.

You can use Metal **W** to displace Metal **Z** from one of its compounds.

You can displace Metal **X** from its oxide by heating with carbon, but not by heating with hydrogen.

You cannot displace Metal **Y** from its oxide with carbon.

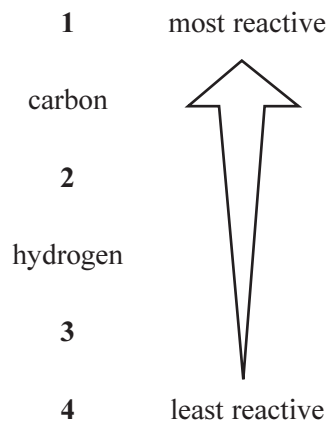
Match metals from the list with the numbers **1 – 4** in the reactivity series.

metal W

metal X

metal Y

metal Z



SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION SIX

This question is about metal ores and extraction.

Choose the **two** statements that are correct.**calcium is usually found in the Earth's crust as the metal itself****copper metal is extracted from cryolite by electrolysis****gold is usually found in the Earth's crust as the oxide****the main ore of aluminium is bauxite****the main ore of iron is haematite****QUESTION SEVEN**

This question is about hydrogen and oxygen gases.

Choose the **two** statements that are correct.**hydrogen forms positive ions****hydrogen is released when an acid reacts with an alkali****hydrogen is released when Group 1 metals react with water****oxygen does not react with aluminium****oxygen forms positive ions**

Turn over ►

SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

This question is about three metals.

They are all in the same Group in the periodic table.

lithium**sodium****potassium****8.1** Lithium, sodium and potassium are in**A** Group 0.**B** Group 1.**C** Group 2.**D** Group 3.**8.2** The metals in this Group are known as**A** acidic metals.**B** alkali metals.**C** noble metals.**D** transition metals.**8.3** Sodium will react with the non-metal, bromine, to produce the compound, sodium bromide.

Which two properties are correct for sodium bromide?

Colour **Solubility in water****A** blue insoluble**B** blue soluble**C** white insoluble**D** white soluble

- 8.4** Lithium will react with the non-metal, chlorine, to produce the compound, lithium chloride. Molten lithium chloride will conduct an electric current.

What happens as the current flows?

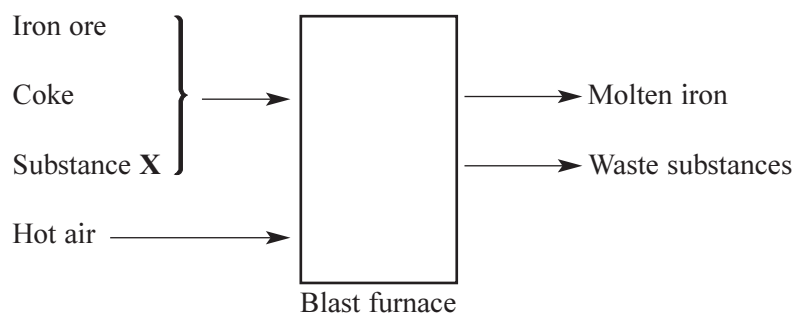
	In the molten lithium chloride	At the negative electrode
A	ions decompose	chlorine given off
B	ions decompose	lithium is deposited
C	ions move	chlorine given off
D	ions move	lithium is deposited

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The diagram shows most of the substances used in the blast furnace to produce iron.



9.1 The mixture containing iron ore and coke put into the blast furnace also contains Substance X.

What is Substance X?

- A Bauxite
- B Cryolite
- C Limestone
- D Sulphur

9.2 Which element does the coke provide for the reactions in the blast furnace?

- A Carbon
- B Iron
- C Oxygen
- D Sulphur

9.3 The hot air is blasted into the furnace

- A to circulate and thoroughly mix the iron ore and coke.
- B to react with coke and release energy.
- C to react with the iron ore.
- D to sweep out the waste gases.

9.4 Which two substances collect at the bottom of the furnace?

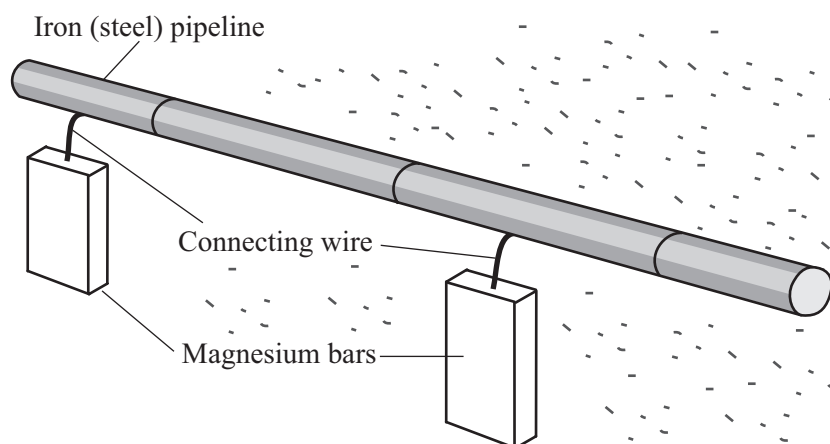
- A** Molten iron floating on molten slag
- B** Molten slag floating on molten iron
- C** Molten slag floating on solid iron
- D** Solid slag floating on molten iron

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

Iron, in the form of steel, is used to make underground pipelines to carry gas and oil.



magnesium	most reactive
aluminium	
carbon	
zinc	
iron	
tin	
lead	
copper	least reactive

10.1 Iron (steel) will corrode faster than most other transition metals because

- A it combines with carbon dioxide in the air.
- B it does not have a shiny surface.
- C it has only a thin oxide layer.
- D it reacts more quickly with oxygen and water.

- 10.2** The magnesium bars are attached to the iron
- A** to neutralise acid solutions in the soil.
 - B** to neutralise alkaline solutions in the soil.
 - C** to prevent the pipes sinking further into the ground.
 - D** to stop the iron (steel) corroding.
- 10.3** Why would you expect aluminium to corrode more quickly than iron?
- A** Aluminium is above iron in the reactivity series.
 - B** Aluminium is harder than iron.
 - C** Aluminium is more dense than iron.
 - D** Aluminium is not a transition metal.
- 10.4** Corrosion of aluminium is very slow because
- A** it does not react with oxygen or water.
 - B** it has a shiny surface.
 - C** it is a hard and tough metal.
 - D** it is protected by a thin oxide layer.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.

The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION A

Questions **ONE** and **TWO**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the positions of four metals, **W**, **X**, **Y** and **Z** in the reactivity series.

You can displace Metal **W** from its oxide by heating with hydrogen.

You can use Metal **W** to displace Metal **Z** from one of its compounds.

You can displace Metal **X** from its oxide by heating with carbon, but not by heating with hydrogen.

You cannot displace Metal **Y** from its oxide with carbon.

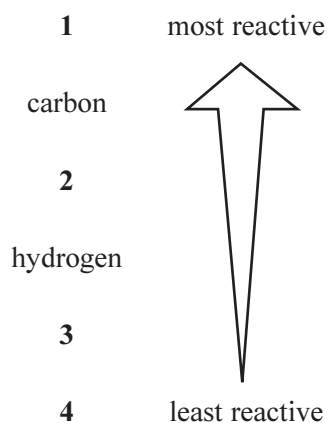
Match metals from the list with the numbers **1 – 4** in the reactivity series.

metal W

metal X

metal Y

metal Z



QUESTION TWO

Chemical reactions can be represented by word equations.

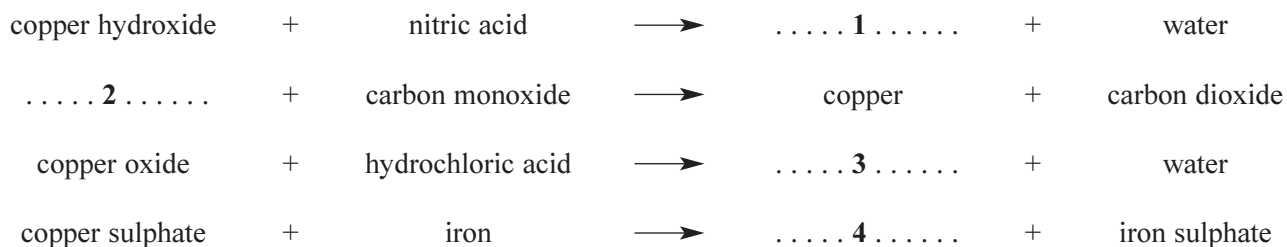
Match words from the list with the spaces **1 – 4** in the word equations.

copper

copper chloride

copper nitrate

copper oxide



TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION THREE

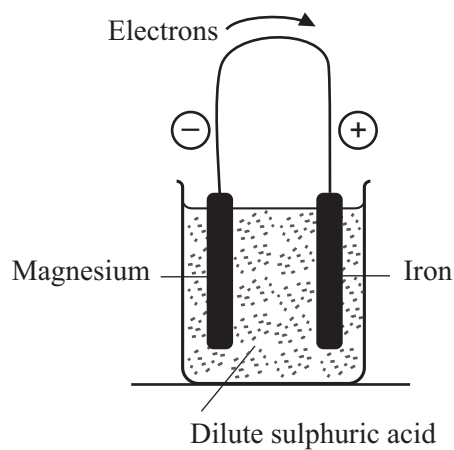
This question is about hydrogen and oxygen gases.

Choose the **two** statements that are correct.**hydrogen forms positive ions****hydrogen is released when an acid reacts with an alkali****hydrogen is released when Group 1 metals react with water****oxygen does not react with aluminium****oxygen forms positive ions**

QUESTION FOUR

When you put two different metals into dilute sulphuric acid, you form a simple cell.

A current will flow through a wire joining the two metals.



Which **two** statements correctly describe what is happening in the cell?

magnesium atoms become magnesium ions

magnesium atoms gain electrons and iron atoms lose electrons

the iron plate will be coated in magnesium

the magnesium plate will be coated in iron

the magnesium plate will gradually become thinner

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION CQuestions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION FIVE

This question is about three metals.

They are all in the same Group in the periodic table.

lithium**sodium****potassium****5.1** Lithium, sodium and potassium are in**A** Group 0.**B** Group 1.**C** Group 2.**D** Group 3.**5.2** The metals in this Group are known as**A** acidic metals.**B** alkali metals.**C** noble metals.**D** transition metals.**5.3** Sodium will react with the non-metal, bromine, to produce the compound, sodium bromide.

Which two properties are correct for sodium bromide?

Colour **Solubility in water****A** blue insoluble**B** blue soluble**C** white insoluble**D** white soluble

- 5.4** Lithium will react with the non-metal, chlorine, to produce the compound, lithium chloride. Molten lithium chloride will conduct an electric current.

What happens as the current flows?

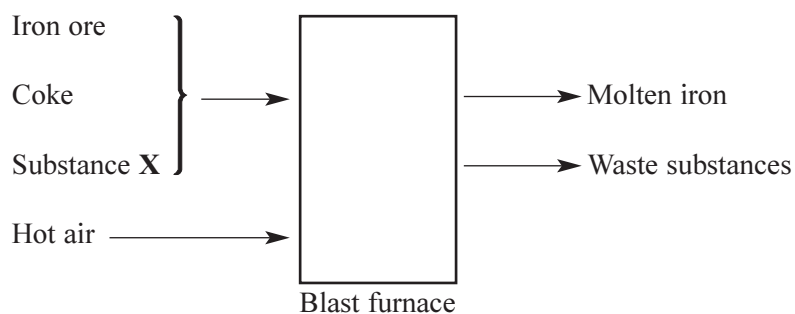
	In the molten lithium chloride	At the negative electrode
A	ions decompose	chlorine given off
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Turn over ►

QUESTION SIX

The diagram shows most of the substances used in the blast furnace to produce iron.



6.1 The mixture containing iron ore and coke put into the blast furnace also contains Substance X.

What is substance X?

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- B Cryolite
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6.2 Which element does the coke provide for the reactions in the blast furnace?

- A Carbon
- B Iron
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6.3 The hot air is blasted into the furnace

- A to circulate and thoroughly mix the iron ore and coke.
- B to react with coke and release energy.
- C to react with the iron ore.
- D to sweep out the waste gases.

6.4 Which two substances collect at the bottom of the furnace?

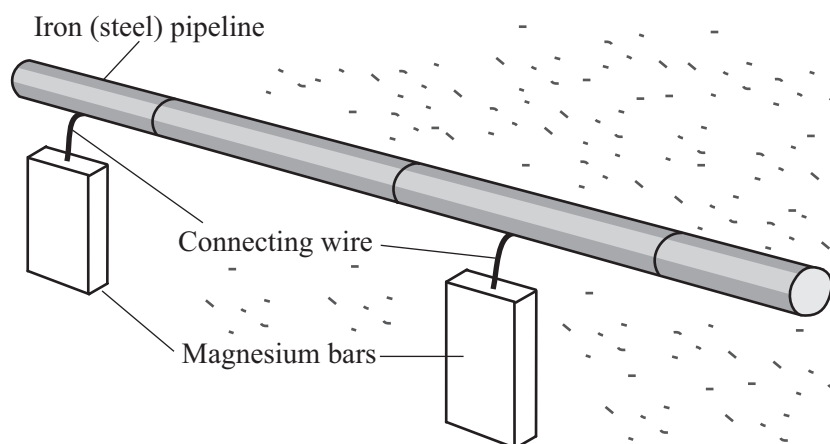
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Turn over ►

QUESTION SEVEN

Iron, in the form of steel, is used to make underground pipelines to carry gas and oil.



magnesium	most reactive
aluminium	
carbon	
zinc	
iron	
tin	
lead	
copper	least reactive

7.1 Iron (steel) will corrode faster than most other transition metals because

- A** it combines with carbon dioxide in the air.
- B** it does not have a shiny surface.
- C** it has only a thin oxide layer.
- D** it reacts more quickly with oxygen and water.

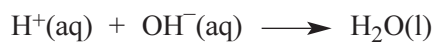
- 7.2 The magnesium bars are attached to the iron
- A to neutralise acid solutions in the soil.
 - B to neutralise alkaline solutions in the soil.
 - C to prevent the pipes sinking further into the ground.
 - D to stop the iron (steel) corroding.
- 7.3 Why would you expect aluminium to corrode more quickly than iron?
- A Aluminium is above iron in the reactivity series.
 - B Aluminium is harder than iron.
 - C Aluminium is more dense than iron.
 - D Aluminium is not a transition metal.
- 7.4 Corrosion of aluminium is very slow because
- A it does not react with oxygen or water.
 - B it has a shiny surface.
 - C it is a hard and tough metal.
 - D it is protected by a thin oxide layer.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The ionic equation shown can be used to represent a type of chemical reaction.



8.1 What type of reaction does this equation represent?

- A Electrolysis
- B Neutralisation
- C Oxidation
- D Reduction

8.2 Which of the following is correct for the two ions in the equation?

	H⁺(aq) ions make the solution	OH⁻(aq) ions make the solution
A	acidic	alkaline
B	alkaline	acidic
C	alkaline	basic
D	more concentrated	more dilute

8.3 Which of these reactions could be represented by the ionic equation $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow \text{H}_2\text{O}(\text{l})$?

- A copper oxide + sulphuric acid \longrightarrow copper sulphate + water
- B copper oxide + zinc \longrightarrow zinc oxide + copper
- C sodium hydroxide + hydrochloric acid \longrightarrow sodium chloride + water
- D sodium sulphate + lead chloride \longrightarrow sodium chloride + lead sulphate

8.4 Transition metal salts are not made by this type of reaction.

This is because

- A transition metal hydroxides are acidic.
- B transition metal hydroxides are coloured.
- C transition metal hydroxides are insoluble in water.
- D transition metal hydroxides are neutral.

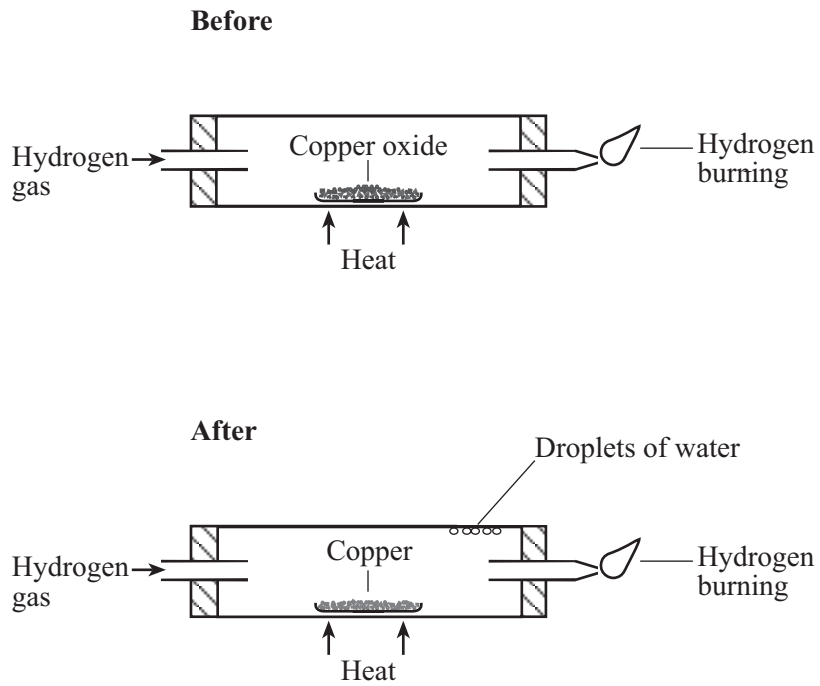
NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The drawings show how hydrogen can be used to displace a metal from one of its compounds.



sodium	most reactive
magnesium	
aluminium	
carbon	
zinc	
iron	
tin	
lead	
hydrogen	
copper	least reactive
silver	

9.1 In the reaction shown, the hydrogen is

- A dehydrated.
- B neutralised.
- C oxidised.
- D reduced.

9.2 The word equation for the reaction is

- A copper + hydrogen \longrightarrow copper oxide
- B copper + hydrogen \longrightarrow copper oxide + water
- C copper oxide + hydrogen \longrightarrow copper + water
- D copper oxide + water \longrightarrow copper + hydrogen

9.3 Which of these metal oxides could be reduced by carbon but not by hydrogen?

- A Aluminium oxide
- B Lead oxide
- C Magnesium oxide
- D Sodium oxide

9.4 Zinc will displace copper from copper oxide.



What happens to the copper ions in this reaction?

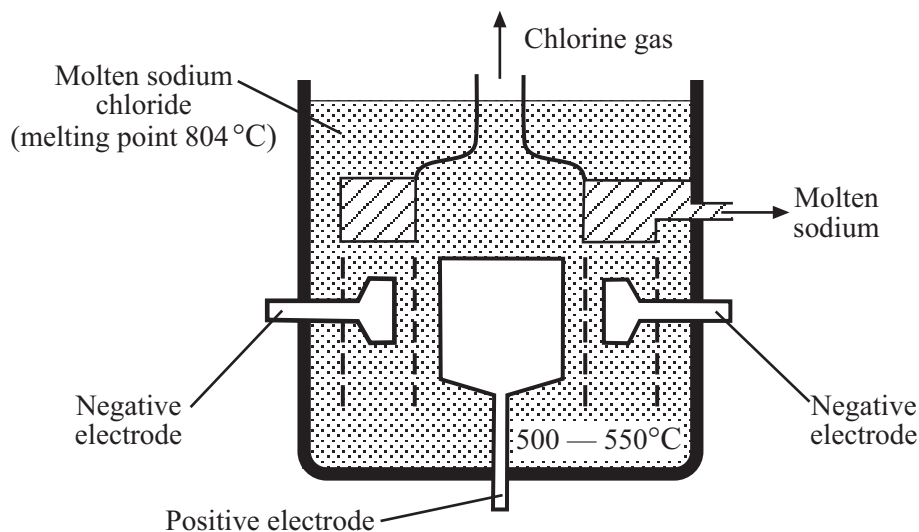
- A They gain electrons and are oxidised
- B They gain electrons and are reduced
- C They lose electrons and are oxidised
- D They lose electrons and are reduced

Turn over ►

QUESTION TEN

The diagram shows an electrolytic cell.

It is used to obtain sodium metal from sodium chloride. The process is similar to that used in the manufacture of aluminium.



10.1 Some calcium chloride is mixed with the molten sodium chloride.

This is necessary because

- A calcium chloride raises the melting point of the mixture.
- B sodium chloride alone reacts with the electrodes.
- C sodium chloride has a very high melting point.
- D the sodium metal produced is more pure.

10.2 Where in the cell is the sodium produced and why?

	Produced	Reason
A	at the negative electrode	the sodium ions have a negative charge
B	at the negative electrode	the sodium ions have a positive charge
C	at the positive electrode	the sodium ions have a negative charge
D	at the positive electrode	the sodium ions have a positive charge

10.3 At the positive electrode

- A chloride ions gain electrons to form chlorine atoms.
- B chloride ions lose electrons to form chlorine atoms.
- C chlorine atoms gain electrons to form chloride ions.
- D chlorine atoms lose electrons to form chloride ions.

10.4 The **overall** reaction in which sodium is produced from sodium chloride is

- A a displacement reaction.
- B a redox reaction.
- C a reduction reaction.
- D an oxidation reaction.

END OF TEST

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