Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
June 2006

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

Tuesday 27 June 2006 Morning Session

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

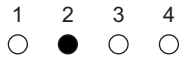
You may use a calculator.

Time allowed: 30 minutes

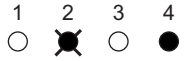
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Metals' printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or**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

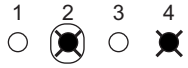
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 part of the periodic table.

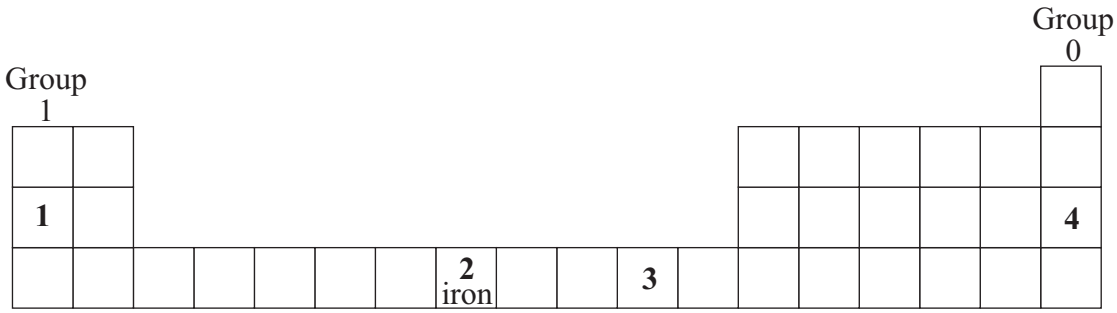
Match words from the list with the numbers **1–4** in the table.

a metal that weathers to a green colour

a metal used in the form of steel

an alkali metal

argon



QUESTION TWO

This question is about solutions.

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

acidic

alkaline

aqueous

neutral

Dissolving a substance in water produces an . . . **1** . . . solution.

Hydrogen ions make a solution . . . **2** . . . .

Hydroxide ions make a solution . . . **3** . . . .

When an acid completely reacts with an alkali, the resulting solution is . . . **4** . . . .

QUESTION THREE

This question is about the properties of some metals.

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

conduct

corrode

cut

melt

All metals . . . **1** . . . electricity easily.

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

Transition metals are less reactive than alkali metals, so they . . . **3** . . . more slowly.

Alkali metals . . . **4** . . . at much lower temperatures than transition metals.

QUESTION FOUR

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

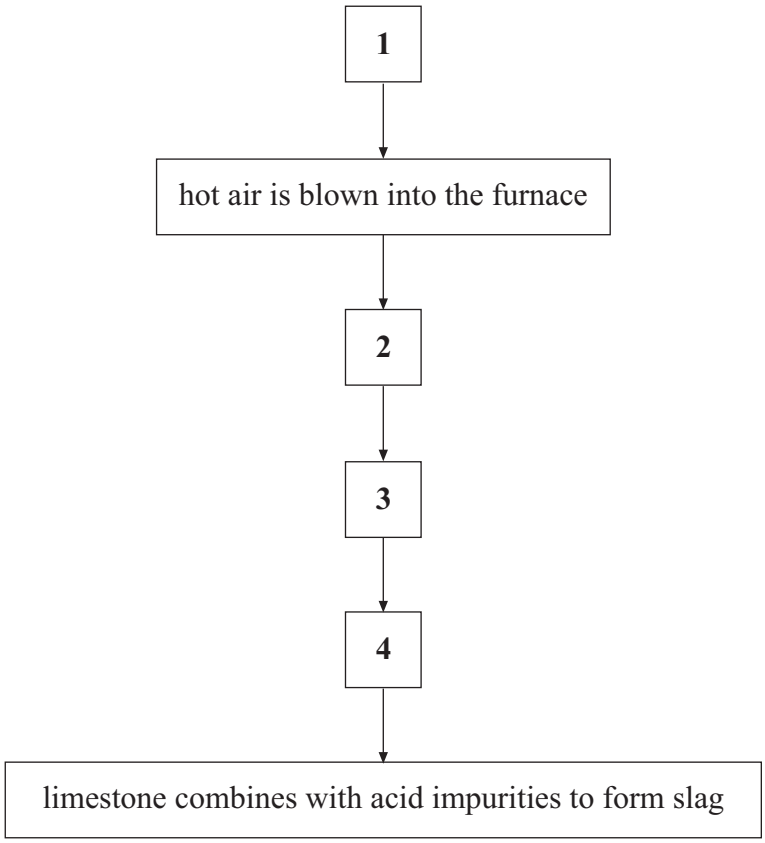
Match the statements, **P**, **Q**, **R** and **S**, from the list with the numbers **1–4** to explain what happens in this process.

P **carbon dioxide reacts with coke to make carbon monoxide**

Q **carbon monoxide reacts with iron oxide to make iron**

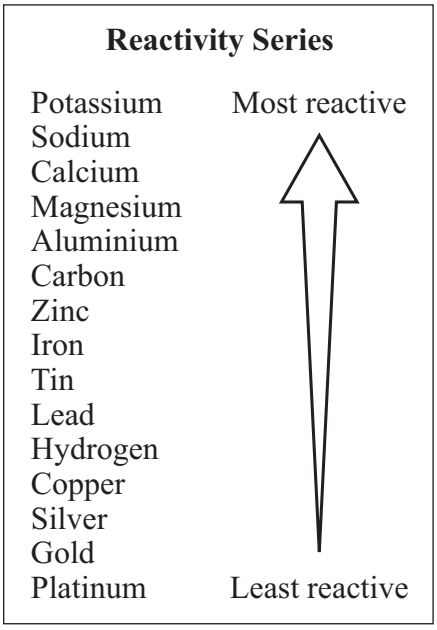
R **coke burns to make carbon dioxide**

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



QUESTION FIVE

(You may find it helpful to use the reactivity series when you answer this question.)



The table is about 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 is extracted from its ore, haematite
2	it is found in the Earth's crust as the metal itself
3	it is in Group 1 of the periodic table
4	it is less reactive than calcium but it **cannot** be extracted from its ore using carbon

SECTION B

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

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

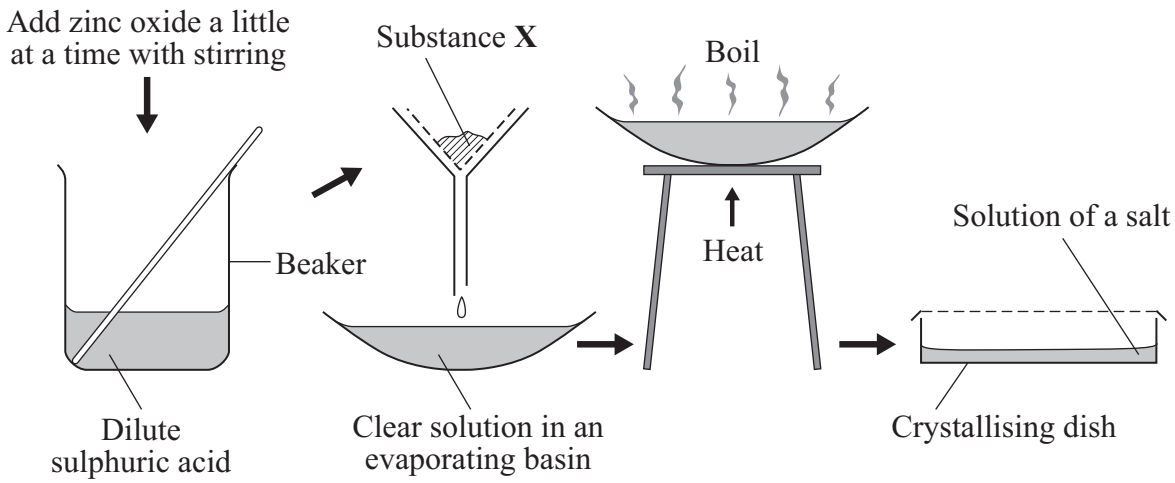
Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

Zinc is a transition metal.

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



Which **two** statements about this preparation are correct?

the clear solution in the evaporating basin is alkaline

the salt in the crystallising dish is zinc sulphate

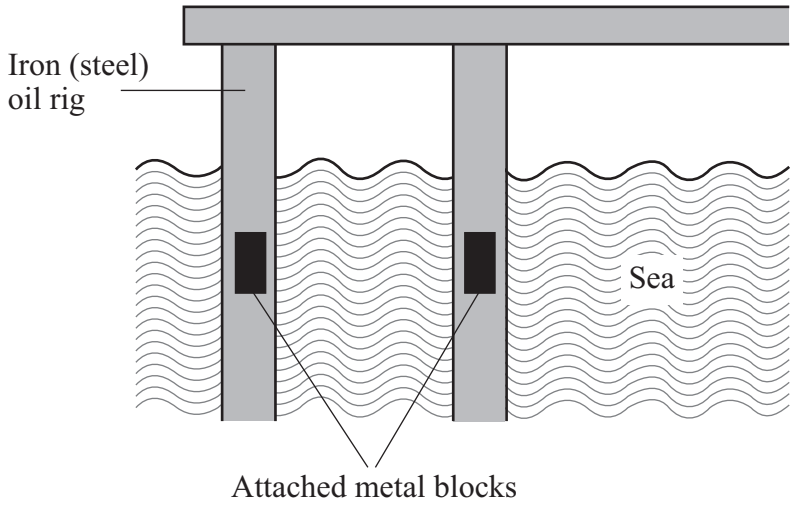
the solution of the salt is boiled to remove excess acid

the substance X in the filter funnel is zinc sulphate

zinc oxide is added to the dilute sulphuric acid until no more will react

QUESTION SEVEN

The diagram shows part of an oil rig made from iron (steel).



Reactivity Series

Magnesium	Most reactive
Zinc	
Iron	
Tin	
Lead	Least reactive

Which **two** of the statements, **G**, **H**, **I**, **J** and **K**, are correct?

G **attaching zinc metal blocks speeds up the corrosion of iron (steel)**

H **iron corrodes more slowly than most other transition metals**

I **protection of one metal by attaching another metal is called 'redox protection'**

J **the iron (steel) does not corrode if the metal blocks are made from magnesium**

K **unprotected iron (steel) corrodes when in contact with air and water**

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 table gives information about the composition of two metal alloys, stainless steel and duralumin.

Stainless steel	Duralumin
Iron 74 %	Aluminium 95 %
Chromium 18 %	Copper 4 %
Nickel 8 %	Magnesium 0.5 %
	Manganese 0.5 %

8.1 Iron, chromium and nickel all belong to the block of metallic elements called . . .

A alkali metals.

B alkaline earth metals.

C noble metals.

D transition metals.

8.2 What is the main advantage of stainless steel compared to iron?

A Stainless steel does not corrode.

B Stainless steel is a better conductor of electricity.

C Stainless steel is less shiny.

D Stainless steel is lighter.

8.3 Duralumin is used in aircraft construction.

What is the main advantage of duralumin compared to aluminium?

A Duralumin has a lower melting point.

B Duralumin is a better heat conductor.

C Duralumin is lighter.

D Duralumin is stronger.

8.4 Aluminium metal, although reactive, corrodes only on its surface.

This is because it is then protected by . . .

A a film of water.

B a layer of alloy.

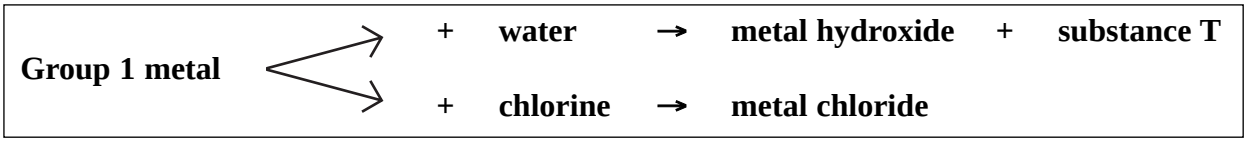
C a layer of aluminium oxide.

D an oily deposit.

Turn over for the next question

QUESTION NINE

The information in the box below shows how the Group 1 metals react with water and with the non-metal, chlorine.



9.1 Substance **T** is . . .

A carbon dioxide.

B hydrogen.

C oxygen.

D water.

9.2 The metal chloride in the box could be . . .

A copper chloride.

B iron chloride.

C platinum chloride.

D potassium chloride.

9.3 The metal chloride in the box is . . .

A a blue solid, soluble in water.

B a green solid, soluble in water.

C a white solid, insoluble in water.

D a white solid, soluble in water.

9.4 The Group 1 metals . . .

A are hard and strong.

B conduct heat.

C have high densities.

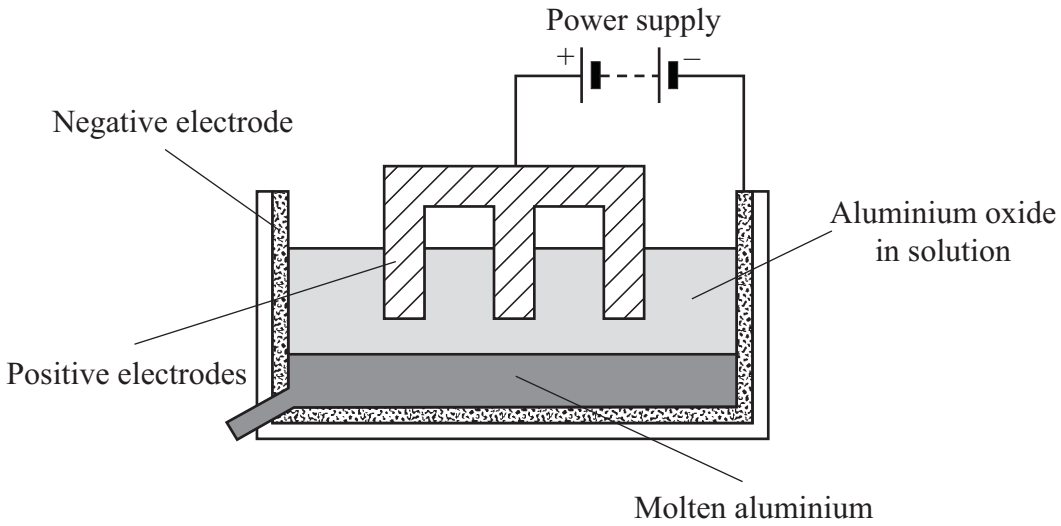
D have high melting points.

Turn over for the next question

QUESTION TEN

Aluminium is produced by passing an electric current through dissolved aluminium oxide.

The process takes places in an electrolytic cell.



10.1 What are the electrodes made from?

A Carbon

B Chromium

C Iron

D Platinum

10.2 Some of the electrodes have to be replaced frequently.

What type of reaction destroys the electrodes?

A Condensation

B Deposition

C Oxidation

D Reduction

10.3 In the cell, the aluminium oxide has to be dissolved so that . . .

A the aluminium oxide can be poured into the cell.

B the aluminium produced is molten.

C the ions can move to the electrodes.

D the rate of reaction is increased.

10.4 Where is the aluminium formed and why?

	Where formed	**Reason**
A	at the negative electrode	the aluminium ions have a negative charge
B	at the negative electrode	the aluminium ions have a positive charge
C	at the positive electrodes	the aluminium ions have a negative charge
D	at the positive electrodes	the aluminium ions have a positive charge

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

(You may find it helpful to use the reactivity series when you answer the question opposite.)

Reactivity Series

Potassium	Most reactive
Sodium	
Calcium	
Magnesium	
Aluminium	
Carbon	
Zinc	
Iron	
Tin	
Lead	
Hydrogen	
Copper	
Silver	
Gold	
Platinum	Least reactive

The table is about 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 is extracted from its ore, haematite
2	it is found in the Earth's crust as the metal itself
3	it is in Group 1 of the periodic table
4	it is less reactive than calcium but it **cannot** be extracted from its ore using carbon

QUESTION TWO

Chemical reactions can be represented by word equations.

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

carbon dioxide

copper

copper chloride

iron sulphate

copper hydroxide + hydrochloric acid → . . . **1** . . . + water

copper oxide + hydrogen → . . . **2** . . . + water

lead sulphate + iron → lead + . . . **3** . . .

tin oxide + carbon → tin + . . . **4** . . .

SECTION B

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

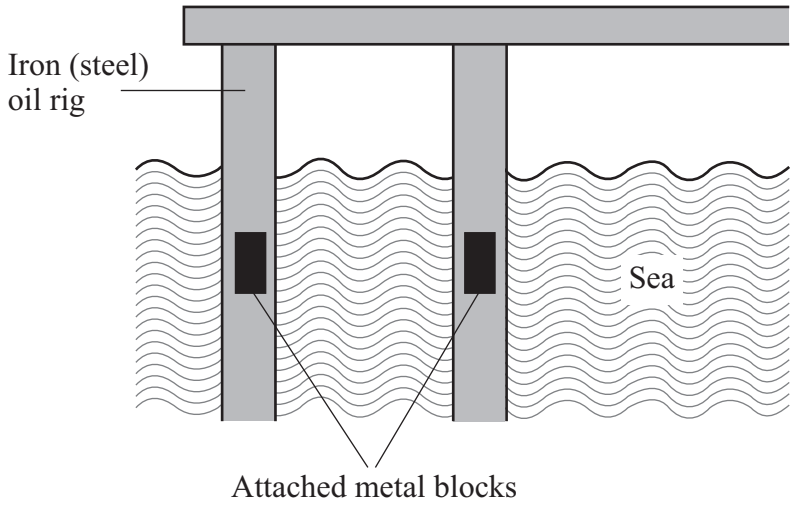
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows part of an oil rig made from iron (steel).



Reactivity Series

Magnesium	Most reactive
Zinc	
Iron	
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Lead	Least reactive

Which **two** of the statements, **G**, **H**, **I**, **J** and **K**, are correct?

G **attaching zinc metal blocks speeds up the corrosion of iron (steel)**

H **iron corrodes more slowly than most other transition metals**

I **protection of one metal by attaching another metal is called 'redox protection'**

J **the iron (steel) does not corrode if the metal blocks are made from magnesium**

K **unprotected iron (steel) corrodes when in contact with air and water**

QUESTION FOUR

Which **two** of the reactions, **P**, **Q**, **R**, **S** and **T**, are redox reactions?

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

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

R **lead oxide + hydrogen → lead + water**

S **oxygen ions lose electrons to form oxygen molecules**

T **sodium hydroxide + hydrochloric acid → sodium chloride + water**

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 table gives information about the composition of two metal alloys, stainless steel and duralumin.

Stainless steel	Duralumin
Iron 74 %	Aluminium 95 %
Chromium 18 %	Copper 4 %
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5.1 Iron, chromium and nickel all belong to the block of metallic elements called . . .

A alkali metals.

B alkaline earth metals.

C noble metals.

D transition metals.

5.2 What is the main advantage of stainless steel compared to iron?

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B Stainless steel is a better conductor of electricity.

C Stainless steel is less shiny.

D Stainless steel is lighter.

5.3 Duralumin is used in aircraft construction.

What is the main advantage of duralumin compared to aluminium?

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B Duralumin is a better heat conductor.

C Duralumin is lighter.

D Duralumin is stronger.

5.4 Aluminium metal, although reactive, corrodes only on its surface.

This is because it is then protected by . . .

A a film of water.

B a layer of alloy.

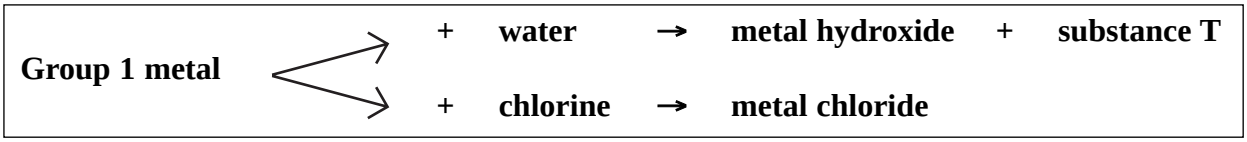
C a layer of aluminium oxide.

D an oily deposit.

Turn over for the next question

QUESTION SIX

The information in the box below shows how the Group 1 metals react with water and with the non-metal, chlorine.



6.1 Substance **T** is . . .

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B hydrogen.

C oxygen.

D water.

6.2 The metal chloride in the box could be . . .

A copper chloride.

B iron chloride.

C platinum chloride.

D potassium chloride.

6.3 The metal chloride in the box is . . .

A a blue solid, soluble in water.

B a green solid, soluble in water.

C a white solid, insoluble in water.

D a white solid, soluble in water.

6.4 The Group 1 metals . . .

A are hard and strong.

B conduct heat.

C have high densities.

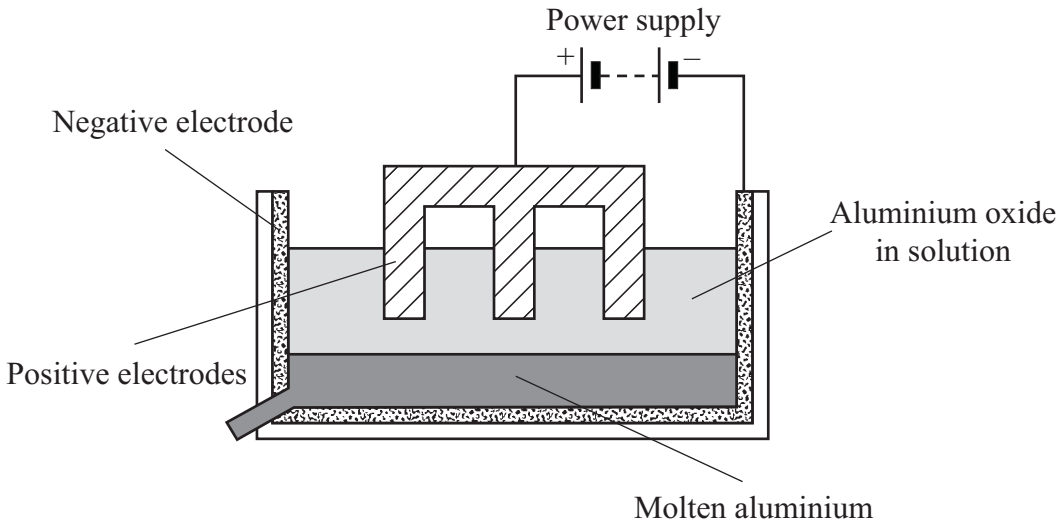
D have high melting points.

Turn over for the next question

QUESTION SEVEN

Aluminium is produced by passing an electric current through dissolved aluminium oxide.

The process takes place in an electrolytic cell.



7.1 What are the electrodes made from?

A Carbon

B Chromium

C Iron

D Platinum

7.2 Some of the electrodes have to be replaced frequently.

What type of reaction destroys the electrodes?

A Condensation

B Deposition

C Oxidation

D Reduction

7.3 In the cell, the aluminium oxide has to be dissolved so that . . .

A the aluminium oxide can be poured into the cell.

B the aluminium produced is molten.

C the ions can move to the electrodes.

D the rate of reaction is increased.

7.4 Where is the aluminium formed and why?

	Where formed	Reason
A	at the negative electrode	the aluminium ions have a negative charge
B	at the negative electrode	the aluminium ions have a positive charge
C	at the positive electrodes	the aluminium ions have a negative charge
D	at the positive electrodes	the aluminium ions have a positive charge

Turn over for the next question

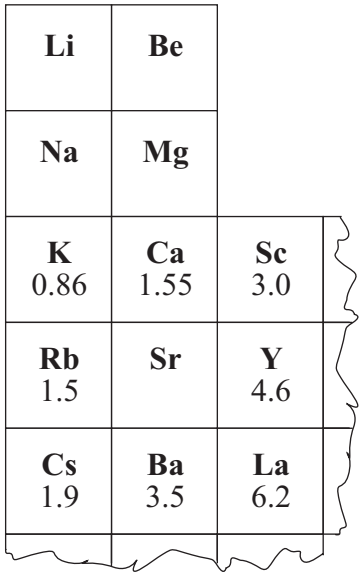
QUESTION EIGHT

This question is about the metal strontium (Sr).

The diagram shows part of the periodic table. The density of some of the metals is shown.

The density of a substance is the mass in grams of 1 cubic centimetre of the substance. So the density of calcium (Ca) is 1.55 g/cm^3.

Density changes in a fairly regular way within a Group of the periodic table.



8.1 Which value is most likely to be the density of strontium?

A 0.6 g/cm^3

B 1.6 g/cm^3

C 2.6 g/cm^3

D 3.6 g/cm^3

In both Groups 1 and 2, the metals lower down the group are more reactive. Calcium is about as reactive as lithium.

8.2 Which of the following best describes the reactivity of strontium?

A Similar to barium (Ba)

B Similar to caesium (Cs)

C Similar to magnesium (Mg)

D Similar to sodium (Na)

Lithium and calcium both react with water. Hydrogen gas is given off. The metal hydroxide is also formed. Lithium hydroxide is soluble in water; calcium hydroxide is only slightly soluble in water.

8.3 What happens when strontium reacts with water?

A Carbon dioxide gas is given off and the solution goes cloudy.

B Carbon dioxide gas is given off and the solution remains clear.

C Hydrogen gas is given off and the solution goes cloudy.

D Hydrogen gas is given off and the solution remains clear.

8.4 Which of the following statements best describes how the water changes as strontium reacts with it?

A It becomes more acidic.

B It becomes more alkaline.

C It becomes neutral.

D It stays neutral.

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 What is the salt **S** produced in this reaction?

sulphuric acid + ammonia solution → salt **S** + water

A Ammonium chloride

B Ammonium hydroxide

C Ammonium nitrate

D Ammonium sulphate

9.2 Which equation shows the reaction when sulphuric acid is completely neutralised by the ammonia solution?

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

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

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

D $H^-(aq) + OH^+(aq) \rightarrow H^{2+}O^-(l)$

9.3 At the neutral point, the mixture contains . . .

A salt **S** and water.

B salt **S**, ammonia solution and water.

C salt **S**, sulphuric acid and water.

D salt **S** only.

9.4 Which of these reactions makes the salt, copper sulphate?

A Copper bromide + sulphuric acid

B Copper chloride + sulphuric acid

C Copper nitrate + sulphuric acid

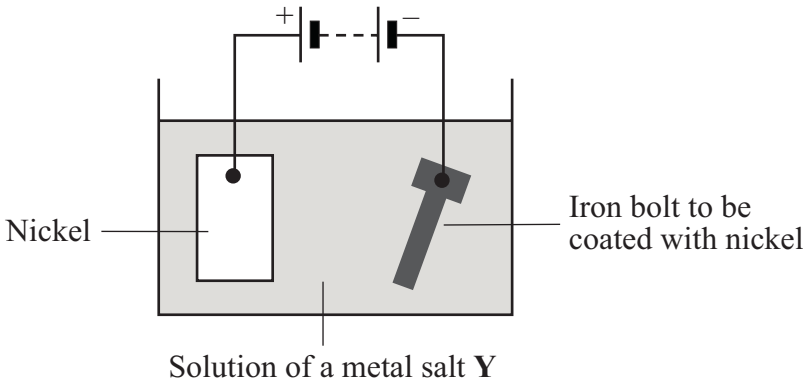
D Copper oxide + sulphuric acid

Turn over for the next question

QUESTION TEN

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.



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

A aluminium nitrate.

B copper sulphate.

C iron chloride.

D nickel sulphate.

10.2 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.

10.3 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.

10.4 The reaction at the negative electrode is . . .

A a displacement reaction.

B an oxidation reaction.

C a redox reaction.

D a reduction reaction.

END OF TEST

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