

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
Spring 2003



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

346005

Wednesday 5 March 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

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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:

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QUESTION XXX				
xxx.1	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
xxx.2	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
xxx.3	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
xxx.4	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D

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 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 metals.

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

iron

magnesium

mercury

potassium

Metal	What we can say about the metal
1	it is a transition metal, liquid at 20 °C
2	it is extracted from the ore, haematite
3	it is used in alloys to make aluminium stronger
4	it reacts with water to produce hydrogen

QUESTION TWO

This passage is about the properties of some metals.

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

conduct

corrode

cut

melt

Both alkali and transition metals **1** electricity easily.

Because they are hard, transition metals do not **2** as easily as alkali metals.

Transition metals react less quickly than alkali metals with water and oxygen so **3** more slowly.

Alkali metals **4** at a much lower temperature than transition metals.

QUESTION THREE

This question is about chemical processes.

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

electrolysis

neutralisation

oxidation

thermal decomposition

Process	Example of the process
1	aluminium oxide splits into aluminium and oxygen when an electric current is passed through it
2	calcium carbonate changes to calcium oxide and gives off carbon dioxide when it is heated
3	carbon monoxide reacts with oxygen to form carbon dioxide
4	sodium hydroxide reacts with hydrochloric acid to form sodium chloride and water

Turn over ►

QUESTION FOUR

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

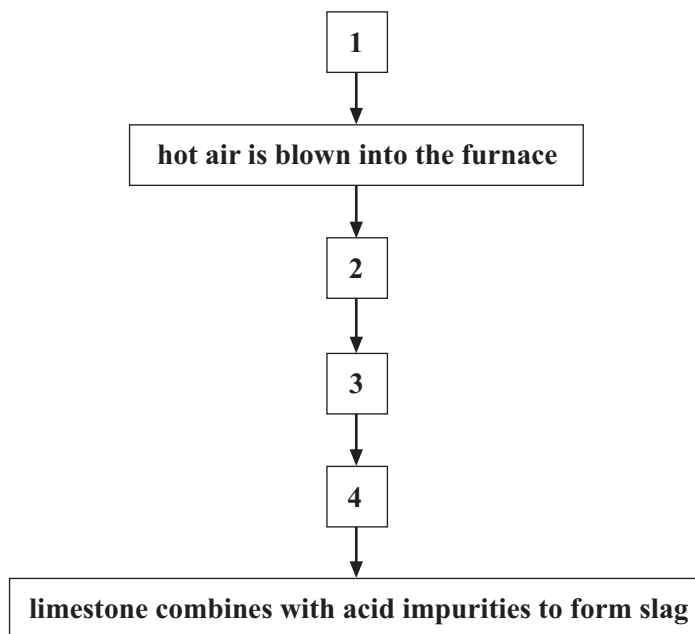
Match statements **P**, **Q**, **R** and **S** from the list with each of the spaces **1–4** to explain what happens in this process.

P carbon dioxide reacts with coke to produce carbon monoxide

Q carbon monoxide reacts with iron oxide to produce iron

R coke burns to form carbon dioxide

S iron ore, coke and limestone are put into the furnace



QUESTION FIVE

This question is about the reactivity series.

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

Hydrogen will displace metal **K** from its oxide but cannot 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.

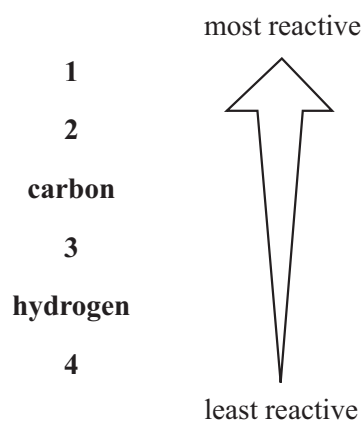
Match metals from the list with each of the numbers 1–4 in the reactivity series.

metal K

metal L

metal M

metal N



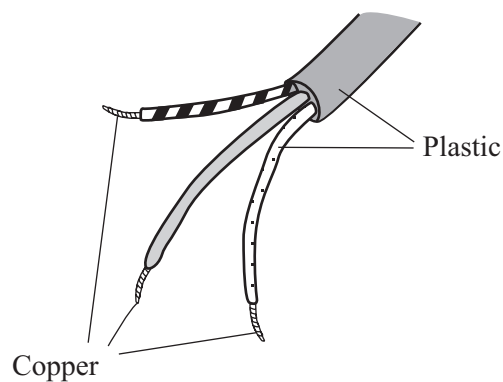
TURN OVER FOR THE NEXT QUESTION

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

The diagram shows an electrical cable.

Which **two** of the following properties of copper make it suitable for the wire in the cables?**it bends and shapes easily****it does not react with dilute hydrochloric acid****it is a fairly expensive metal****it is a good conductor of electricity****it is a good conductor of heat**

QUESTION SEVEN

Which **two** of the following substances dissolve in water to form alkaline solutions?

aluminium hydroxide

ammonia

copper hydroxide

iron hydroxide

sodium hydroxide

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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.

The symbols for some of the elements are given in their correct position in the table.

Group 1	Group 2									Group 3						Group 0
Li	Be															He
Na	Mg									Al						Ar
K	Ca				Cr		Fe		Ni	Cu	Zn					

8.1 In the periodic table, the chemical elements are arranged in order of their

- A density.
- B molecular size.
- C reactivity.
- D relative atomic mass.

8.2 Elements within a Group have

- A a similar colour.
- B a similar density.
- C similar chemical properties.
- D similar melting points.

8.3 Most of the metal elements are found in the central block and

- A in Groups 1 and 2.
- B in Groups 1 and 0.
- C in Groups 2 and 3.
- D in Groups 2 and 0.

8.4 The metal elements in Group 1 are known as

- A alkali metals.
- B alkaline earth metals.
- C soft and reactive metals.
- D transition metals.

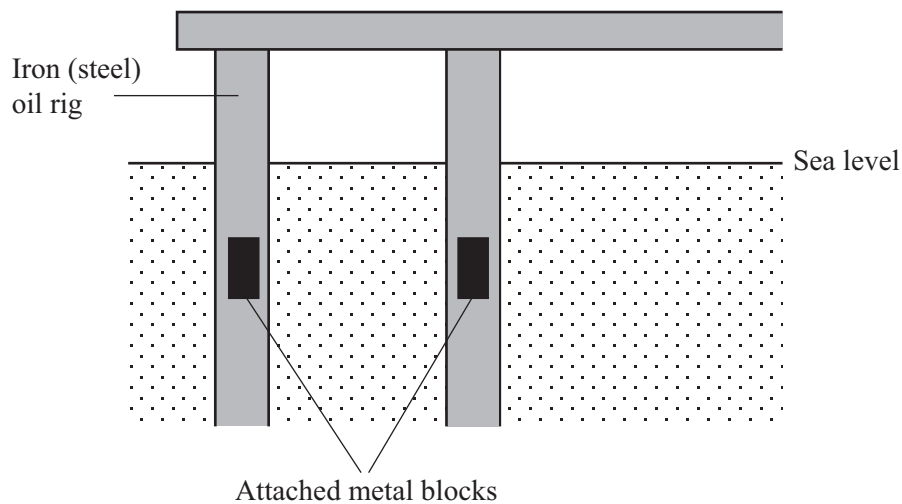
TURN OVER FOR THE NEXT QUESTION

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QUESTION NINE

The diagram shows part of an oil rig.

Unprotected iron (steel) will corrode (rust) if it is in contact with oxygen and water.



9.1 The iron (steel) will be protected from rusting if the metal of the attached blocks is

- A** an alloy.
- B** less reactive than iron (steel).
- C** more reactive than iron (steel).
- D** a transition metal.

9.2 Stainless steel is a non-rusting alloy of iron.

Stainless steel is an alloy of iron, nickel and

- A** aluminium.
- B** chromium.
- C** magnesium.
- D** zinc.

9.3 Aluminium does not corrode as quickly as iron (steel) because

- A it develops a thin layer of oxide on its surface.
- B it is in Group 3 of the periodic table.
- C it is lower in the reactivity series than iron.
- D there is a thin layer of grease on its surface.

9.4 The roofs of buildings are sometimes covered with copper sheet.

The compound formed on the surface of the copper when it is weathered is

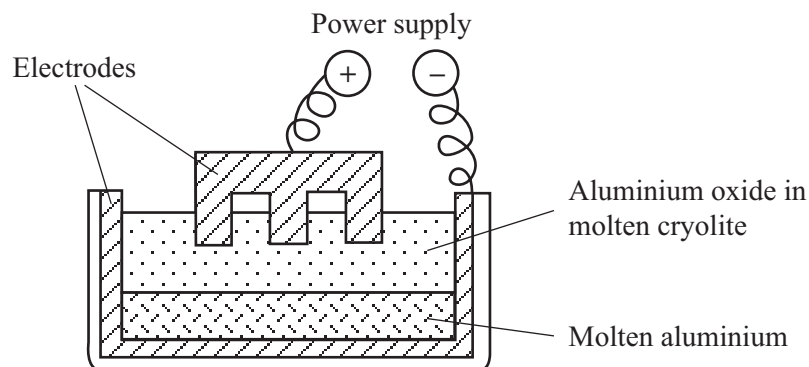
- A black.
- B green.
- C white.
- D yellow.

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

The diagram shows an electrolytic cell.

The cell is used to produce aluminium from aluminium oxide.



10.1 Aluminium is obtained from the main ore of aluminium which is

- A bauxite.
- B cryolite.
- C galena.
- D magnetite.

10.2 The electrodes of the cell are made from

- A carbon.
- B copper.
- C platinum.
- D steel.

10.3 The positive electrode needs to be regularly replaced because

- A it becomes coated with aluminium.
- B it burns away.
- C it dissolves.
- D it melts.

10.4 During electrolysis of the aluminium oxide, the aluminium and oxygen ions move as follows

	to the positive electrode	to the negative electrode
A	negative aluminium ions	positive oxygen ions
B	negative oxygen ions	positive aluminium ions
C	positive aluminium ions	negative oxygen ions
D	positive oxygen ions	negative aluminium 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**.

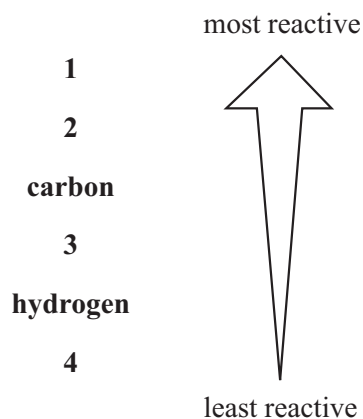
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QUESTION TWO

Chemical reactions can be represented by word equations.

Choose words from the list for each of the spaces **1–4** in the equations.

carbon dioxide

carbon monoxide

hydrogen

water

carbon dioxide + carbon \longrightarrow **1**

copper oxide + carbon \longrightarrow copper + **2**

potassium + water \longrightarrow potassium hydroxide + **3**

copper oxide + hydrochloric acid \longrightarrow copper chloride + **4**

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 THREEWhich **two** of the following substances dissolve in water to form alkaline solutions?**aluminium hydroxide****ammonia****copper hydroxide****iron hydroxide****sodium hydroxide****QUESTION FOUR**

This question is about sodium hydroxide and sulphuric acid and the reaction between them.

Which **two** of the statements **P**, **Q**, **R**, **S** and **T** are correct?**P** hydrogen ions make the sodium hydroxide solution alkaline**Q** sodium hydroxide and sulphuric acid react to produce a base**R** sodium hydroxide and sulphuric acid react to produce the salt, sodium sulphate**S** sodium hydroxide solution is alkaline because it contains OH^- (aq) ions**T** sulphuric acid solution contains H^+ (aq) ions

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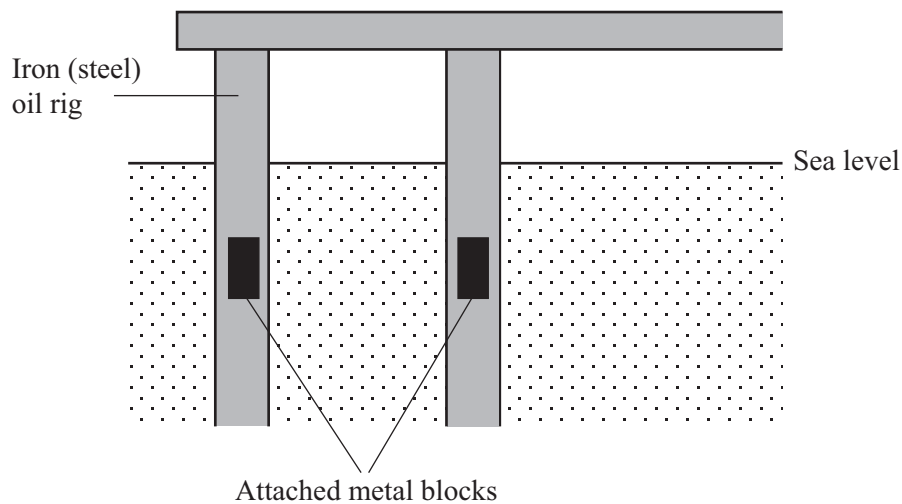
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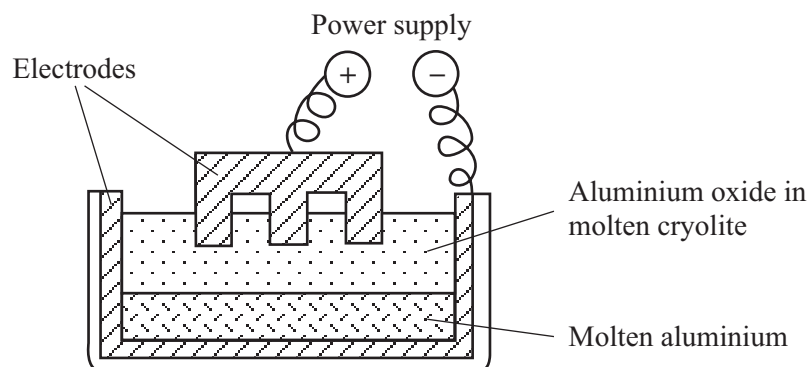
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Turn over ►

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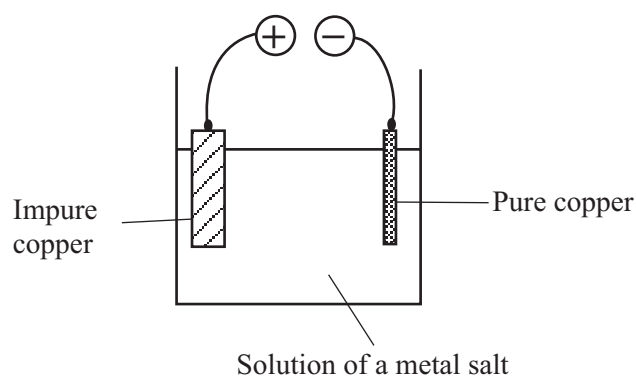
7.4 During electrolysis of the aluminium oxide, the aluminium and oxygen ions move as follows

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A	negative aluminium ions	positive oxygen ions
B	negative oxygen ions	positive aluminium ions
C	positive aluminium ions	negative oxygen ions
D	positive oxygen ions	negative aluminium ions

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

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



8.1 A suitable metal salt would be

- A aluminium chloride.
- B copper sulphate.
- C magnesium chloride.
- D magnesium sulphate.

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

- A Copper atoms gain electrons and form copper ions
- B Copper atoms lose electrons and form copper ions
- C Copper ions gain electrons and form copper atoms
- D Copper ions lose electrons and form copper atoms

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

- A $\text{Cu}^{2+} + 2\text{e}^- \longrightarrow \text{Cu}$
- B $\text{Cu}^{2+} - 2\text{e}^- \longrightarrow \text{Cu}$
- C $\text{Cu} + 2\text{e}^- \longrightarrow \text{Cu}^{2+}$
- D $\text{Cu} - 2\text{e}^- \longrightarrow \text{Cu}^{2+}$

8.4 The reaction at the negative electrode is

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

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

You can make a solution of a salt by reacting an acid with an alkali.

9.1 Which salt is produced in this reaction?

ammonia solution + nitric acid \longrightarrow ? + water

- A** ammonia
- B** ammonium chloride
- C** ammonium nitrate
- D** ammonium sulphate

9.2 When the ammonia solution is completely neutralised by the nitric acid solution, the reaction can be written

- A** $\text{H}^{\text{-(aq)}} + \text{OH}^{\text{+(aq)}} \longrightarrow \text{H}_2\text{O(l)}$
- B** $\text{H}^{\text{+(aq)}} + \text{OH}^{\text{-(aq)}} \longrightarrow \text{H}_2\text{O(l)}$
- C** $\text{H}^{\text{+(aq)}} - \text{OH}^{\text{-(aq)}} \longrightarrow \text{H}_2\text{O(l)}$
- D** $\text{H}^{\text{(aq)}} - \text{OH}^{\text{(aq)}} \longrightarrow \text{H}_2\text{O(l)}$

9.3 A molecule of nitric acid (HNO_3) has one hydrogen atom which can be replaced by a metal to form a normal salt. When the acid molecule has two or more replaceable hydrogen atoms, normal or acid salts may be formed.

Which one of these acids will form acid salts?

- A** Carbonic acid, H_2CO_3
- B** Hydriodic acid, HI
- C** Hydrobromic acid, HBr
- D** Hydrochloric acid, HCl

9.4 Which of these substances will react with nitric acid to produce the salt, copper nitrate?

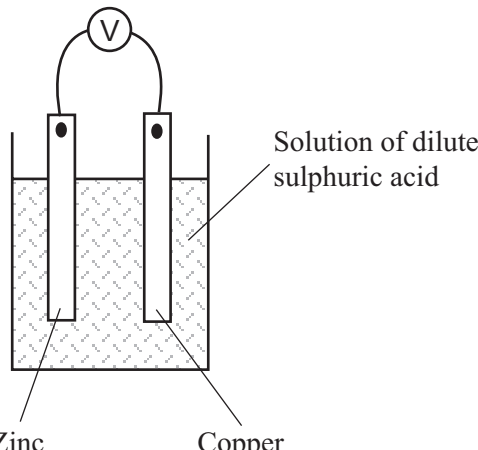
- A** Copper bromide
- B** Copper chloride
- C** Copper oxide
- D** Copper sulphate

QUESTION TEN

This question is about simple cells.

You may find this information useful in answering this 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 potential difference (in volts) across the two metals.



Solution of dilute sulphuric acid

Zinc Copper

Zn²⁺ = a zinc ion
Cu²⁺ = a copper ion

The electrode potential of a metal is a measure of the ease with which it can lose electrons. The more negative it is then the more easily it 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 Which of these equations shows what happens at the zinc plate?

- A Zn \longrightarrow Zn²⁺ + 2e⁻
- B Zn²⁺ - 2e⁻ \longrightarrow Zn
- C Zn²⁺ + 2e⁻ \longrightarrow Zn
- D Zn²⁺ + 2e⁻ \longrightarrow Zn⁴⁺

10.2 As the reaction proceeds, the zinc plate

- A will be coated in copper.
- B will gradually dissolve.
- C will have more zinc deposited on it.
- D will turn a red-brown colour.

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

What is the potential difference of a simple cell with zinc and copper electrodes?

- A 0.4 volts
- B 0.5 volts
- C 1.1 volts
- D 1.7 volts

10.4 Which two metals from the list would give a potential difference of 2 volts?

- A Lead and iron
- B Magnesium and iron
- C Silver and copper
- D Silver and magnesium

END OF TEST