

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2005



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

Thursday 24 November 2005 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

The diagram shows a blast furnace.

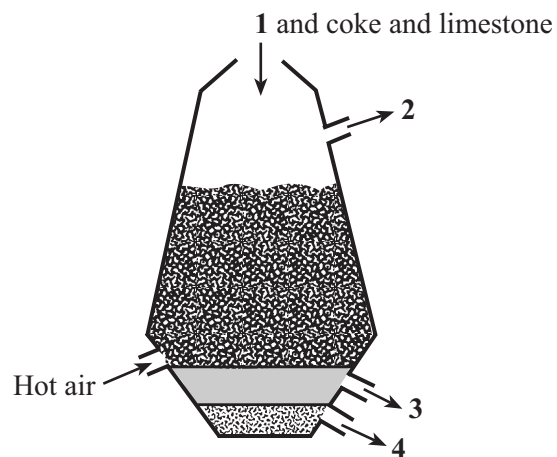
Match words from the list with the labels **1–4** on the diagram.

iron ore

molten iron

slag

waste gases



QUESTION TWO

This question is about the way we use metals.

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

chromium

copper

magnesium

platinum

Metal	How we use the metal
1	as a catalyst
2	mix it with aluminium to make a harder and stronger alloy
3	mix it with iron to make a stainless steel
4	to make electrical cables

QUESTION THREE

This question is about substances produced in chemical reactions.

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

carbon dioxide

hydrogen

oxygen

water

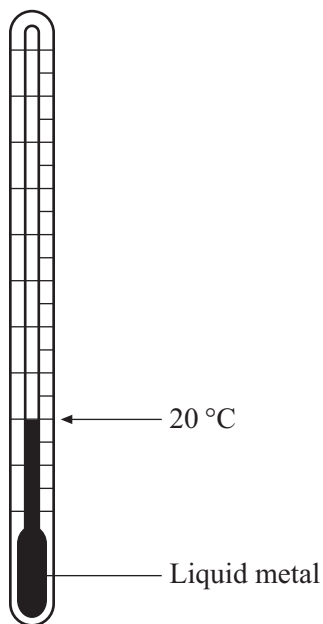
Substance	Chemical reaction in which it is produced
1	when a Group 1 metal reacts with water
2	when an electric current is passed through molten aluminium oxide
3	when copper oxide is reduced using carbon monoxide
4	when sodium hydroxide reacts with hydrochloric acid

Turn over ►

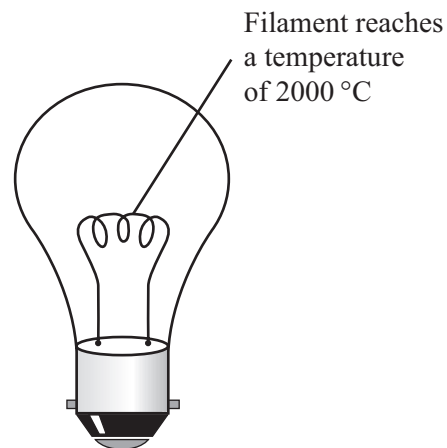
QUESTION FOUR

Use the information in the table and in the diagrams to help you to answer this question.

Metal	Melting point (in °C)
iron	1537
mercury	-39
sodium	98
tungsten	3410



Thermometer



Electric light bulb

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

iron

mercury

sodium

tungsten

Metal	What we can say about the metal
1	it has a low melting point but is solid at room temperature
2	it is liquid at room temperature (20 °C)
3	it is used for the filament of electric light bulbs
4	it is used to make steel

QUESTION FIVE

This question is about the reactivity series.

Carbon will displace metals **K** and **L** from their oxides.

Hydrogen will displace metal **K** from its oxide but will **not** displace metal **L** from its oxide.

Carbon will **not** displace metals **M** and **N** from their oxides.

Metal **M** will displace metal **N** from its oxide.

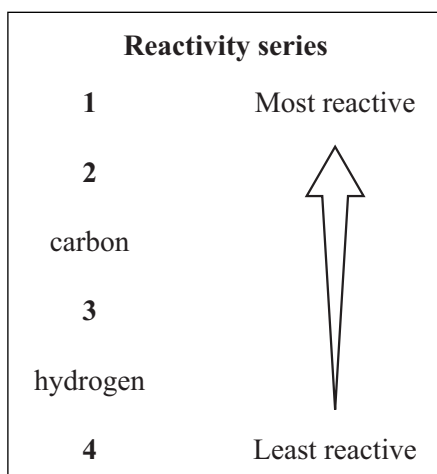
Match metals from the list with the numbers **1–4** in the reactivity series.

metal K

metal L

metal M

metal N



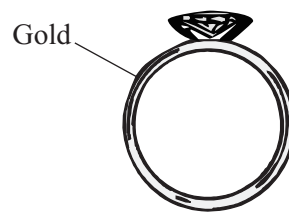
TURN OVER FOR THE NEXT QUESTION

Turn over ►

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.

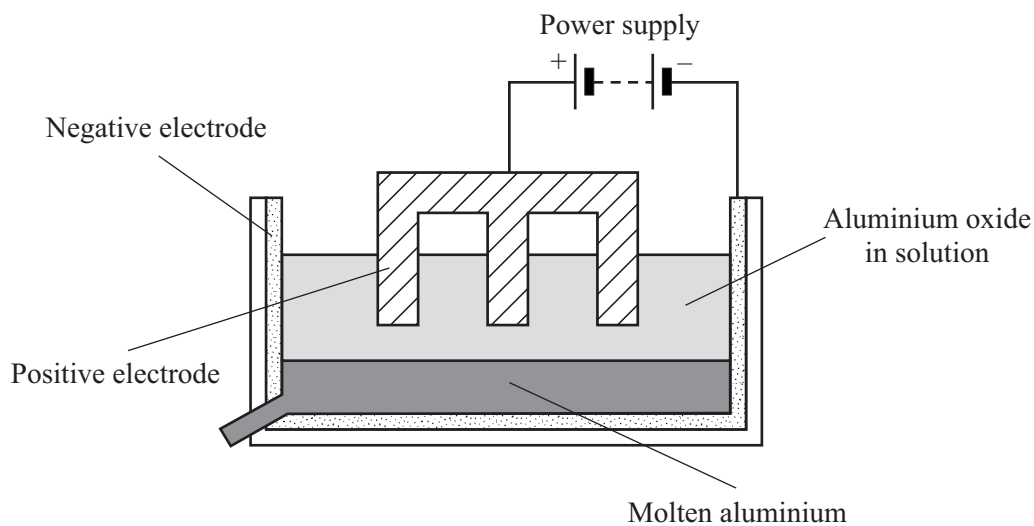
QUESTION SIX

This question is about gold.

Which **two** of these properties of gold make it suitable for making jewellery?**it can be hammered into shape****it is a good conductor of electricity****it is a good conductor of heat****it is a very dense metal****it is an unreactive metal**

QUESTION SEVEN

This question is about the extraction of aluminium.



Which **two** of these statements are correct?

aluminium collects at the positive electrode

aluminium oxide is dissolved in water

aluminium oxide is obtained from bauxite

positive aluminium ions move to the negative electrode

the electrodes are made from steel

TURN OVER FOR THE NEXT QUESTION

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 the extraction of metals.

8.1 Rocks from which a metal can be extracted economically are called

- A compounds.
- B ores.
- C sandstones.
- D veins.

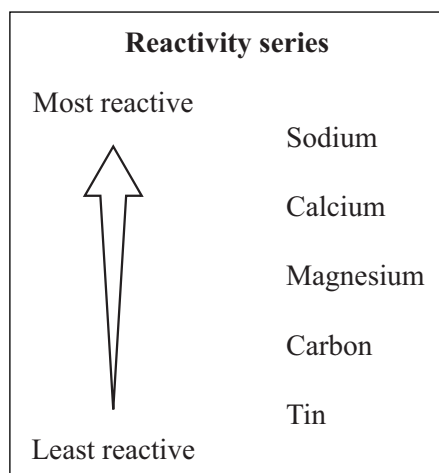
Some metals can be obtained by heating the metal oxide with carbon.

8.2 What is this process called?

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

8.3 Which word equation shows this reaction?

- A metal oxide + carbon \rightarrow metal + carbon dioxide
- B metal oxide + carbon \rightarrow metal + hydrogen
- C metal oxide + carbon \rightarrow metal + oxygen
- D metal oxide + carbon \rightarrow metal + water



8.4 Which of these metals could be obtained from its oxide by heating with carbon?

- A Calcium
- B Magnesium
- C Sodium
- D Tin

TURN OVER FOR THE NEXT QUESTION

Turn over ►

9.4 Which metal weathers to form a green compound?

- A** Al (aluminium)
- B** Ca (calcium)
- C** Cu (copper)
- D** Fe (iron)

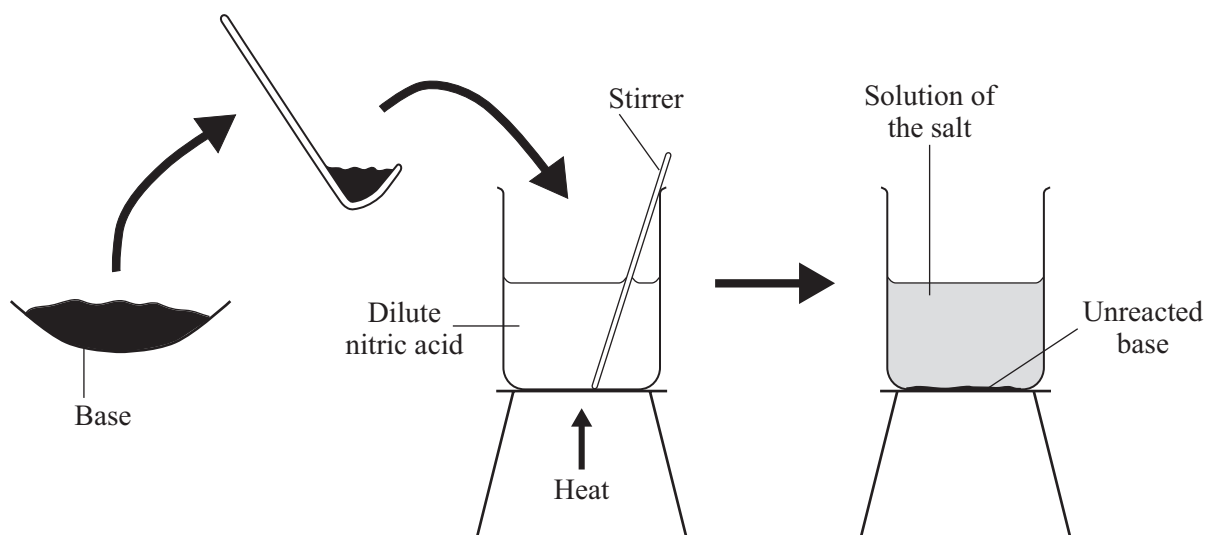
TURN OVER FOR THE NEXT QUESTION

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QUESTION TEN

This question is about making salts.

The diagram shows how to make a salt using a base and dilute nitric acid.



10.1 Why is the mixture of the base and the dilute nitric acid heated and stirred?

- A So that large crystals of the salt will form
- B To drive off the hydrogen gas
- C To evaporate some of the acid
- D To make the base and acid react more quickly

10.2 All the acid has been used up when

- A no more base will react.
- B no more bubbles of hydrogen are produced.
- C the solution begins to turn green.
- D the solution turns colourless.

10.3 What is the general word equation for this type of reaction?

A acid + base → salt + carbon dioxide

B acid + base → salt + hydrogen

C acid + base → salt + oxygen

D acid + base → salt + water

10.4 Which is the base that could be used to produce the salt, lead nitrate?

A Lead bromide

B Lead chloride

C Lead oxide

D Lead sulphate

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**.

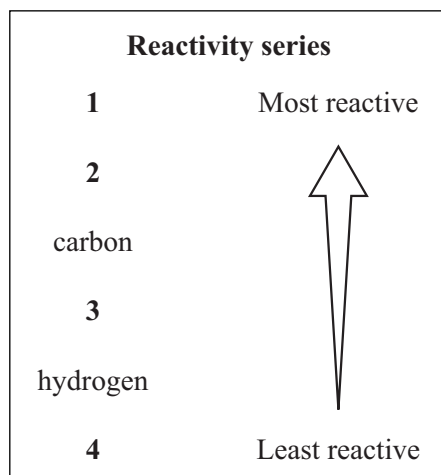
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the reactivity series.

Carbon will displace metals **K** and **L** from their oxides.Hydrogen will displace metal **K** from its oxide but will **not** displace metal **L** from its oxide.Carbon will **not** displace metals **M** and **N** from their oxides.Metal **M** will displace metal **N** from its oxide.Match metals from the list with the numbers **1–4** in the reactivity series.**metal K****metal L****metal M****metal N**

QUESTION TWO

This question is about chemical reactions.

Match reactions, **L**, **M**, **N** and **P**, from the list with the numbers **1–4** in the table.

- L** an oxide layer on aluminium prevents this reaction
- 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	corrosion
2	neutralisation
3	redox
4	reduction

TURN OVER FOR THE NEXT QUESTION

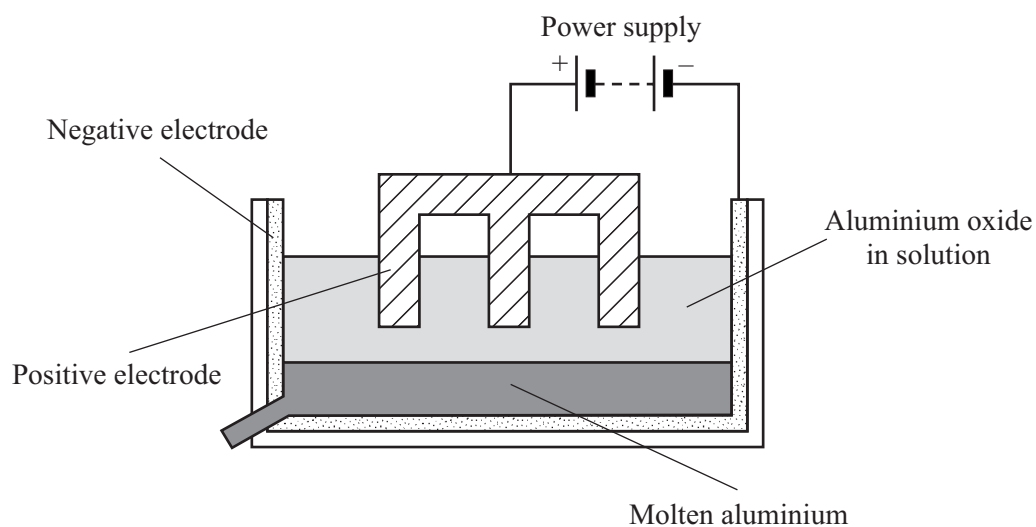
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SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

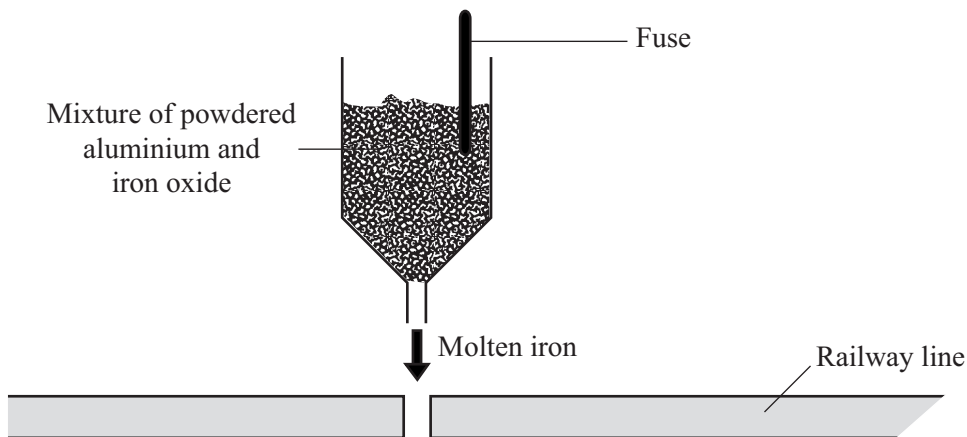
This question is about the extraction of aluminium.

Which **two** of these statements are correct?**aluminium collects at the positive electrode****aluminium oxide is dissolved in water****aluminium oxide is obtained from bauxite****positive aluminium ions move to the negative electrode****the electrodes are made from steel**

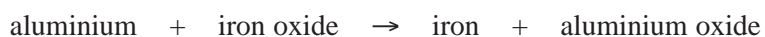
QUESTION FOUR

Molten iron is used to weld railway lines together.

It is produced when a mixture of iron oxide and powdered aluminium is heated.



This is the word equation for the reaction.



Which **two** of the following statements about this reaction are correct?

aluminium is more reactive than iron

aluminium is reduced

iron is more reactive than aluminium

iron oxide is reduced

the reaction is a neutralisation reaction

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 the extraction of metals.

5.1 Rocks from which a metal can be extracted economically are called

- A** compounds.
- B** ores.
- C** sandstones.
- D** veins.

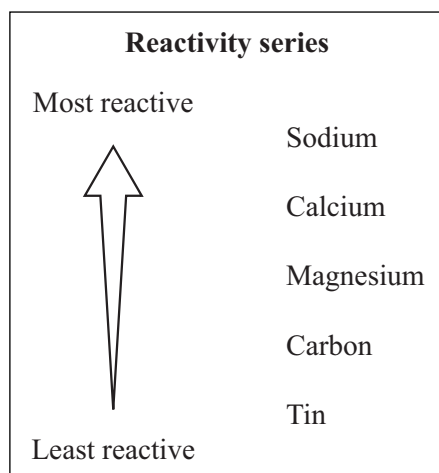
Some metals can be obtained by heating the metal oxide with carbon.

5.2 What is this process called?

- A** Combustion
- B** Electrolysis
- C** Oxidation
- D** Reduction

5.3 Which word equation shows this reaction?

- A** metal oxide + carbon → metal + carbon dioxide
- B** metal oxide + carbon → metal + hydrogen
- C** metal oxide + carbon → metal + oxygen
- D** metal oxide + carbon → metal + water



5.4 Which of these metals could be obtained from its oxide by heating with carbon?

- A Calcium
- B Magnesium
- C Sodium
- D Tin

TURN OVER FOR THE NEXT QUESTION

Turn over ►

6.4 Which metal weathers to form a green compound?

- A** Al (aluminium)
- B** Ca (calcium)
- C** Cu (copper)
- D** Fe (iron)

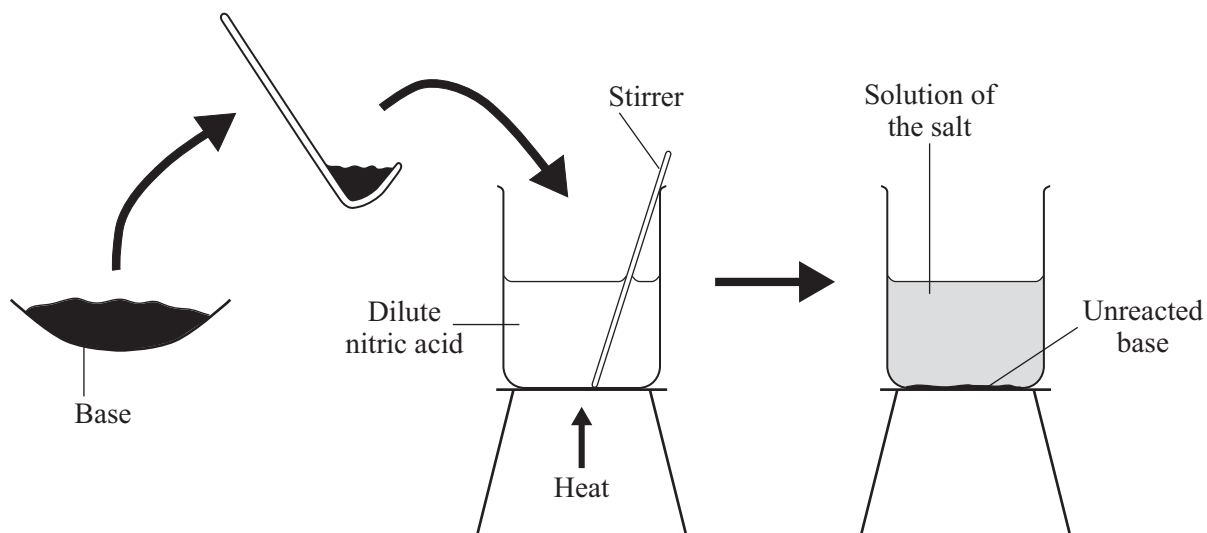
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

This question is about making salts.

The diagram shows how to make a salt using a base and dilute nitric acid.



7.1 Why is the mixture of the base and the dilute nitric acid heated and stirred?

- A** So that large crystals of the salt will form
- B** To drive off the hydrogen gas
- C** To evaporate some of the acid
- D** To make the base and acid react more quickly

7.2 All the acid has been used up when

- A** no more base will react.
- B** no more bubbles of hydrogen are produced.
- C** the solution begins to turn green.
- D** the solution turns colourless.

7.3 What is the general word equation for this type of reaction?

A acid + base → salt + carbon dioxide

B acid + base → salt + hydrogen

C acid + base → salt + oxygen

D acid + base → salt + water

7.4 Which is the base that could be used to produce the salt, lead nitrate?

A Lead bromide

B Lead chloride

C Lead oxide

D Lead sulphate

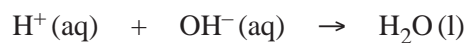
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

This question is about making salts.

The reaction between an acid and an alkali can be represented by this equation.



8.1 What type of reaction does this equation represent?

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

8.2 What are the meanings of **(aq)** and **(l)** in this equation?

- | | (aq) | (l) |
|---|--------------------|--------------------|
| A | dissolved in acid | dissolved in water |
| B | dissolved in water | dissolved in acid |
| C | dissolved in water | liquid |
| D | molten | liquid |

8.3 Which line is correct for hydrogen ions and hydroxide ions?

- | | Hydrogen ions make the solution | Hydroxide ions make the solution |
|---|--|---|
| A | acidic | alkaline |
| B | alkaline | acidic |
| C | acidic | neutral |
| D | neutral | alkaline |

8.4 The salt, ammonium chloride, can be prepared by this method.

Which word equation shows the reaction?

- A** ammonia solution + hydrochloric acid → ammonium chloride + hydrogen
- B** ammonia solution + hydrochloric acid → ammonium chloride + water
- C** ammonia solution + hydrochloric acid → ammonium chloride + water + hydrogen
- D** ammonium sulphate + hydrochloric acid → ammonium chloride + hydrogen

TURN OVER FOR THE NEXT QUESTION

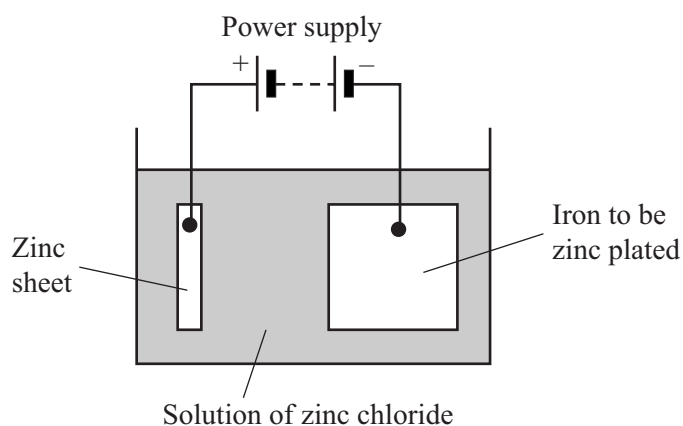
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QUESTION NINE

We can use a thin coating of zinc to protect iron from corrosion.

The zinc can be applied by electrolysis.

The process works in the same way as the process for purifying copper by electrolysis.



Reactivity series	
Most reactive	Magnesium
↑	Zinc
	Iron
	Tin
Least reactive	Lead

9.1 What happens at the positive electrode?

- A Zinc atoms gain electrons and form zinc ions
- B Zinc atoms lose electrons and form zinc ions
- C Zinc ions gain electrons and form zinc atoms
- D Zinc ions lose electrons and form zinc atoms

9.2 What happens at the negative electrode?

- A Zinc atoms gain electrons and form zinc ions
- B Zinc atoms lose electrons and form zinc ions
- C Zinc ions gain electrons and form zinc atoms
- D Zinc ions lose electrons and form zinc atoms

9.3 The reaction at the negative electrode is

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

9.4 If the zinc coating on the iron is damaged, the iron still does not corrode.

However, when a tin coating on iron is damaged, the iron corrodes more quickly than when it is not coated at all.

This suggests that

- A** iron corrodes less easily when attached to a more reactive metal.
- B** iron corrodes less easily when attached to a less reactive metal.
- C** iron corrodes less easily when attached to tin than when attached to zinc.
- D** tin is more reactive than zinc.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

This question is about simple cells.

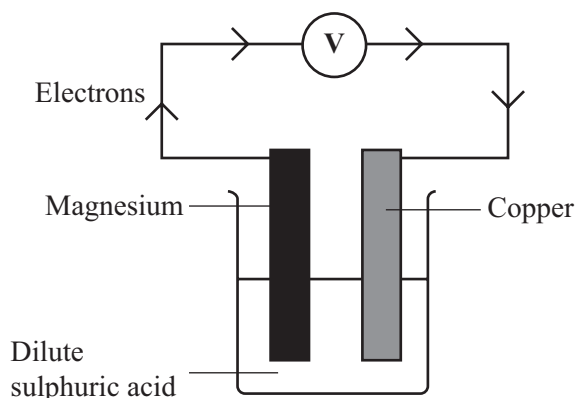
Use this information to help you answer the question.

When two different metals are placed in dilute sulphuric acid solution, a simple cell is formed. Electrons flow along the wire from the more reactive metal to the less reactive metal. A voltmeter connected across the metals shows the potential difference in volts between 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 happens to 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 current flows through the wire, 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 (potential difference) 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

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