Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2003

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

Tuesday 24 June 2003 Morning Session

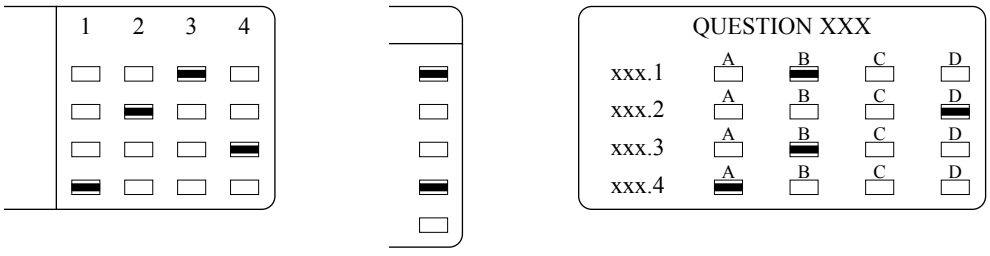
In addition to this paper you will require:
- an HB pencil and a rubber;
- an answer sheet.

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.
- Answer **all** the questions for the Tier you are attempting.
- 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.
- Mark your responses on the separate answer sheet only. Rough work may be done on the question paper.
- Mark the best responses by using a thick pencil stroke to fill in the box. Use an HB pencil. Make sure the pencil stroke does **not** extend beyond the box. Do **not** use ink or ball-point pen. If you wish to change your answer, rub out your first answer completely.
  See below.

Examples:



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 rub 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 12 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 metals.

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

aluminium

copper

iron

mercury

Metal	What we can say about the metal
1	it is extracted from the ore bauxite
2	it is extracted from the ore haematite
3	it changes to green when it weathers
4	it is the transition metal with the lowest melting point

QUESTION TWO

The diagram shows a blast furnace.

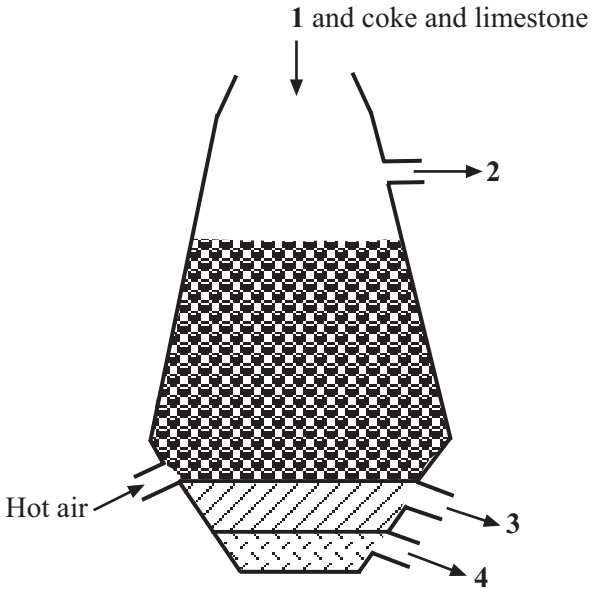
Match words from the list with each of the labels **1–4** on the diagram.

iron ore

molten iron

slag

waste gases



QUESTION THREE

This question is about metals.

Match words from the list with each of the spaces **1–4** in the passage.

chromium

copper

gold

potassium

The metal that will float in water is . . . . . **1** . . . . . .

We can make stainless steel by mixing iron with . . . . . **2** . . . . . .

The electrical wiring in a house is usually made from . . . . . **3** . . . . . .

Transition metals are usually found in the Earth's crust as compounds, but . . . . . **4** . . . . . is found as the metal itself.

QUESTION FOUR

The diagram shows stages in the manufacture of iron in the blast furnace.

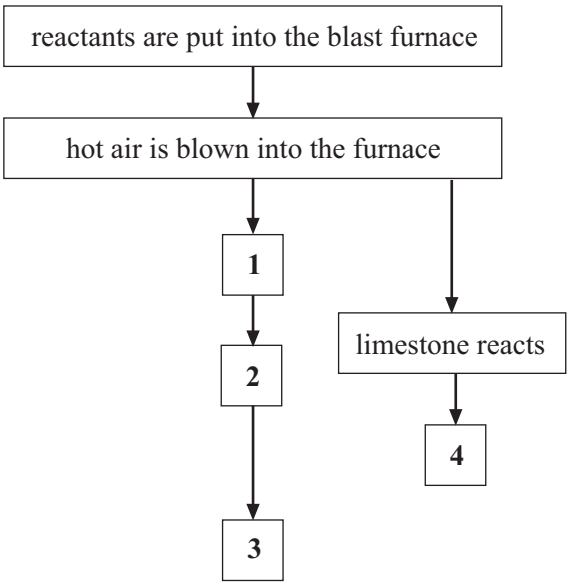
Match each word equation **P**, **Q**, **R** and **S** from the list with the spaces **1 – 4**, to explain what happens in this process.

P **carbon dioxide + carbon → carbon monoxide**

Q **carbon monoxide + iron oxide → iron + carbon dioxide**

R **carbon + oxygen → carbon dioxide**

S **calcium carbonate + acid impurities → calcium silicate (slag)**



QUESTION FIVE

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

Metal **Y** can be extracted from its oxide by heating with carbon.
Metal **Z** can only be extracted from its compounds by electrolysis.

Hydrogen will displace metal **X** from its oxide but cannot displace metal **Y** from its oxide.

Metal **W** will displace metal **X** from its compounds.
Metal **W** will not displace metal **Y** from its compounds.

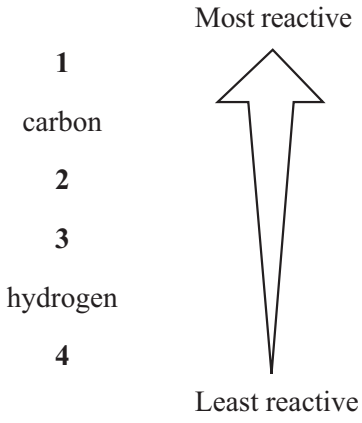
Match metals from the list with each of the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



SECTION B

Questions **SIX** and **SEVEN**.

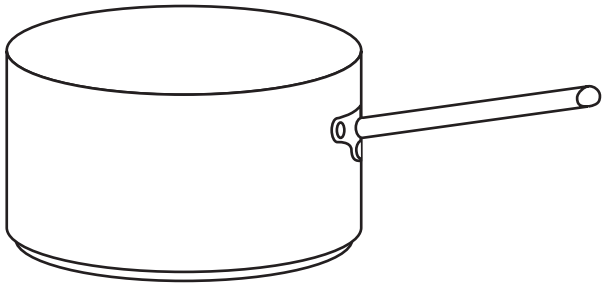
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows one use for aluminium.



Which **two** of the following are properties of aluminium that make it suitable for making saucepans?

it bends and shapes easily

it forms coloured compounds

it is a fairly expensive metal

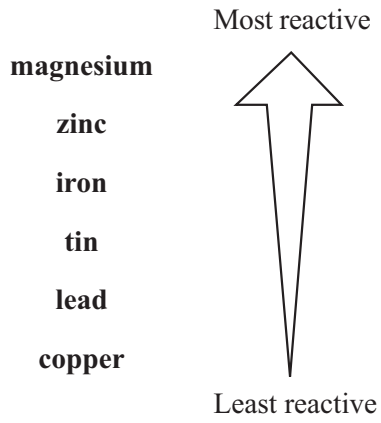
it is a good conductor of electricity

it is a good conductor of heat

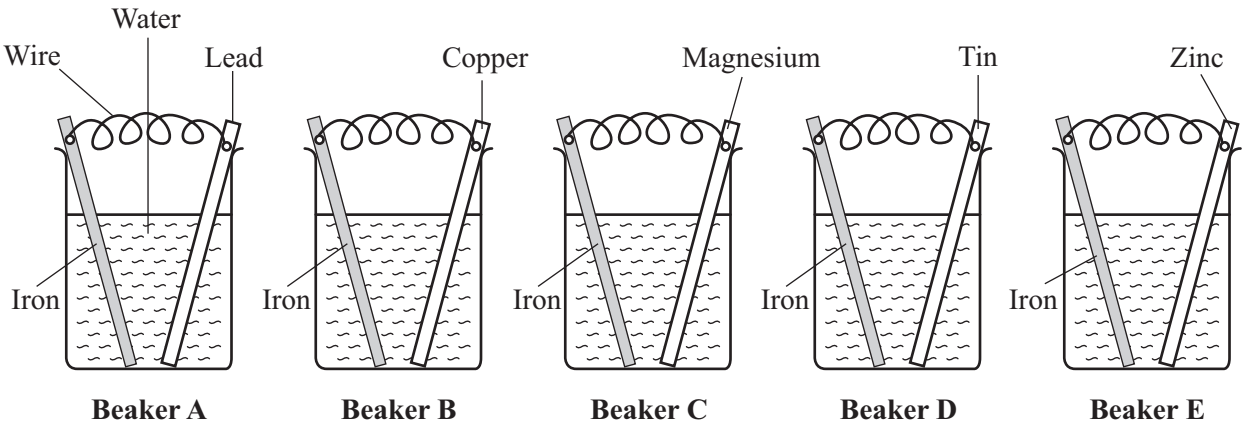
QUESTION SEVEN

Use the order of reactivity for the metals to help you answer this question.

Some metals, when connected to iron, will prevent it from rusting.



In which **two** beakers will the iron **not** rust?



TURN OVER FOR THE NEXT QUESTION

SECTION C

Questions **EIGHT** to **TEN**.

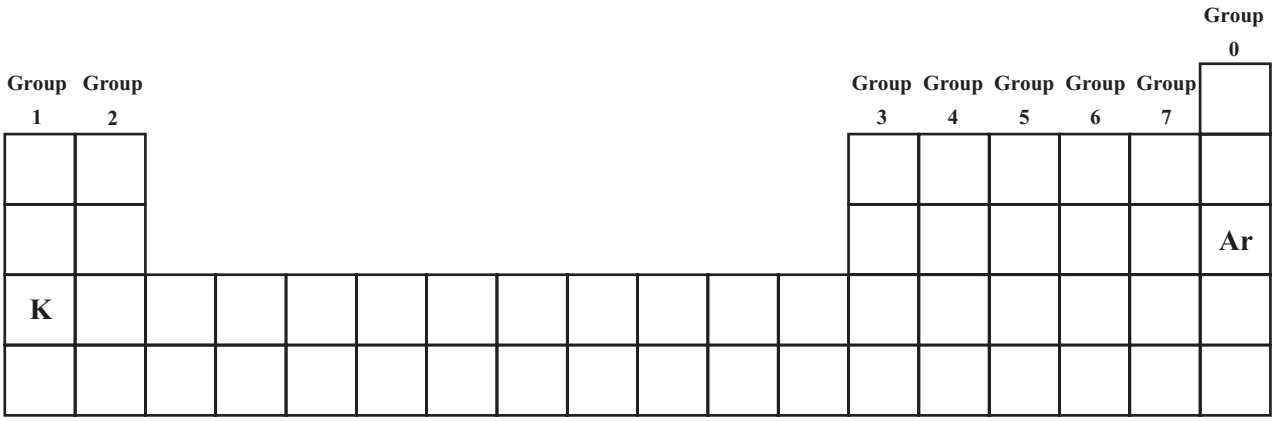
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows a part of the periodic table.



8.1 In the periodic table, the chemical elements are arranged in vertical Groups.

Within each Group, the elements have . . . . .

A similar boiling points.

B similar chemical properties.

C similar rates of reaction.

D the same density.

8.2 Argon is placed before potassium in the table even though . . . . .

A it does not easily oxidise.

B it has a greater relative atomic mass.

C it is more dense.

D it reacts more vigorously with water.

8.3 In the periodic table, the transition elements are found . . . . .

A in a block on the right-hand side.

B in a central block.

C in Groups 0 and 1.

D in Groups 0 and 7.

8.4 There are over 100 elements in the periodic table.

More than $\frac{3}{4}$ of the elements are . . . . . .

A gases.

B metals.

C non-metals.

D transition elements.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

This question is about the Group 1 metals and the transition metals.

9.1 The Group 1 metals . . . . .

A react very slowly with oxygen.

B react with non-metals to form coloured compounds.

C react with water to produce hydrogen.

D react with water to produce salts.

9.2 The Group 1 metals **and** the transition metals . . . . .

A are electrical insulators.

B are poor conductors of heat.

C can be hammered into shape.

D react vigorously with cold water.

9.3 Which properties best describe the hydroxides of Group 1 metals and the transition metals?

	Group 1 metal hydroxides	**Transition metal hydroxides**
A	coloured and insoluble in water	white and soluble in water
B	white and insoluble in water	coloured and soluble in water
C	white and soluble in water	coloured and insoluble in water
D	white and soluble in water	coloured and soluble in water

9.4 When compared to the Group 1 metals, most transition metals . . . . .

A are less dense.

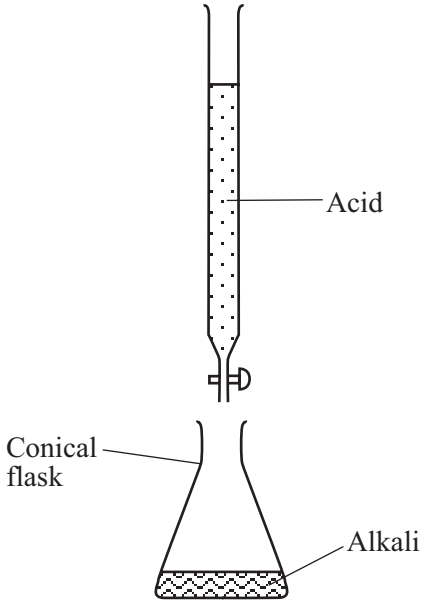
B are softer.

C have higher melting points.

D react more easily with oxygen.

QUESTION TEN

The diagram shows an acid being added to an alkali.



10.1 The acid and alkali react together.

acid + alkali → a neutral salt solution + substance **X**

Substance **X** is . . . . .

A carbon dioxide.

B hydrogen.

C oxygen.

D water.

10.2 This type of reaction is called . . . . .

A a decomposition reaction.

B a neutralisation reaction.

C an addition reaction.

D a substitution reaction.

10.3 Which acid and which alkali would you use to produce sodium chloride?

A Sodium and chlorine

B Sodium and hydrochloric acid

C Sodium hydroxide and hydrochloric acid

D Sodium sulphate and hydrochloric acid

10.4 The solution of sodium chloride produced in this reaction will be acidic rather than neutral if it contains excess . . . . .

A Cl^- ions.

B H^+ (aq) ions.

C Na^+ ions.

D OH^- (aq) ions.

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.

Metal **Y** can be extracted from its oxide by heating with carbon.
Metal **Z** can only be extracted from its compounds by electrolysis.

Hydrogen will displace metal **X** from its oxide but cannot displace metal **Y** from its oxide.

Metal **W** will displace metal **X** from its compounds.
Metal **W** will not displace metal **Y** from its compounds.

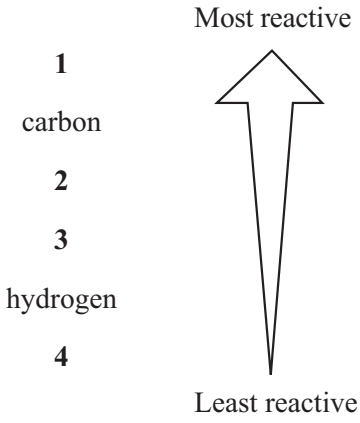
Match metals from the list with each of the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



QUESTION TWO

This question is about chemical reactions.

Match a reaction **L**, **M**, **N** or **P** from the list with each of the numbers **1–4** in the table.

L **aluminium reacts with oxygen in the air to form aluminium oxide**

M **copper hydroxide reacts with dilute sulphuric acid to form copper sulphate and water**

N **iron oxide reacts with carbon monoxide to form iron and carbon dioxide**

P **magnesium ions gain electrons to form magnesium atoms**

Chemical reaction	Type of reaction
1	neutralisation reaction
2	redox reaction
3	reduction reaction
4	corrosion reaction

TURN OVER FOR THE NEXT QUESTION

SECTION B

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

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

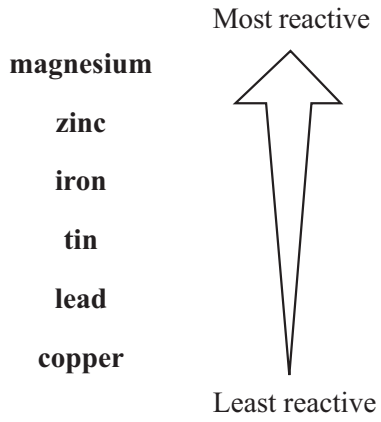
Do **not** choose more than two.

Mark your choices on the answer sheet.

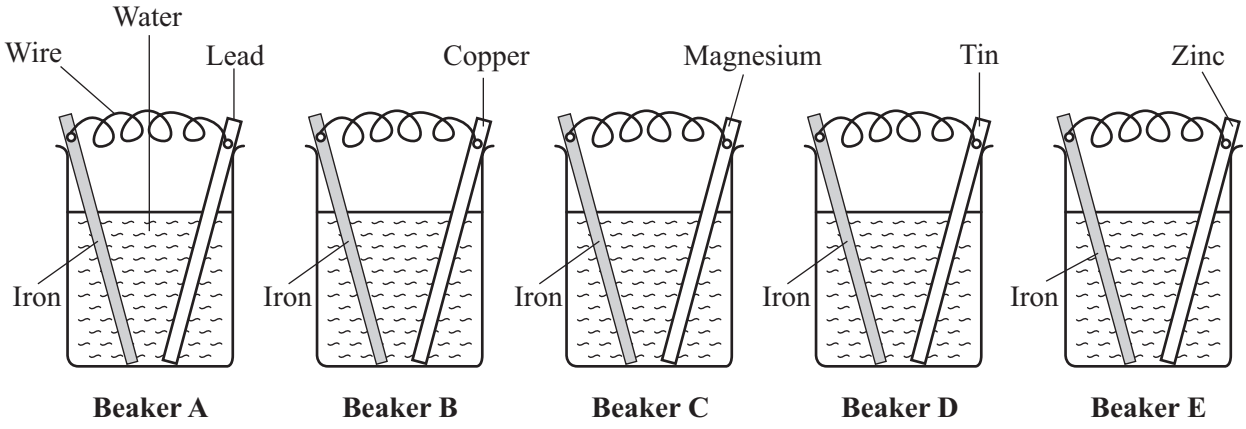
QUESTION THREE

Use the order of reactivity for the metals to help you answer this question.

Some metals, when connected to iron, will prevent it from rusting.



In which **two** beakers will the iron **not** rust?



QUESTION FOUR

This question is about ammonia and nitric acid and the reaction between them.

Choose the **two** statements from **P**, **Q**, **R**, **S** and **T**, which are correct.

P **ammonia dissolves in water to produce ammonium sulphate**

Q **ammonia solution and nitric acid react to produce the salt, ammonium nitrate**

R **ammonia solution is alkaline because it contains OH^+ (aq) ions**

S **hydroxide ions make the nitric acid solution acid**

T **nitric acid solution contains H^+ (aq) ions**

TURN OVER FOR THE NEXT QUESTION

SECTION C

Questions **FIVE** to **TEN**.

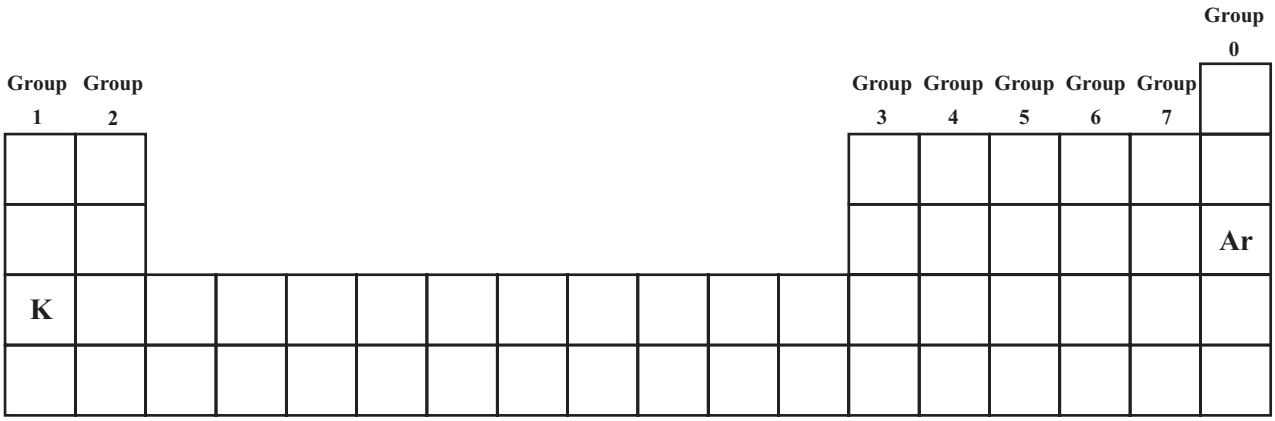
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows a part of the periodic table.



5.1 In the periodic table, the chemical elements are arranged in vertical Groups.

Within each Group, the elements have . . . . .

A similar boiling points.

B similar chemical properties.

C similar rates of reaction.

D the same density.

5.2 Argon is placed before potassium in the table even though . . . . .

A it does not easily oxidise.

B it has a greater relative atomic mass.

C it is more dense.

D it reacts more vigorously with water.

5.3 In the periodic table, the transition elements are found . . . . .

A in a block on the right-hand side.

B in a central block.

C in Groups 0 and 1.

D in Groups 0 and 7.

5.4 There are over 100 elements in the periodic table.

More than $\frac{3}{4}$ of the elements are . . . . . .

A gases.

B metals.

C non-metals.

D transition elements.

TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

This question is about the Group 1 metals and the transition metals.

6.1 The Group 1 metals . . . . .

A react very slowly with oxygen.

B react with non-metals to form coloured compounds.

C react with water to produce hydrogen.

D react with water to produce salts.

6.2 The Group 1 metals **and** the transition metals . . . . .

A are electrical insulators.

B are poor conductors of heat.

C can be hammered into shape.

D react vigorously with cold water.

6.3 Which properties best describe the hydroxides of Group 1 metals and the transition metals?

	Group 1 metal hydroxides	**Transition metal hydroxides**
A	coloured and insoluble in water	white and soluble in water
B	white and insoluble in water	coloured and soluble in water
C	white and soluble in water	coloured and insoluble in water
D	white and soluble in water	coloured and soluble in water

6.4 When compared to the Group 1 metals, most transition metals . . . . .

A are less dense.

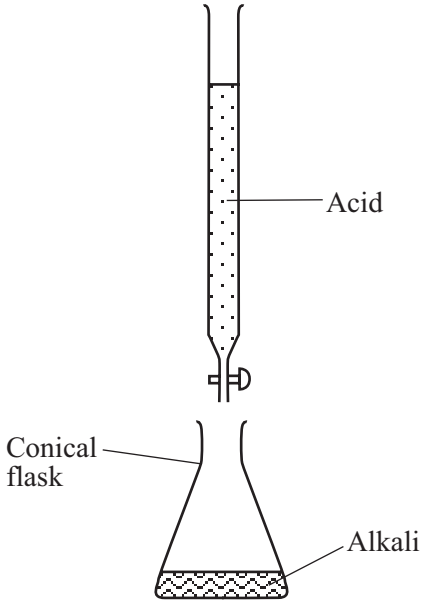
B are softer.

C have higher melting points.

D react more easily with oxygen.

QUESTION SEVEN

The diagram shows an acid being added to an alkali.



7.1 The acid and alkali react together.

acid + alkali → a neutral salt solution + substance **X**

Substance **X** is . . . . .

A carbon dioxide.

B hydrogen.

C oxygen.

D water.

7.2 This type of reaction is called . . . . .

A a decomposition reaction.

B a neutralisation reaction.

C an addition reaction.

D a substitution reaction.

7.3 Which acid and which alkali would you use to produce sodium chloride?

A Sodium and chlorine

B Sodium and hydrochloric acid

C Sodium hydroxide and hydrochloric acid

D Sodium sulphate and hydrochloric acid

7.4 The solution of sodium chloride produced in this reaction will be acidic rather than neutral if it contains excess . . . . .

A Cl^- ions.

B H^+ (aq) ions.

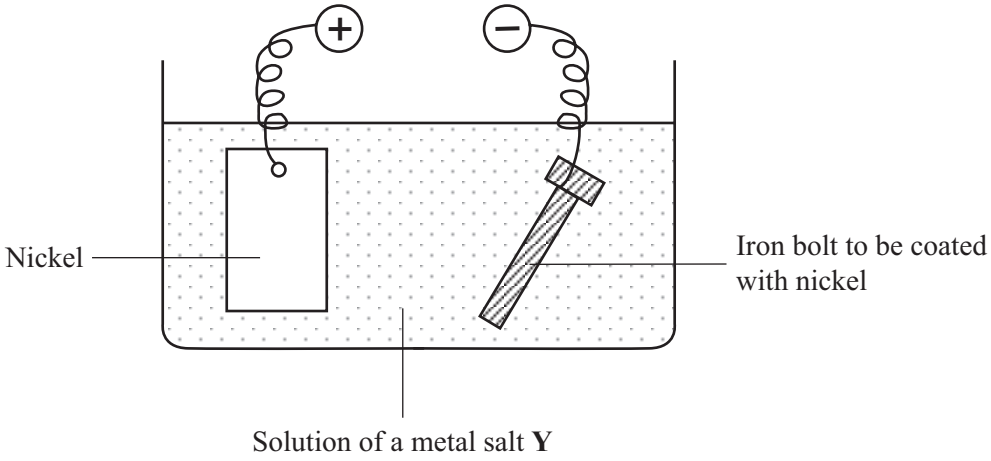
C Na^+ ions.

D OH^- (aq) ions.

QUESTION EIGHT

Electrolysis is used to purify copper.
Electrolysis can also be used in a similar way to give a metal object a thin coating of another metal.

The diagram shows how an iron bolt is coated with the metal, nickel.



8.1 A suitable metal salt **Y** would be . . . . .

A aluminium nitrate.

B copper sulphate.

C iron chloride.

D nickel sulphate.

8.2 Which of the following statements describes what happens at the positive electrode?

A Nickel atoms gain electrons and form nickel ions

B Nickel atoms lose electrons and form nickel ions

C Nickel ions gain electrons and form nickel atoms

D Nickel ions lose electrons and form nickel atoms

8.3 Which of the following statements describes what happens at the negative electrode?

A Nickel atoms gain electrons and form nickel ions

B Nickel atoms lose electrons and form nickel ions

C Nickel ions gain electrons and form nickel atoms

D Nickel ions lose electrons and form nickel atoms

8.4 The reaction at the negative electrode is . . . . .

A a displacement reaction.

B an oxidation reaction.

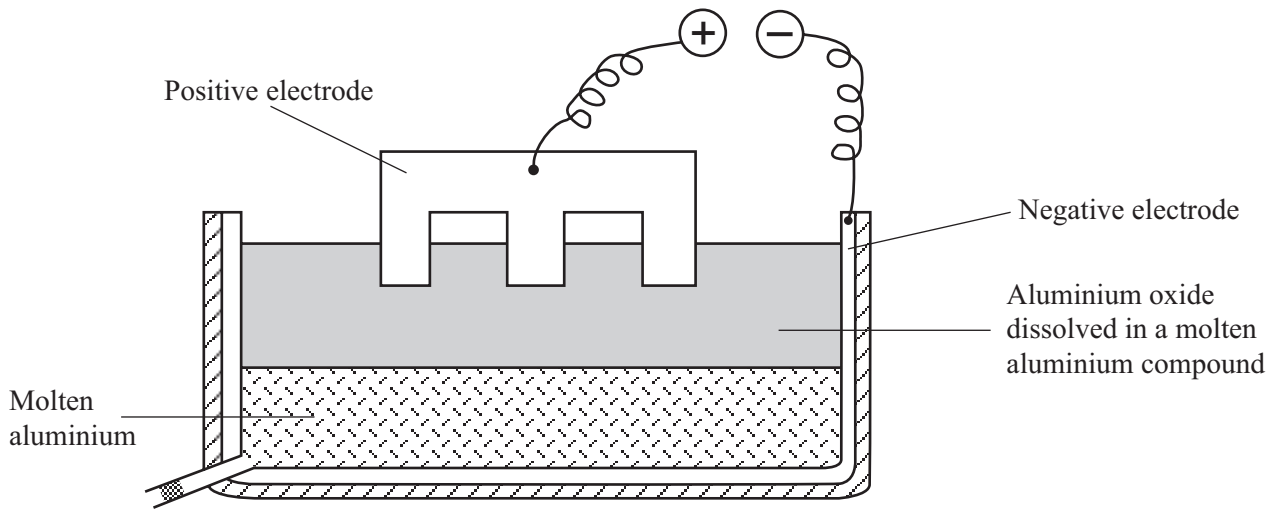
C a redox reaction.

D a reduction reaction.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

We can use electrolysis to extract aluminium from its purified ore.
An electric current is passed through molten aluminium oxide in an electrolytic cell.
The diagram shows the electrolytic cell.



9.1 In the cell, the aluminium oxide is dissolved in a molten aluminium compound called . . . . .

A bauxite.

B chromite.

C cryolite.

D haematite.

9.2 It is necessary to dissolve the aluminium oxide in this way because it . . . . .

A has a high boiling point.

B has a high density.

C has a high melting point.

D is insoluble in water.

9.3 Which gases are given off at the positive electrode?

A Oxygen and carbon dioxide

B Oxygen and nitrogen

C Oxygen and sulphur dioxide

D Oxygen only

9.4 As a result of the reactions taking place, the positive electrode . . . . .

A becomes coated in aluminium.

B becomes coated in cryolite.

C has to be replaced frequently.

D is purified.

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

This question is about simple cells.

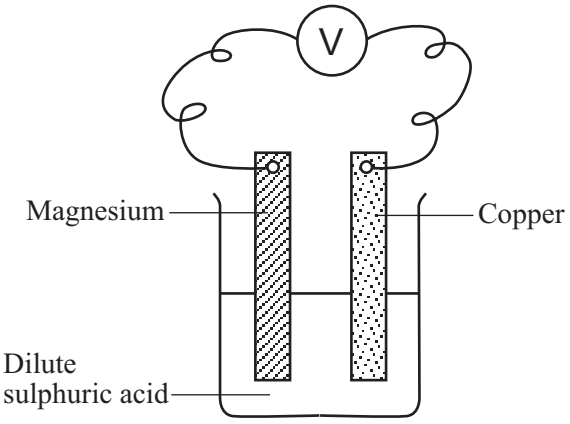
Use this information to help you answer the question.

When two different metals are placed in dilute sulphuric acid solution, a simple cell is formed. A voltmeter connected across the metals will read the voltage across the two metals.

The electrode potential of a metal is a measure of how easily the metal can lose electrons. The more negative it is, the more easily the metal loses electrons.

These are the electrode potentials for six metals.

silver	+ 0.8 volts
copper	+ 0.3 volts
lead	– 0.1 volts
iron	– 0.4 volts
zinc	– 0.8 volts
magnesium	– 2.4 volts



10.1 What is the effect on the two metals when the current flows through the wire?

	Magnesium	**Copper**
A	gains electrons	gains electrons
B	gains electrons	loses electrons
C	loses electrons	gains electrons
D	loses electrons	loses electrons

10.2 As the reaction proceeds, the magnesium plate . . . . .

A will be coated in copper.

B will be coated with bubbles of oxygen.

C will get thinner gradually.

D will melt.

10.3 The voltage of a simple cell is the difference between the electrode potentials of the two metals involved.

What is the voltage of a simple cell with magnesium and copper electrodes?

A 0.125 volts

B 0.8 volts

C 2.1 volts

D 2.7 volts

10.4 Which two metals, used in a simple cell, would give a voltage of 0.5 volts?

A Lead and iron

B Magnesium and iron

C Silver and copper

D Silver and magnesium

END OF TEST