Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
November 2006

SCIENCE: DOUBLE AWARD A (MODULAR) 346005
CHEMISTRY A (MODULAR)
Metals (Module 05)

Thursday 23 November 2006 Morning Session

For this paper you must have:
- a black ball-point pen
- an objective test answer sheet

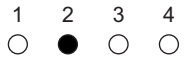
You may use a calculator.

Time allowed: 30 minutes

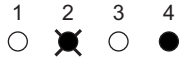
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Metals' printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** 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.
- Do all rough work in this book, **not** on your answer sheet.

Instructions for recording answers

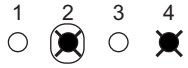
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown:



- 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:



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 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 uses of some elements.

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

carbon

copper

mercury

platinum

Element	How the element is used
1	a liquid metal used in thermometers
2	a metal used to make electricity cables
3	a non-metal used to make electrodes
4	a silver-coloured metal used as a catalyst

QUESTION TWO

This question is about the properties of some metals.

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

gold

iron

magnesium

potassium

Metal	What we can say about the metal
1	it has a low density and floats on water
2	it is a solid that reacts with non-metals to form coloured compounds
3	it is unreactive and is found uncombined in the Earth's crust
4	it mixes with aluminium to make a strong alloy

QUESTION THREE

This question is about elements and compounds.

Match words from the list with the numbers **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 worth mining are called . . . **4** . . . .

QUESTION FOUR

The flow chart shows the stages in making a salt.

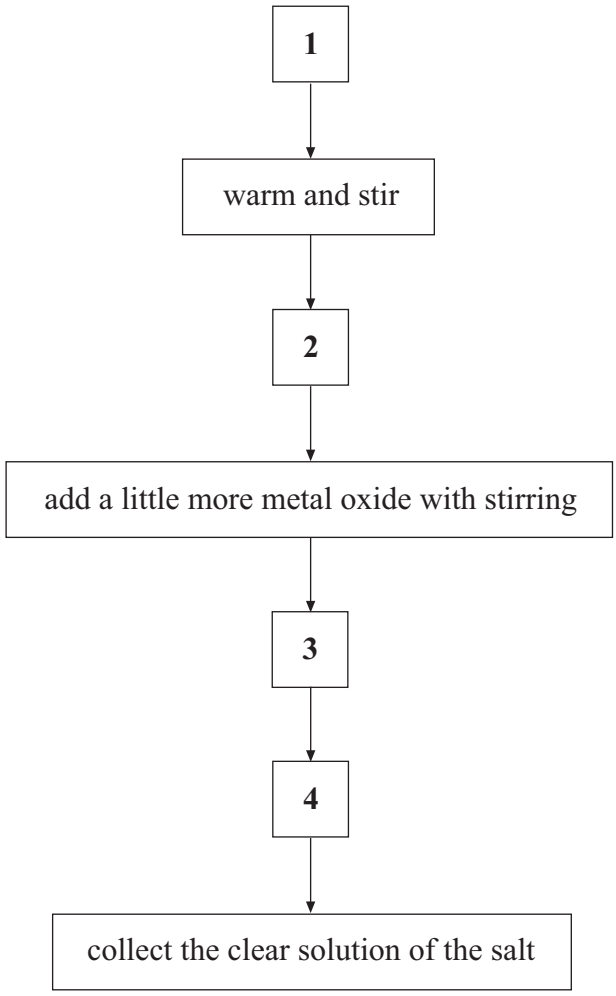
Match words, **E**, **F**, **G** and **H**, from the list with the boxes **1–4** in the flow chart, to explain how to make the salt.

E **add a small amount of metal oxide to the acid**

F **continue to add metal oxide until no more will react**

G **filter to remove excess metal oxide**

H **metal oxide begins to react with acid to make a solution of the salt**



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 reacting the hot oxide 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 reacting the hot oxide with carbon.

You **cannot** displace metal **X** from its oxide by reacting the hot oxide with hydrogen.
You **cannot** displace metal **Y** from its oxide by reacting the hot oxide with carbon.

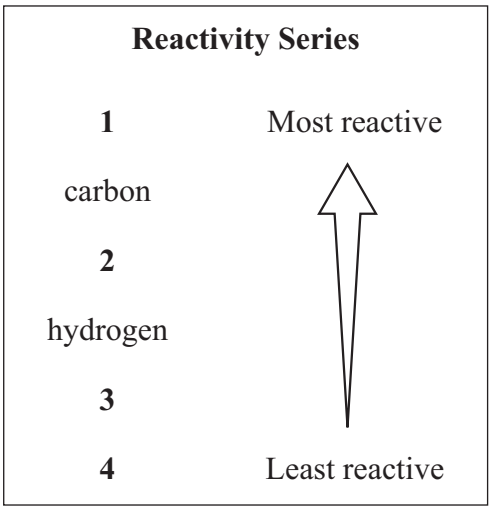
Match metals from the list with the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



Turn over for the next question

SECTION B

Questions **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 gases.

Which **two** statements are correct?

ammonia dissolves in water to make an alkaline solution

argon is in Group 1 of the periodic table

hydrogen is released when an acid reacts with an alkali

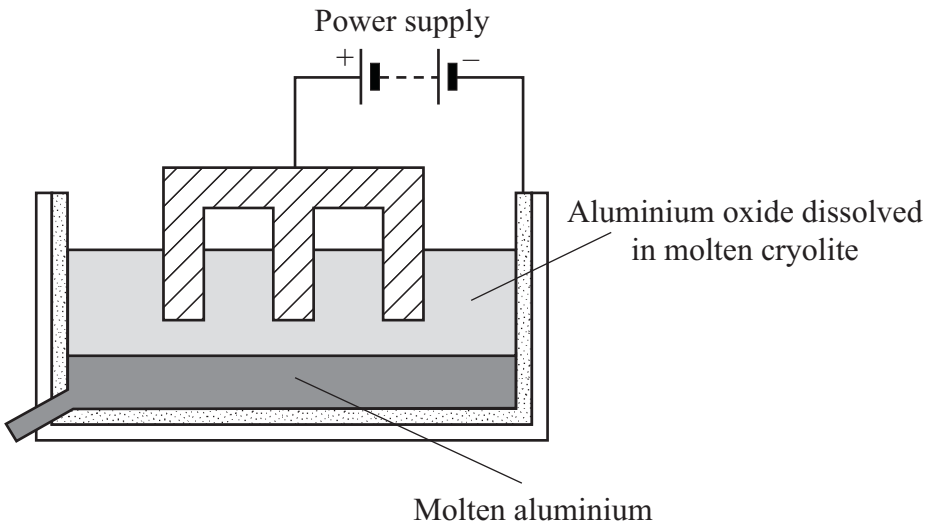
oxidation of carbon monoxide produces carbon dioxide

oxygen is released when an acid reacts with an alkali

QUESTION SEVEN

This question is about the extraction of aluminium from aluminium oxide.

The diagram shows the process.



Which **two** statements are correct?

aluminium ions are negatively charged

aluminium is formed at the positive electrode

aluminium oxide is obtained from bauxite

oxide ions move to the negative electrode

the positive electrode is frequently replaced

Turn over for the next question

SECTION C

Questions **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 the elements in Group 1 of the periodic table.

8.1 All the elements in Group 1 of the periodic table are . . .

A gases.

B liquids.

C metals.

D non-metals.

8.2 Which of these elements is a Group 1 element?

A Argon

B Iron

C Oxygen

D Potassium

8.3 Group 1 elements react with water.

Group 1 element + water → Group 1 hydroxide + substance **G**

What is substance **G**?

A Carbon dioxide

B Carbon monoxide

C Hydrogen

D Oxygen

8.4 Group 1 elements are extracted from their compounds by . . .

A electrolysis.

B oxidation.

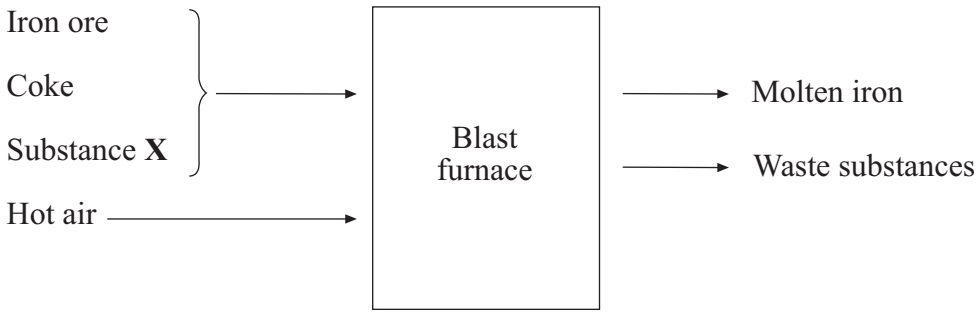
C reduction using carbon.

D reduction using hydrogen.

Turn over for the next question

QUESTION NINE

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



9.1 What is substance **X**?

A Bauxite

B Cryolite

C Limestone

D Sulphur

9.2 Which is the main element in coke?

A Carbon

B Iron

C Oxygen

D Sulphur

9.3 The hot air is blasted into the furnace . . .

A to mix the iron ore and coke.

B to react with the coke and release energy.

C to react with the iron ore.

D to sweep out the waste gases.

9.4 What collects at the bottom of the blast 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

QUESTION TEN

This question is about the corrosion of metals.

10.1 Iron (steel) is used as a structural material for bridges. Corrosion will weaken the iron.

Bridges made of iron are painted frequently.

This reduces corrosion because . . .

A oxygen and water cannot react with the iron.

B paint forms an oxide layer on the surface of the iron.

C paint makes the iron much harder.

D paint reflects the light.

10.2 Car exhaust pipes can corrode quickly. Corrosion can be prevented by making the exhaust pipes from stainless steel.

Stainless steel is an alloy made mainly of . . .

A aluminium and magnesium.

B iron and carbon.

C iron and magnesium.

D iron, chromium and nickel.

10.3 Iron in sea water rusts very quickly. The iron hull of a ship rusts more slowly if blocks of zinc are attached to it.

Why does iron react more slowly if zinc is attached to it?

A Iron is a harder metal than zinc.

B Zinc does not react with oxygen and water.

C Zinc is a transition metal.

D Zinc is more reactive than iron.

10.4 The roofs of some buildings weather to a green colour.

This is because they are made from . . .

A aluminium.

B copper.

C iron.

D platinum.

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 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 reacting the hot oxide 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 reacting the hot oxide with carbon.

You **cannot** displace metal **X** from its oxide by reacting the hot oxide with hydrogen.
You **cannot** displace metal **Y** from its oxide by reacting the hot oxide with carbon.

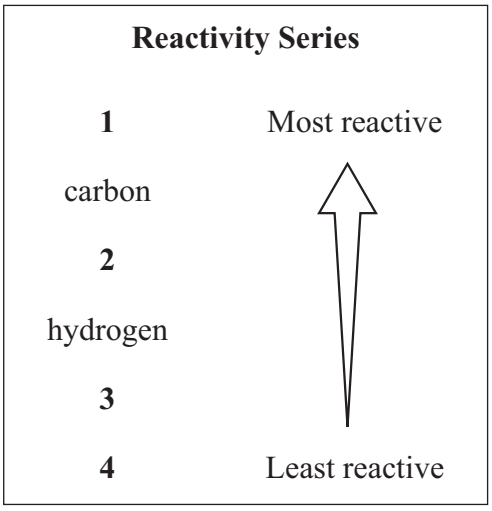
Match metals from the list with the numbers **1–4** in the reactivity series.

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 numbers **1–4** in the word equations.

copper

copper chloride

copper nitrate

copper oxide

copper hydroxide	+	nitric acid	→	. . . **1** . . .	+	water
. . . **2** . . .	+	carbon monoxide	→	copper	+	carbon dioxide
copper oxide	+	hydrochloric acid	→	. . . **3** . . .	+	water
copper sulphate	+	iron	→	. . . **4** . . .	+	iron sulphate

Turn over for the next question

SECTION B

Questions **THREE** and **FOUR**.

In these questions choose the best **two** answers.

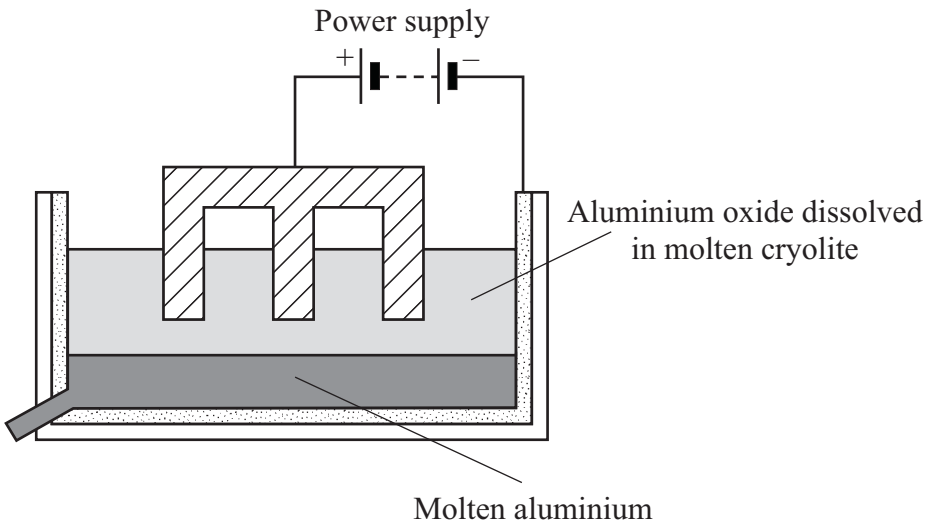
Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

This question is about the extraction of aluminium from aluminium oxide.

The diagram shows the process.



Which **two** statements are correct?

aluminium ions are negatively charged

aluminium is formed at the positive electrode

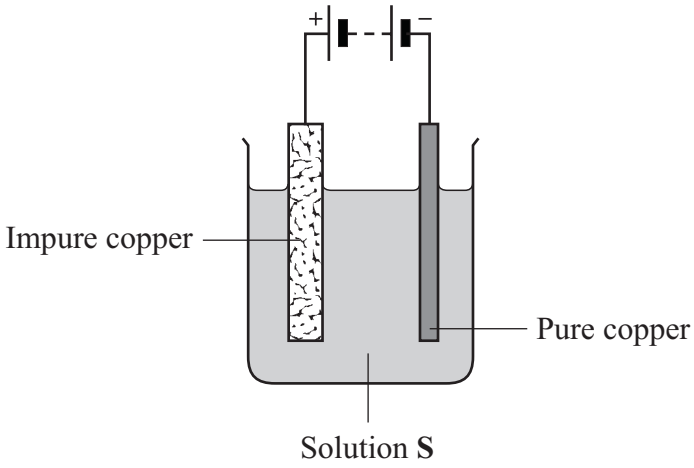
aluminium oxide is obtained from bauxite

oxide ions move to the negative electrode

the positive electrode is frequently replaced

QUESTION FOUR

The diagram shows how pure copper can be obtained from impure copper.



Which **two** statements are correct?

at the negative electrode, copper ions lose electrons and form copper atoms

at the positive electrode, copper atoms lose electrons and form copper ions

the reaction at the negative electrode is oxidation

the reaction at the positive electrode is reduction

the solution S contains copper ions

Turn over for the next question

SECTION C

Questions **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 the elements in Group 1 of the periodic table.

5.1 All the elements in Group 1 of the periodic table are . . .

A gases.

B liquids.

C metals.

D non-metals.

5.2 Which of these elements is a Group 1 element?

A Argon

B Iron

C Oxygen

D Potassium

5.3 Group 1 elements react with water.

Group 1 element + water → Group 1 hydroxide + substance **G**

What is substance **G**?

A Carbon dioxide

B Carbon monoxide

C Hydrogen

D Oxygen

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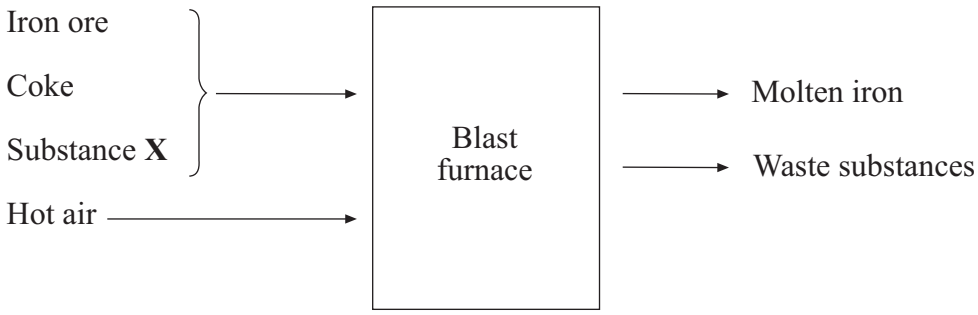
QUESTION SIX

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



6.1 What is substance **X**?

A Bauxite

B Cryolite

C Limestone

D Sulphur

6.2 Which is the main element in coke?

A Carbon

B Iron

C Oxygen

D Sulphur

6.3 The hot air is blasted into the furnace . . .

A to mix the iron ore and coke.

B to react with the coke and release energy.

C to react with the iron ore.

D to sweep out the waste gases.

6.4 What collects at the bottom of the blast 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

QUESTION SEVEN

This question is about the corrosion of metals.

7.1 Iron (steel) is used as a structural material for bridges. Corrosion will weaken the iron.

Bridges made of iron are painted frequently.

This reduces corrosion because . . .

A oxygen and water cannot react with the iron.

B paint forms an oxide layer on the surface of the iron.

C paint makes the iron much harder.

D paint reflects the light.

7.2 Car exhaust pipes can corrode quickly. Corrosion can be prevented by making the exhaust pipes from stainless steel.

Stainless steel is an alloy made mainly of . . .

A aluminium and magnesium.

B iron and carbon.

C iron and magnesium.

D iron, chromium and nickel.

7.3 Iron in sea water rusts very quickly. The iron hull of a ship rusts more slowly if blocks of zinc are attached to it.

Why does iron react more slowly if zinc is attached to it?

A Iron is a harder metal than zinc.

B Zinc does not react with oxygen and water.

C Zinc is a transition metal.

D Zinc is more reactive than iron.

7.4 The roofs of some buildings weather to a green colour.

This is because they are made from . . .

A aluminium.

B copper.

C iron.

D platinum.

Turn over for the next question

QUESTION EIGHT

Ammonium chloride is a salt.

Ammonium chloride can be made by the reaction of an acid with an alkali:

$$\text{acid} + \text{alkali} \rightarrow \text{ammonium chloride} + \text{water}$$

8.1 Which acid and alkali would you use to make ammonium chloride?

	Acid	**Alkali**
A	ethanoic acid	ammonia solution
B	ethanoic acid	sodium hydroxide
C	hydrochloric acid	ammonia solution
D	hydrochloric acid	sodium hydroxide

8.2 When the acid is neutralised by the alkali, the reaction can be written . . .

A $H^+(aq) + OH^+(aq) \rightarrow H_2O(l)$

B $H^-(aq) + OH^-(aq) \rightarrow H_2O(l)$

C $H^+(l) + OH^-(l) \rightarrow H_2O(aq)$

D $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

8.3 The salt, copper sulphate, **cannot** be made by the reaction of an acid with an alkali because . . .

A copper hydroxide does not react with sulphuric acid.

B copper hydroxide forms a neutral solution.

C copper hydroxide is a coloured compound.

D copper hydroxide is insoluble in water.

8.4 Which of these salts **cannot** be made by the reaction of an acid with an alkali?

A Ammonium sulphate

B Potassium chloride

C Sodium nitrate

D Zinc sulphate

Turn over for the next question

QUESTION NINE

This question is about the compound copper oxide.

9.1 Copper metal can be obtained from copper oxide.
One way in which this is done is to heat strongly a mixture of copper oxide and carbon.

Which is the word equation for this reaction?

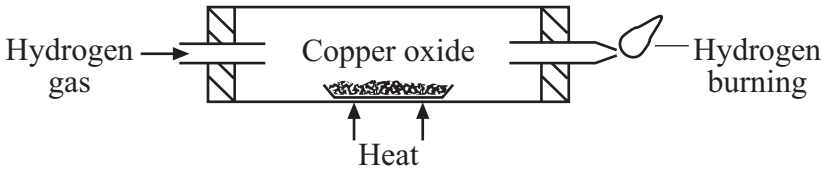
A copper oxide + carbon → copper + carbon dioxide

B copper oxide + carbon → copper + copper carbonate

C copper oxide + carbon → copper + hydrogen

D copper oxide + carbon → copper + water

9.2 Copper can also be obtained by heating copper oxide in a stream of hydrogen gas.



The products of the reaction are . . .

A copper and carbon dioxide.

B copper and hydrogen.

C copper and water.

D copper, hydrogen and water.

9.3 The **overall** reactions in both **9.1** and **9.2** are . . .

A neutralisation reactions.

B oxidation reactions.

C redox reactions.

D reduction reactions.

9.4 Magnesium will displace copper from copper oxide.

copper oxide	+	magnesium	→	copper	+	magnesium oxide
CuO	+	Mg	→	Cu	+	MgO

Copper oxide contains copper ions, Cu^{2+}

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 for the next question

QUESTION TEN

Electrolysis is used to extract aluminium from aluminium oxide.

A similar process is used to extract sodium from sodium chloride.

10.1 The sodium chloride is mixed with calcium chloride.

A mixture is used 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 chlorine atoms gain electrons to form chloride ions.

B chlorine atoms lose electrons to form chloride ions.

C chloride ions gain electrons to form chlorine atoms.

D chloride ions lose electrons to form chlorine atoms.

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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