Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
March 2007

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

ASSESSMENT and QUALIFICATIONS ALLIANCE

Wednesday 7 March 2007 Morning Session

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

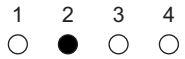
You may use a calculator.

Time allowed: 30 minutes

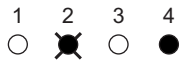
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Metals' printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** 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

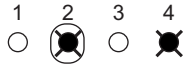
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 16 of this booklet.

FOUNDATION TIER

SECTION A

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

In these questions, match words from the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the properties of metals.

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

bendable

good conductor

high melting point

strong

Property	A use that takes advantage of this property of a metal
1	for making car body panels which are shaped
2	for making electrical cables
3	for making steel girders
4	for making the filaments of electric light bulbs which reach a temperature of 2000 °C

QUESTION TWO

This question is about iron and substances which contain iron.

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

haematite

iron

iron oxide

stainless steel

Substance	Type of substance
1	it is a compound
2	it is an alloy
3	it is an element
4	it is an iron ore

Turn over for the next question

QUESTION THREE

This question is about reactions used to make salts.

When acids react with alkalis, salts are formed.

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

ammonia solution

hydrochloric acid

potassium nitrate

sulphuric acid

Acid	Alkali	Salt formed
nitric acid	**1**	ammonium nitrate
nitric acid	potassium hydroxide	**2**
3	potassium hydroxide	potassium sulphate
4	potassium hydroxide	potassium chloride

QUESTION FOUR

The flow chart shows stages in the manufacture of iron in a blast furnace.

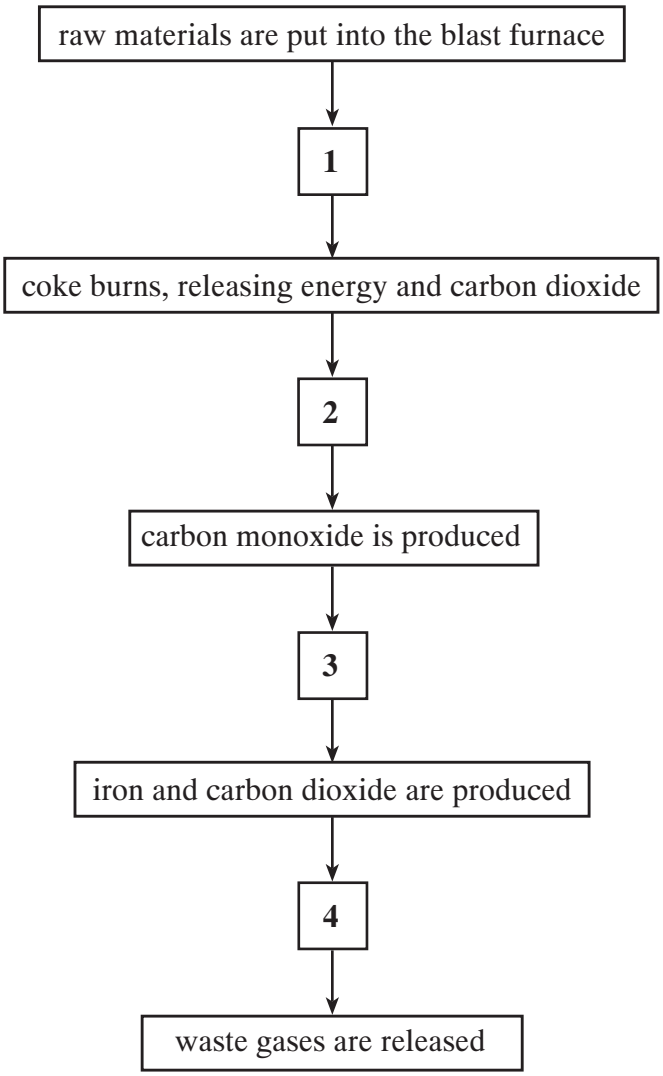
Match statements, **J**, **K**, **L** and **M**, from the list with the numbers **1 – 4** in the flow chart, to explain what happens in this process.

J **carbon dioxide reacts with coke**

K **carbon monoxide reacts with iron oxide**

L **hot air is blown into the furnace**

M **molten iron flows to the bottom of the furnace**



QUESTION FIVE

This question is about the reactivity series.

Metal **K** can be extracted from its oxide by reacting the hot oxide with hydrogen.

Metal **J** will displace metal **K** from a solution of its nitrate but will not displace aluminium from a solution of aluminium nitrate.

Metal **G** can only be extracted from its compounds by electrolysis.

When put into water, metal **G** reacts more quickly than metal **H**.

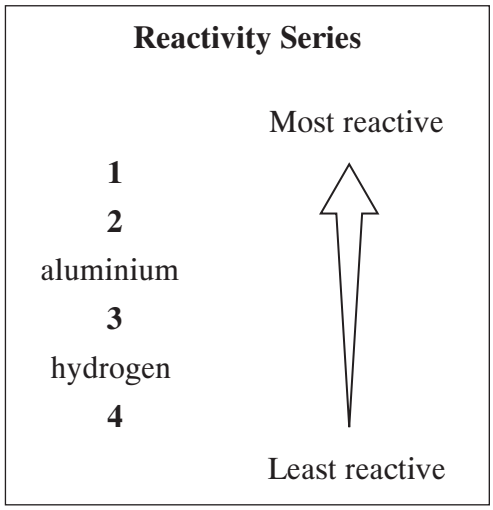
Match metals from the list with the numbers **1–4** in the reactivity series.

metal G

metal H

metal J

metal K



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 the metal potassium.

Which **two** of the statements, **H**, **J**, **K**, **L** and **M**, are correct?

H **potassium hydroxide is insoluble in water**

J **potassium is the only Group 1 metal that does not float on water**

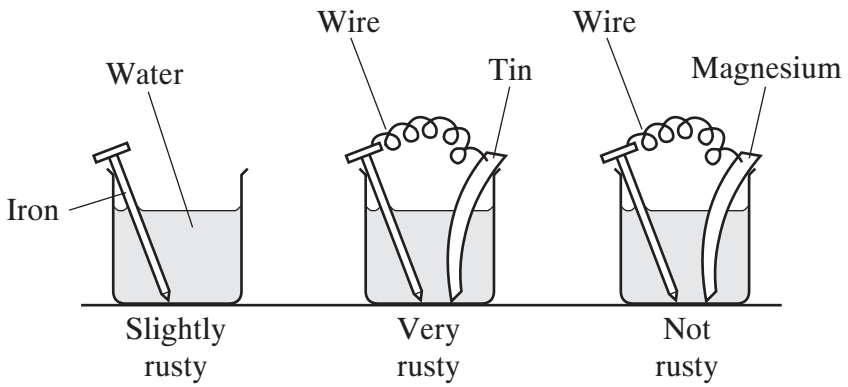
K **potassium reacts with the non-metal element bromine to form an ionic compound**

L **potassium reacts with the non-metal element chlorine to form a green compound**

M **potassium reacts with water to produce hydrogen**

QUESTION SEVEN

Iron reacts with oxygen from the air to form rust. This reaction happens only if water is also present. The diagrams show the amount of rusting after 24 hours if the iron is connected to other metals.



Reactivity Series

Most reactive

Magnesium
Zinc
Iron
Tin
Copper

Least reactive

Which **two** of the statements, **N**, **P**, **Q**, **R** and **S**, are correct?

N **magnesium connected to iron protects the iron from corrosion**

P **the experiment suggests that a less reactive metal can protect iron from corrosion**

Q **the experiment suggests that a more reactive metal can protect iron from corrosion**

R **tin connected to iron protects the iron from corrosion**

S **tin corrodes more quickly than magnesium**

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 periodic table. The diagram shows the symbols for some of the elements in part of the table.

The Group number is shown at the top of each column.

1	2										3	4	5	6	7	0
	Be															
Na	Mg										Al					Ar
	Ca				Cr		Fe				Zn					

8.1 Which of the following elements has the highest relative atomic mass?

A Na (sodium)

B Mg (magnesium)

C Al (aluminium)

D Ar (argon)

8.2 Which of the following is a transition element?

A Na (sodium)

B Ca (calcium)

C Fe (iron)

D Ar (argon)

8.3 Which two elements are most similar in their chemical properties?

A Na (sodium) and Mg (magnesium)

B Mg (magnesium) and Ca (calcium)

C Mg (magnesium) and Al (aluminium)

D Ca (calcium) and Cr (chromium)

8.4 Haematite is not found in the periodic table because . . .

A it has properties different from the metals in any other group.

B it is not an element.

C it is only a recent discovery.

D its relative atomic mass is too great.

Turn over for the next question

QUESTION NINE

Aluminium oxide is electrolysed to produce aluminium metal.

9.1 Aluminium oxide is obtained from the main ore of aluminium which is . . .

A bauxite.

B cryolite.

C galena.

D magnetite.

9.2 The aluminium oxide is mixed with cryolite . . .

A because cryolite acts as a catalyst.

B so that electrolysis can take place at a lower temperature.

C to provide a high yield of aluminium.

D to raise the temperature in the cell.

9.3 This reaction takes place during the manufacture of aluminium.

carbon + oxygen → carbon dioxide

Where does this reaction take place?

A At the carbon cell lining that acts as the negative electrode

B At the carbon rods that act as positive electrodes

C In the molten electrolyte far from either negative or positive electrodes

D Where the molten aluminium leaves the electrolytic cell

9.4 Aluminium does not corrode easily even though it is a reactive metal because . . .

A it has a high melting point.

B it is a transition metal.

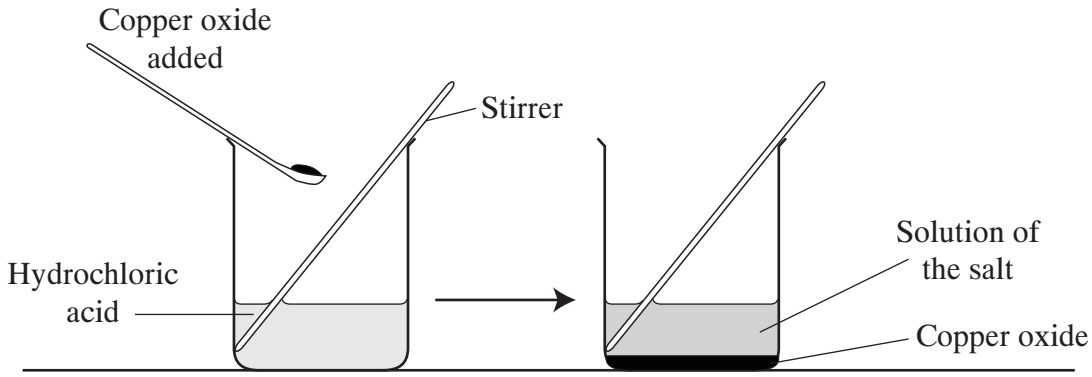
C it is hard, tough and strong.

D it is protected by a layer of aluminium oxide.

Turn over for the next question

QUESTION TEN

The diagram shows how a student makes a solution of a salt.



10.1 The student knows when all the acid is used up because . . .

A no more bubbles of carbon dioxide will be produced.

B no more bubbles of hydrogen will be produced.

C no more copper oxide will react.

D the solution will begin to turn blue.

10.2 Any solid copper oxide can be removed from the solution of the salt by . . .

A crystallisation.

B distillation.

C evaporation.

D filtration.

10.3 The products of the reaction between copper oxide and hydrochloric acid are . . .

A copper chloride and carbon dioxide.

B copper chloride and hydrogen.

C copper chloride and water.

D copper chloride only.

10.4 Copper oxide is a base that will **not** dissolve in water.

What name do we give to a soluble base?

A A hydroxide

B A nitrate

C An acid

D An alkali

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 from the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the reactivity series.

Metal **K** can be extracted from its oxide by reacting the hot oxide with hydrogen.

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When put into water, metal **G** reacts more quickly than metal **H**.

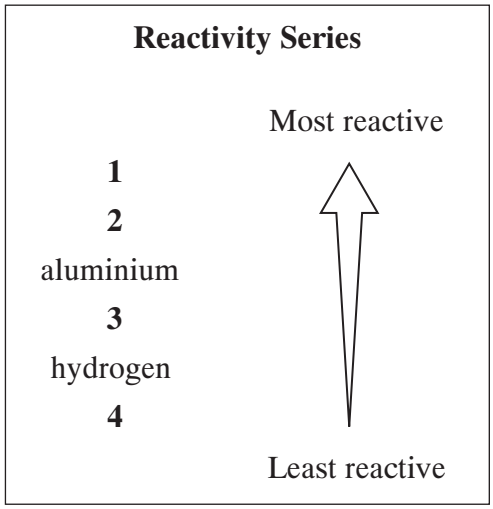
Match metals from the list with the numbers **1–4** in the reactivity series.

metal G

metal H

metal J

metal K



QUESTION TWO

The word equations show what happens when some substances are heated together.

zinc oxide + hydrogen → no reaction

copper oxide + hydrogen → copper + water

zinc oxide + carbon → zinc + carbon dioxide

carbon dioxide + carbon → carbon monoxide

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

carbon dioxide

copper

hydrogen

zinc

Substance	What we can say about the substance
1	it is above hydrogen but below carbon in the reactivity series
2	it is below hydrogen in the reactivity series
3	it is oxidised to water
4	it is reduced to carbon monoxide

Turn over for the next question

SECTION B

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

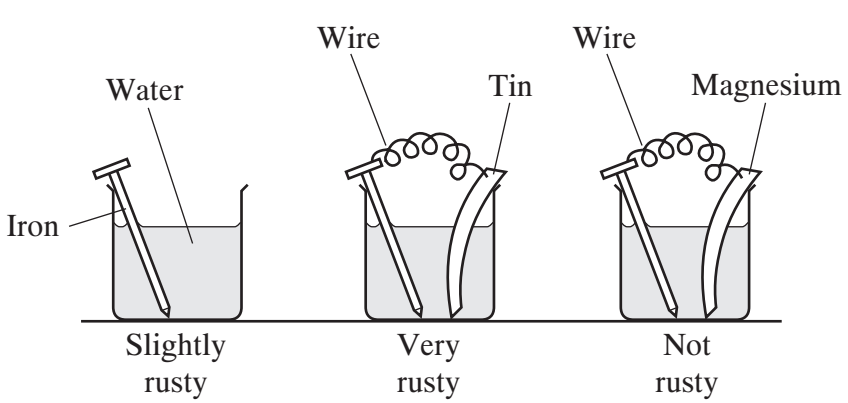
In these questions choose the best **two** answers.

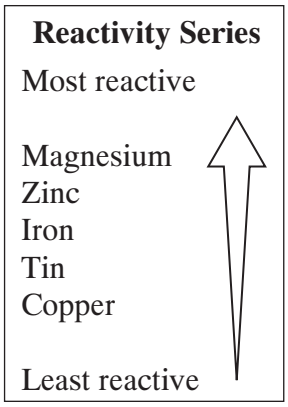
Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

Iron reacts with oxygen from the air to form rust. This reaction happens only if water is also present. The diagrams show the amount of rusting after 24 hours if the iron is connected to other metals.





Which **two** of the statements, **N**, **P**, **Q**, **R** and **S**, are correct?

N **magnesium connected to iron protects the iron from corrosion**

P **the experiment suggests that a less reactive metal can protect iron from corrosion**

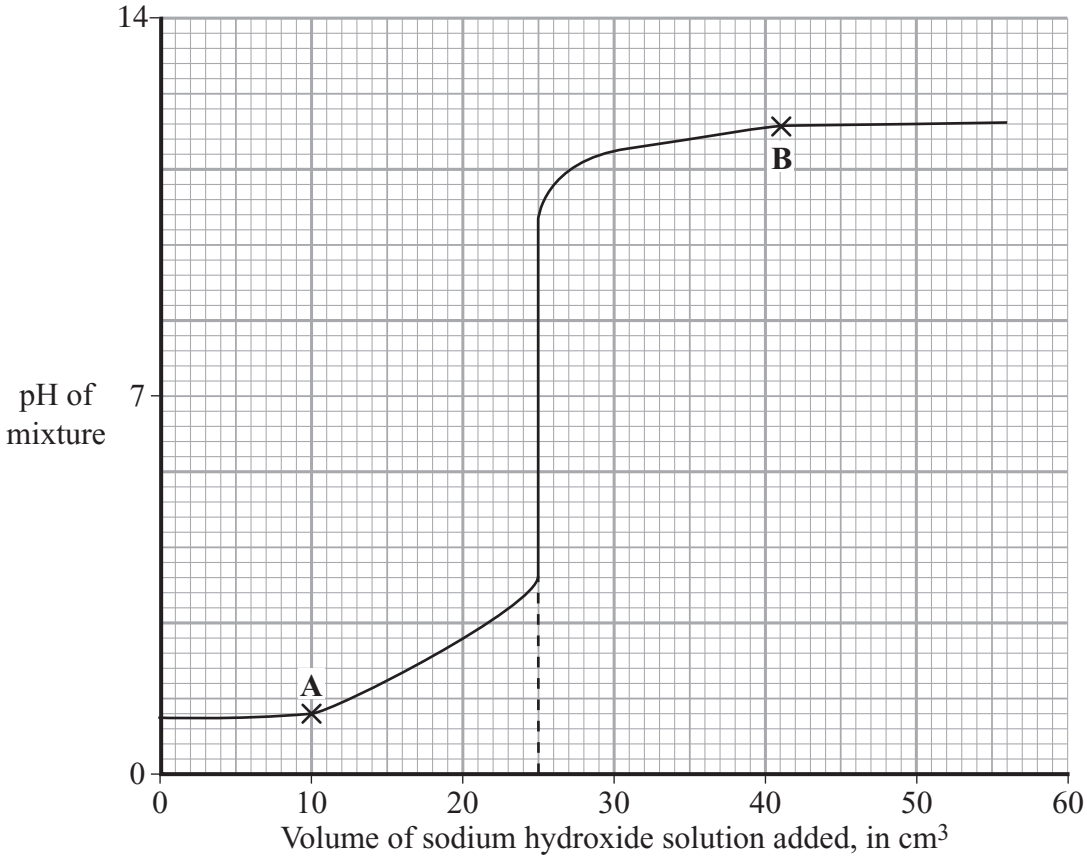
Q **the experiment suggests that a more reactive metal can protect iron from corrosion**

R **tin connected to iron protects the iron from corrosion**

S **tin corrodes more quickly than magnesium**

QUESTION FOUR

Sodium hydroxide solution was slowly added to 25 cm^3 dilute hydrochloric acid.
The mixture was stirred and its pH was measured.
The graph shows how the pH changed as the sodium hydroxide solution was added.



Which **two** of the statements, **D**, **E**, **F**, **G** and **H**, are correct?

D **25 cm^3 of hydrochloric acid are exactly neutralised by 20 cm^3 of sodium hydroxide**

E **25 cm^3 of hydrochloric acid are exactly neutralised by 25 cm^3 of sodium hydroxide**

F **at pH7, the mixture contains water and sodium chloride only**

G **at pH7, the mixture contains water, sodium chloride and hydrochloric acid**

H **the concentration of H^+ ions is the same at points A and B on the graph**

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 periodic table. The diagram shows the symbols for some of the elements in part of the table.

The Group number is shown at the top of each column.

1	2										3	4	5	6	7	0
	Be															
Na	Mg										Al					Ar
	Ca				Cr		Fe				Zn					

5.1 Which of the following elements has the highest relative atomic mass?

A Na (sodium)

B Mg (magnesium)

C Al (aluminium)

D Ar (argon)

5.2 Which of the following is a transition element?

A Na (sodium)

B Ca (calcium)

C Fe (iron)

D Ar (argon)

5.3 Which two elements are most similar in their chemical properties?

A Na (sodium) and Mg (magnesium)

B Mg (magnesium) and Ca (calcium)

C Mg (magnesium) and Al (aluminium)

D Ca (calcium) and Cr (chromium)

5.4 Haematite is not found in the periodic table because . . .

A it has properties different from the metals in any other group.

B it is not an element.

C it is only a recent discovery.

D its relative atomic mass is too great.

Turn over for the next question

QUESTION SIX

Aluminium oxide is electrolysed to produce aluminium metal.

6.1 Aluminium oxide is obtained from the main ore of aluminium which is . . .

A bauxite.

B cryolite.

C galena.

D magnetite.

6.2 The aluminium oxide is mixed with cryolite . . .

A because cryolite acts as a catalyst.

B so that electrolysis can take place at a lower temperature.

C to provide a high yield of aluminium.

D to raise the temperature in the cell.

6.3 This reaction takes place during the manufacture of aluminium.

carbon + oxygen → carbon dioxide

Where does this reaction take place?

A At the carbon cell lining that acts as the negative electrode

B At the carbon rods that act as positive electrodes

C In the molten electrolyte far from either negative or positive electrodes

D Where the molten aluminium leaves the electrolytic cell

6.4 Aluminium does not corrode easily even though it is a reactive metal because . . .

A it has a high melting point.

B it is a transition metal.

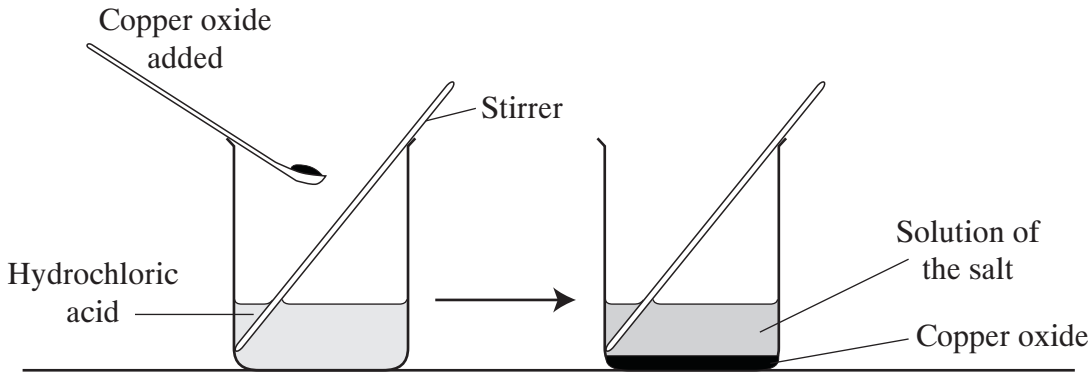
C it is hard, tough and strong.

D it is protected by a layer of aluminium oxide.

Turn over for the next question

QUESTION SEVEN

The diagram shows how a student makes a solution of a salt.



7.1 The student knows when all the acid is used up because . . .

A no more bubbles of carbon dioxide will be produced.

B no more bubbles of hydrogen will be produced.

C no more copper oxide will react.

D the solution will begin to turn blue.

7.2 Any solid copper oxide can be removed from the solution of the salt by . . .

A crystallisation.

B distillation.

C evaporation.

D filtration.

7.3 The products of the reaction between copper oxide and hydrochloric acid are . . .

A copper chloride and carbon dioxide.

B copper chloride and hydrogen.

C copper chloride and water.

D copper chloride only.

7.4 Copper oxide is a base that will **not** dissolve in water.

What name do we give to a soluble base?

A A hydroxide

B A nitrate

C An acid

D An alkali

Turn over for the next question

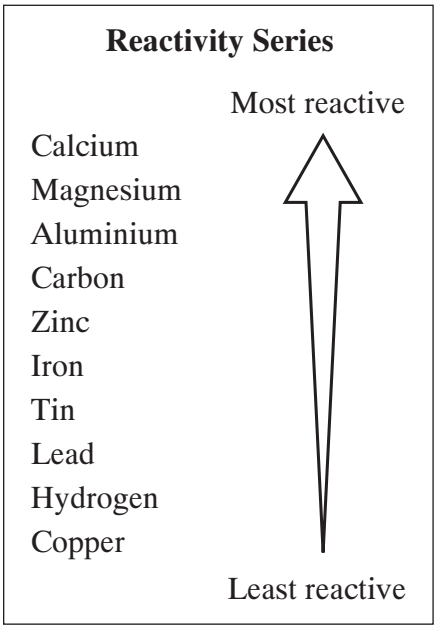
QUESTION EIGHT

Iron is obtained from iron oxide in a blast furnace.

The word equations show two of the reactions which take place in the furnace.

carbon + oxygen → carbon dioxide

carbon dioxide + carbon → carbon monoxide



8.1 The substance oxidised in **both** these reactions is . . .

A carbon.

B carbon dioxide.

C carbon monoxide.

D oxygen.

8.2 How is the iron obtained from the iron oxide?

A The iron ore is decomposed by the heat energy produced.

B The iron oxide is reduced by carbon dioxide.

C The iron oxide is reduced by carbon monoxide.

D The iron ore reacts with limestone.

8.3 Another way in which iron can be displaced from iron oxide is by reaction with . . .

A aluminium.

B copper.

C lead.

D tin.

8.4 How could calcium be extracted from calcium chloride?

A By displacement reaction with magnesium

B By passing an electric current through solid calcium chloride

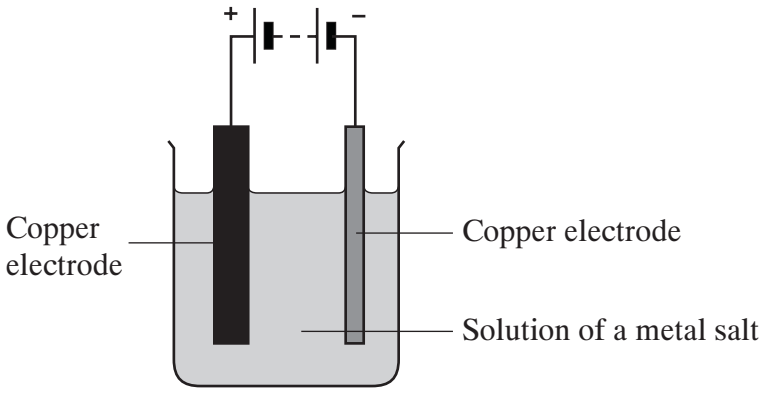
C By passing an electric current through molten calcium chloride

D By strongly heating calcium chloride with carbon

Turn over for the next question

QUESTION NINE

The diagram shows how pure copper can be obtained from impure copper. One electrode is pure copper, the other is impure copper.



9.1 A suitable metal salt would be . . .

A copper hydroxide.

B copper sulphate.

C zinc hydroxide.

D zinc sulphate.

9.2 Which row in the table best describes the two electrodes towards the end of the purification process?

	Positive electrode	**Negative electrode**
A	thicker, made of impure copper	thicker, made of pure copper
B	thicker, made of pure copper	thinner, made of impure copper
C	thinner, made of impure copper	thicker, made of pure copper
D	thinner, made of pure copper	thinner, made of impure copper

You may find the following information useful when answering this question.

Cu means 1 atom of copper
Cu^{2+} means 1 ion of copper
e^- means 1 electron

9.3 Which equation describes what happens at the negative electrode?

A $Cu + 2e^- \rightarrow Cu^{2+}$

B $Cu - 2e^- \rightarrow Cu^{2+}$

C $Cu^{2+} + 2e^- \rightarrow Cu$

D $Cu^{2+} - 2e^- \rightarrow Cu$

9.4 The reaction at the positive electrode is . . .

A displacement.

B oxidation.

C redox.

D reduction.

Turn over for the next question

QUESTION TEN

This question is about reactions between acids and alkalis.

10.1 A solution of an acid is completely neutralised by an alkali and the products are left in solution.

This reaction can be represented by . . .

A H^+ (aq) + OH^+ (aq) → H_2O (l)

B H^+ (aq) + OH^+ (aq) → 2HO (l)

C H^+ (aq) + OH^- (aq) → H_2O (l)

D H^- (aq) + OH^- (aq) → H_2O (l)

10.2 Which of these salts can be made by the reaction of an acid with an alkali?

A Iron sulphate

B Lead sulphate

C Potassium sulphate

D Zinc sulphate

10.3 Which word equation shows a correct reaction to produce sodium sulphate?

A sodium hydroxide + sulphuric acid → sodium sulphate + hydrogen

B sodium hydroxide + sulphuric acid → sodium sulphate + water

C sodium nitrate + sulphuric acid → sodium sulphate + hydrogen

D sodium nitrate + sulphuric acid → sodium sulphate + water

10.4 There are two sodium salts of sulphuric acid (H_2SO_4). They are sodium sulphate (Na_2SO_4) and sodium hydrogensulphate ($NaHSO_4$).

There is only one sodium salt of hydrochloric acid (HCl), called sodium chloride (NaCl).

This is because . . .

A sulphuric acid has larger molecules than hydrochloric acid.

B sulphuric acid has two hydrogen atoms in each molecule, but hydrochloric acid has only one.

C sulphuric acid is stronger than hydrochloric acid.

D sulphuric acid reacts more vigorously than hydrochloric acid.

END OF TEST

There are no questions printed on this page