

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2005



SCIENCE: SINGLE AWARD A (MODULAR)
Materials and Reactions (Module 15)

346015

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 “Materials and Reactions” 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 16 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.

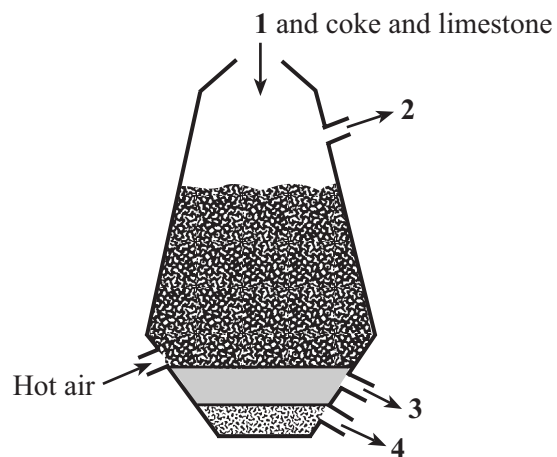
Match words from the list with the labels **1–4** on the diagram.

iron ore

molten iron

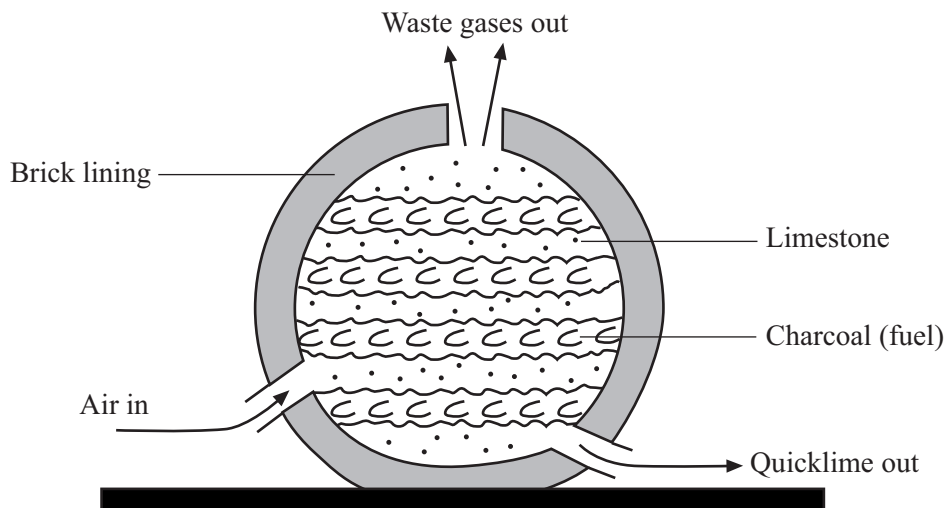
slag

waste gases



QUESTION TWO

The diagram shows a simple lime kiln.
When the limestone is heated, it decomposes.



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

calcium carbonate

calcium hydroxide

calcium oxide

carbon dioxide

Limestone is mainly **1**

In the lime kiln, the limestone decomposes into quicklime and **2**

The chemical name of quicklime is **3**

When water and quicklime are mixed, they react to form **4**

Turn over ►

QUESTION THREE

The diagram shows stages in the cracking of hydrocarbons.

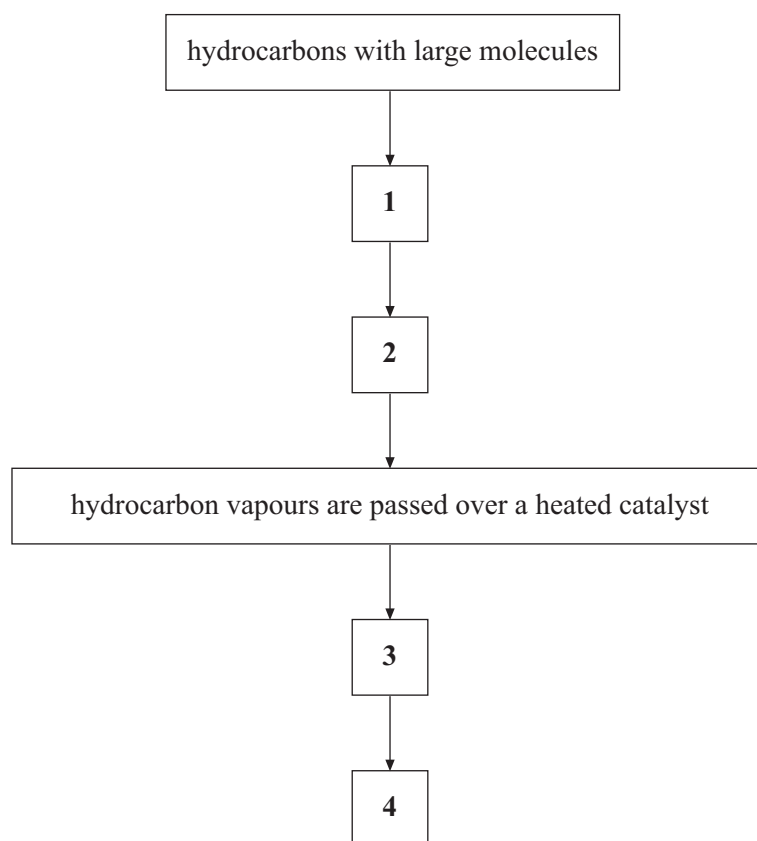
Match words from the list with the numbers 1–4 to show what happens in this process.

hydrocarbons are heated

hydrocarbons vaporise

hydrocarbons with small molecules

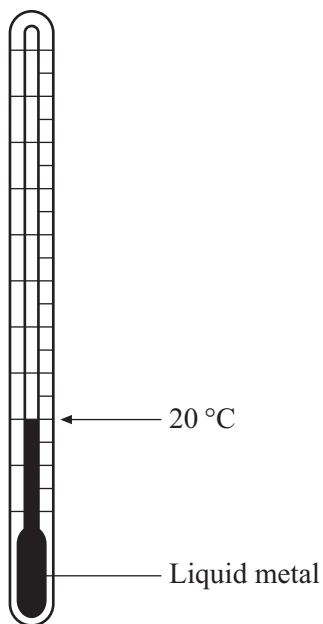
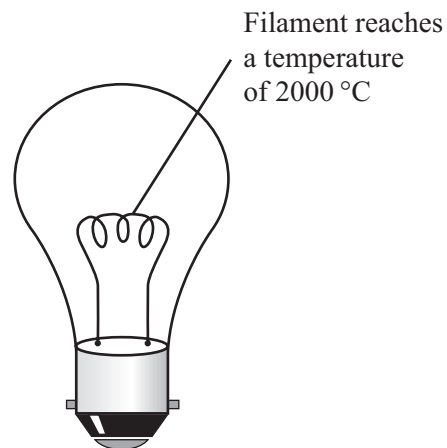
thermal decomposition occurs



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

Turn over ►

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.

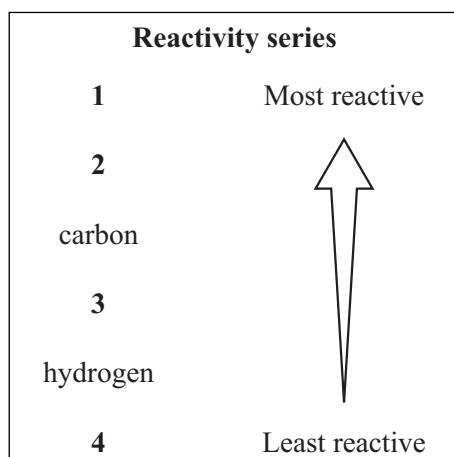
Match metals from the list with the numbers **1–4** in the reactivity series.

metal K

metal L

metal M

metal N



NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

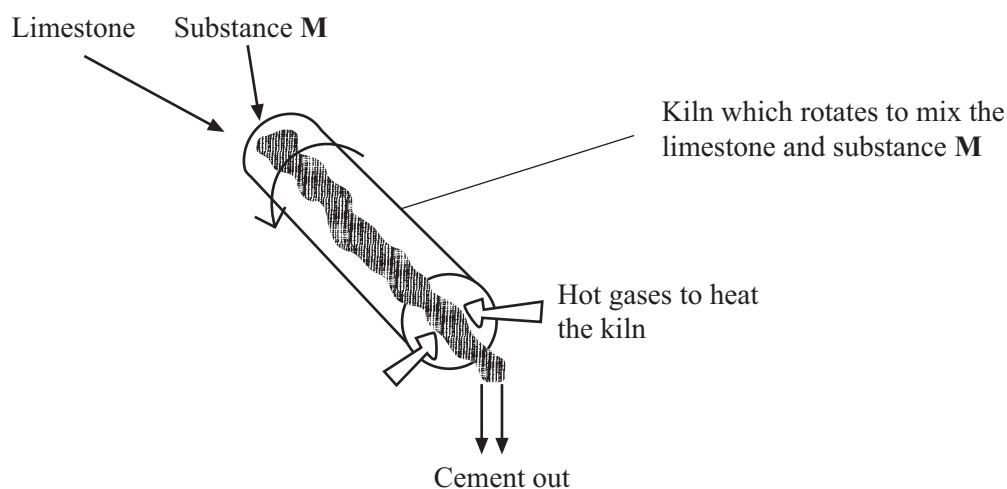
Turn over ►

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

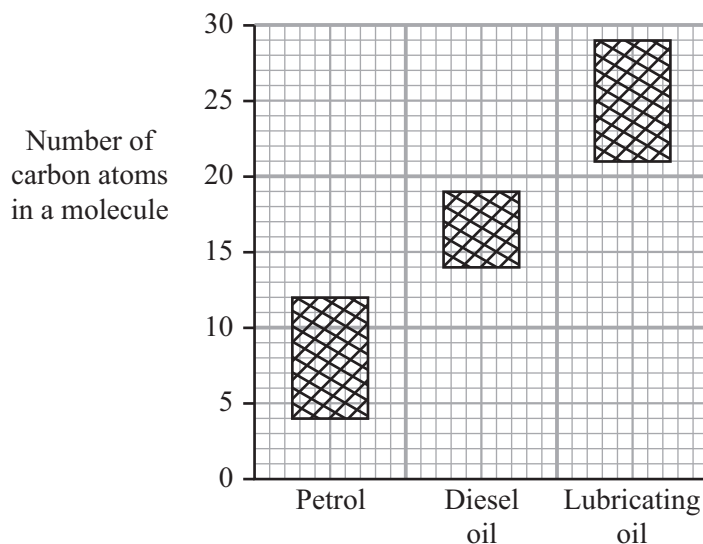
Cement is produced in a rotating kiln.

Which **two** of the following statements about the production of cement are correct?**limestone and substance M react when they are heated together****limestone and substance M react when they are mixed together****substance M is a mixture of clay and quicklime****substance M is a mixture of clay and slaked lime****substance M is clay**

QUESTION SEVEN

Petrol, diesel oil and lubricating oil are three of the fractions obtained by the fractional distillation of crude oil.

The shaded areas on the chart show the number of carbon atoms in the hydrocarbon molecules in these fractions.



Which **two** of the following statements are correct?

lubricating oil flows more easily than petrol

lubricating oil is more volatile than petrol

petrol ignites more easily than diesel oil

the boiling point of diesel oil is higher than the boiling point of petrol

the hydrocarbon molecules in petrol are larger than those in diesel oil

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 Haematite is

- A a non-metal element.
- B a transition element.
- C an alloy.
- D an iron ore.

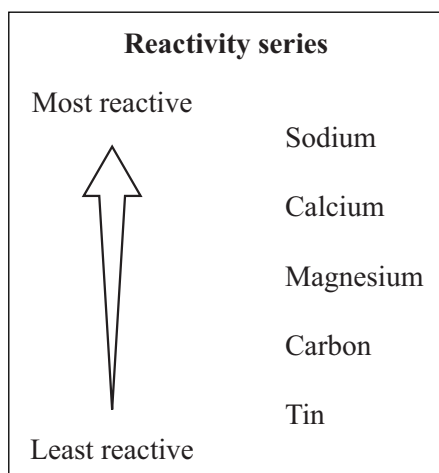
Some metals can be obtained by heating the metal oxide with carbon.

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 → metal + carbon dioxide
- B metal oxide + carbon → metal + hydrogen
- C metal oxide + carbon → metal + oxygen
- D metal oxide + carbon → 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 ►

QUESTION NINE

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

Group 1		Group 2		Central block						Group 3		Group 4		Group 0	
															He
Na	Mg									Al	C				Ar
K	Ca				Cr		Fe								

9.1 Which element is a non-metal?

- A Al (aluminium)
- B C (Carbon)
- C Mg (magnesium)
- D Na (sodium)

9.2 Which two elements are transition metals?

- A Al (aluminium) and Mg (magnesium)
- B Ca (calcium) and Fe (iron)
- C Cu (copper) and Fe (iron)
- D Mg (magnesium) and Na (sodium)

9.3 K (potassium) has a lower relative atomic mass than Ar (argon), but comes after argon in the periodic table.

K (potassium) is placed in Group 1 because

- A it has similar properties to the other Group 1 metals.
- B it is more reactive than argon.
- C it is not a transition metal.
- D it reacts with water.

9.4 Which metal is mixed with iron to make stainless steel?

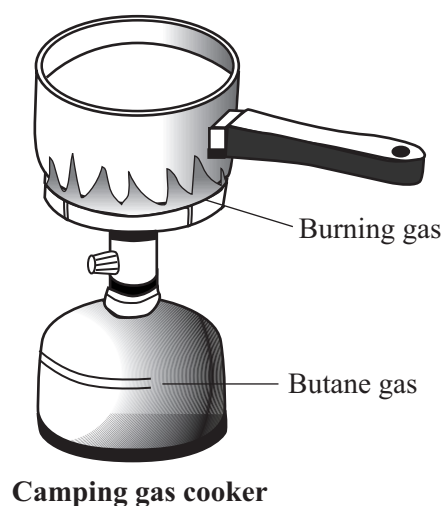
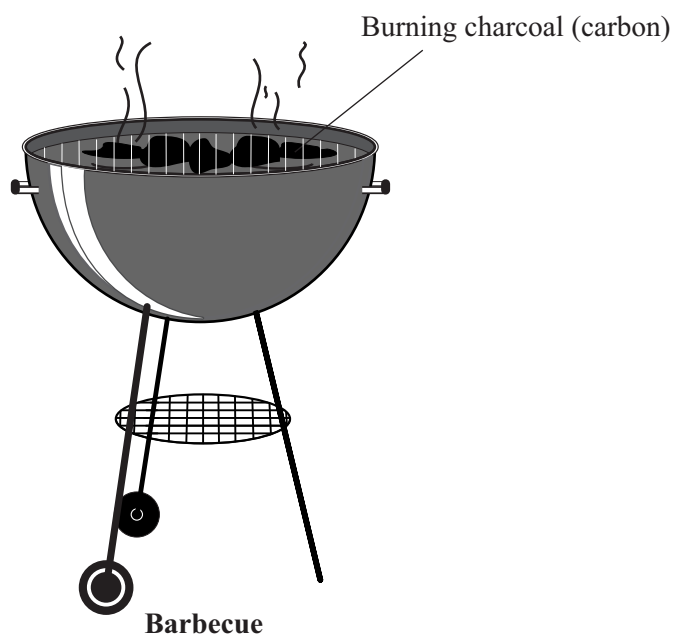
- A** Al (aluminium)
- B** Ca (calcium)
- C** Cr (chromium)
- D** Cu (copper)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

Campers sometimes cook food on a barbecue or on a camping gas cooker.



10.1 Which gas is produced when charcoal (carbon) burns?

- A Carbon dioxide
- B Nitrogen
- C Oxygen
- D Water (vapour)

10.2 Butane is a hydrocarbon.

Which elements does butane contain?

- A Carbon and hydrogen
- B Carbon and oxygen
- C Carbon, hydrogen and oxygen
- D Hydrogen and oxygen

10.3 Which word equation shows the reaction when butane burns?

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

10.4 Some fuels also produce sulphur dioxide when they burn.

This is because they contain

- A dioxide.
- B oxygen.
- C sodium.
- D sulphur.

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.

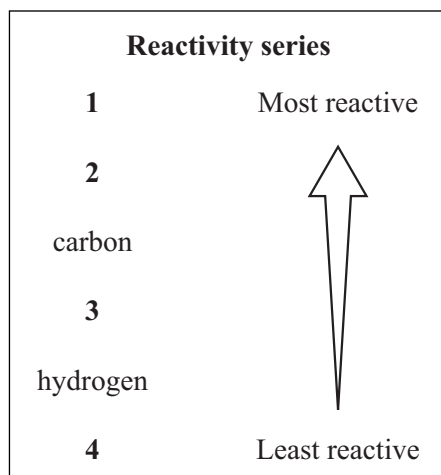
Match metals from the list with the numbers **1–4** in the reactivity series.

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** carbon monoxide reacts with oxygen to form carbon dioxide
- M** copper carbonate breaks down when heated into carbon dioxide and copper oxide
- N** iron oxide reacts with carbon monoxide to form iron
- P** sodium hydroxide solution reacts with dilute sulphuric acid to form sodium sulphate and water

Chemical reaction	Type of reaction
1	decomposition
2	neutralisation
3	oxidation
4	reduction

TURN OVER FOR THE NEXT QUESTION

Turn over ►

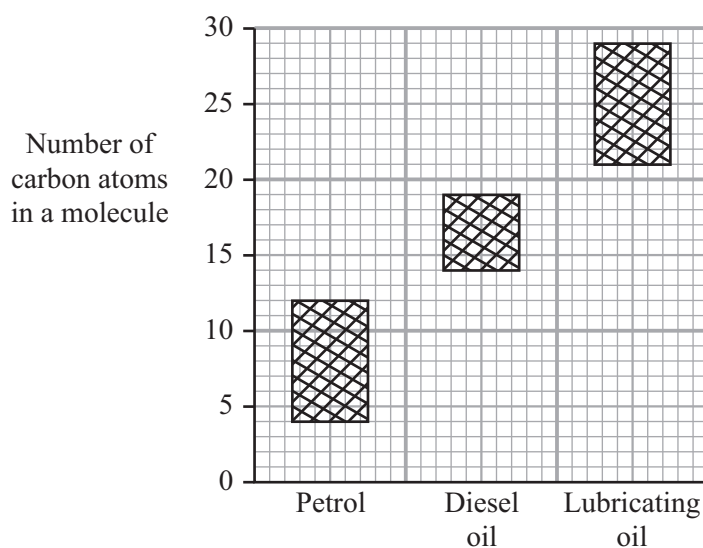
SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

Petrol, diesel oil and lubricating oil are three of the fractions obtained by the fractional distillation of crude oil.

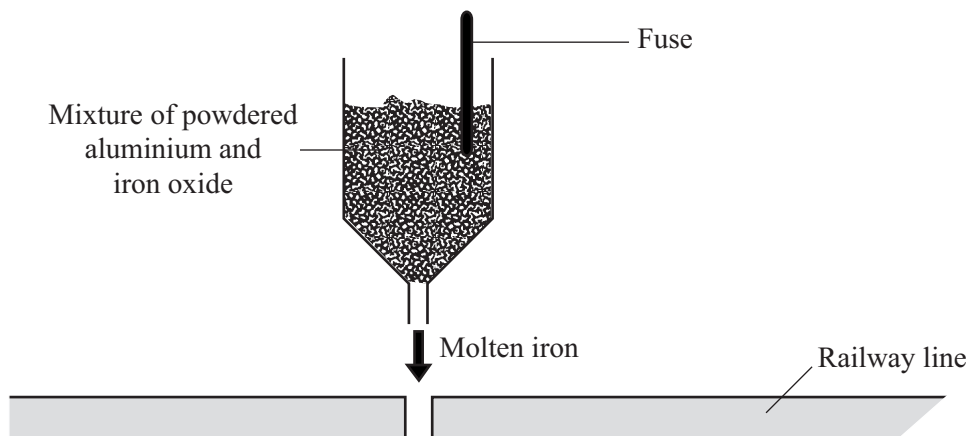
The shaded areas on the chart show the number of carbon atoms in the hydrocarbon molecules in these fractions.

Which **two** of the following statements are correct?**lubricating oil flows more easily than petrol****lubricating oil is more volatile than petrol****petrol ignites more easily than diesel oil****the boiling point of diesel oil is higher than the boiling point of petrol****the hydrocarbon molecules in petrol are larger than those in diesel oil**

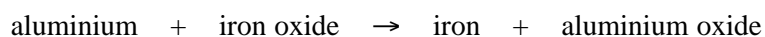
QUESTION FOUR

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 Haematite is

- A** a non-metal element.
- B** a transition element.
- C** an alloy.
- D** an iron ore.

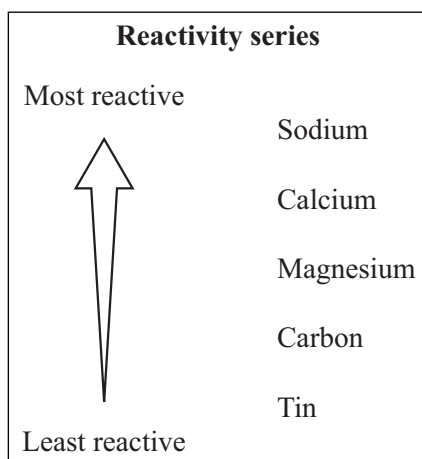
Some metals can be obtained by heating the metal oxide with carbon.

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 \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



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 ►

QUESTION SIX

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

Group 1		Group 2		Central block						Group 3		Group 4		Group 0	
											C				He
Na	Mg									Al					Ar
K	Ca				Cr										

6.1 Which element is a non-metal?

- A Al (aluminium)
- B C (carbon)
- C Mg (magnesium)
- D Na (sodium)

6.2 Which two elements are transition metals?

- A Al (aluminium) and Mg (magnesium)
- B Ca (calcium) and Fe (iron)
- C Cu (copper) and Fe (iron)
- D Mg (magnesium) and Na (sodium)

6.3 K (potassium) has a lower relative atomic mass than Ar (argon), but comes after argon in the periodic table.

K (potassium) is placed in Group 1 because

- A it has similar properties to the other Group 1 metals.
- B it is more reactive than argon.
- C it is not a transition metal.
- D it reacts with water.

6.4 Which metal is mixed with iron to make stainless steel?

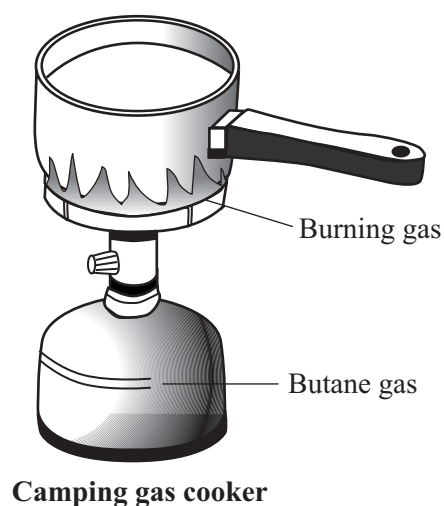
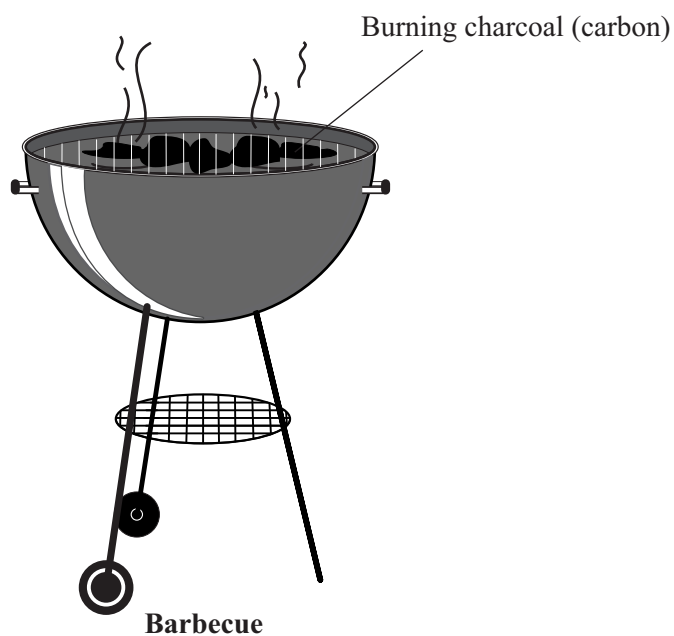
- A** Al (aluminium)
- B** Ca (calcium)
- C** Cr (chromium)
- D** Cu (copper)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

Campers sometimes cook food on a barbecue or on a camping gas cooker.



7.1 Which gas is produced when charcoal (carbon) burns?

- A Carbon dioxide
- B Nitrogen
- C Oxygen
- D Water (vapour)

7.2 Butane is a hydrocarbon.

Which elements does butane contain?

- A Carbon and hydrogen
- B Carbon and oxygen
- C Carbon, hydrogen and oxygen
- D Hydrogen and oxygen

7.3 Which word equation shows the reaction when butane burns?

A butane + oxygen \rightarrow carbon dioxide + hydrogen

B butane + oxygen \rightarrow carbon dioxide + water

C carbon dioxide + hydrogen \rightarrow butane + oxygen

D carbon dioxide + water \rightarrow butane + oxygen

7.4 Some fuels also produce sulphur dioxide when they burn.

This is because they contain

A dioxide.

B oxygen.

C sodium.

D sulphur.

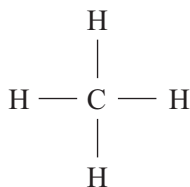
TURN OVER FOR THE NEXT QUESTION

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QUESTION EIGHT

This question is about saturated and unsaturated hydrocarbons.

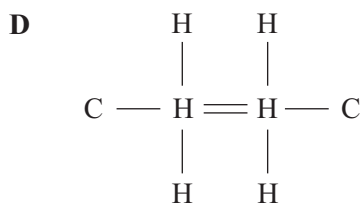
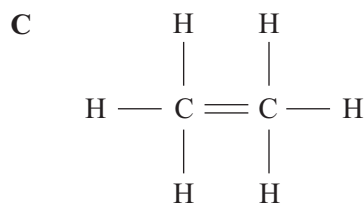
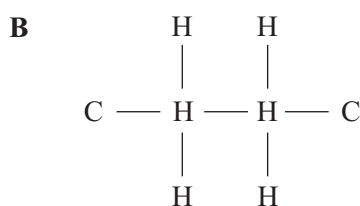
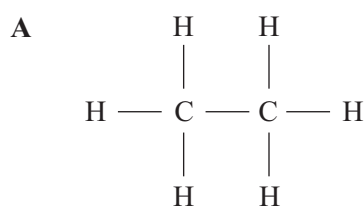
The saturated hydrocarbon with the smallest molecules is called methane.



**Structural formula of methane
showing the bonds between the atoms**

8.1 The next saturated hydrocarbon in the series is ethane, C_2H_6

What is the structural formula for ethane?



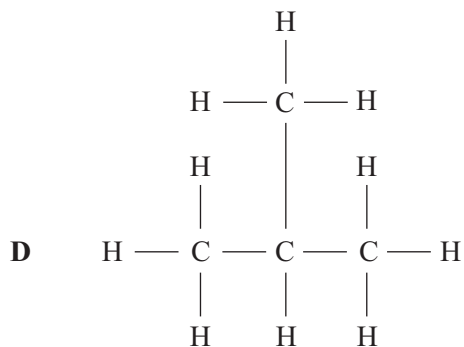
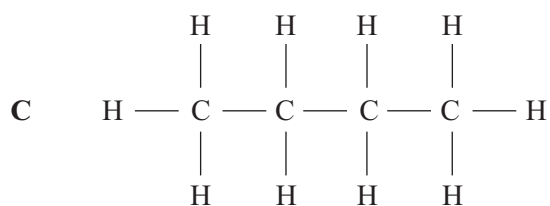
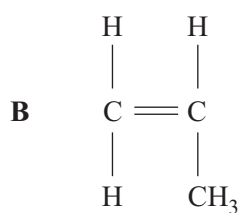
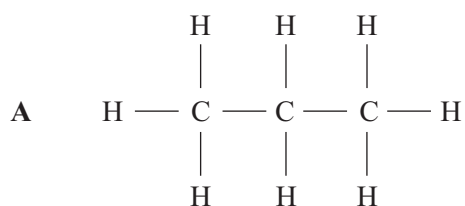
8.2 Which line shows the number of bonds to each carbon and hydrogen atom in a saturated hydrocarbon molecule?

	Bonds to each carbon atom	Bonds to each hydrogen atom
A	1	1
B	1	4
C	4	1
D	4	4

8.3 The simplest unsaturated hydrocarbon is

- A butane.
- B ethane.
- C ethene.
- D propene.

8.4 Which of the following is an unsaturated hydrocarbon?



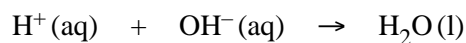
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

This question is about making salts.

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



9.1 What type of reaction does this equation represent?

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

9.2 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 |

9.3 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 |

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

Which word equation shows the reaction?

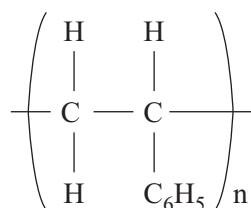
- A ammonia solution + hydrochloric acid \rightarrow ammonium chloride + hydrogen
- B ammonia solution + hydrochloric acid \rightarrow ammonium chloride + water
- C ammonia solution + hydrochloric acid \rightarrow ammonium chloride + water + hydrogen
- D ammonium sulphate + hydrochloric acid \rightarrow ammonium chloride + hydrogen

TURN OVER FOR THE NEXT QUESTION

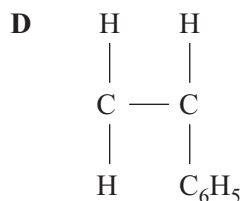
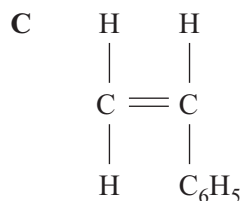
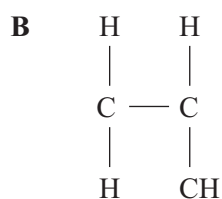
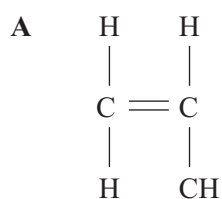
Turn over ►

QUESTION TEN

The polymer, poly(styrene), can be represented like this:



10.1 The monomer from which this polymer is formed is



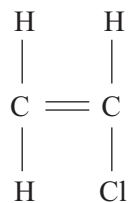
10.2 The monomer is

- A** a saturated alkene.
- B** a saturated hydrocarbon.
- C** an oxide.
- D** an unsaturated hydrocarbon.

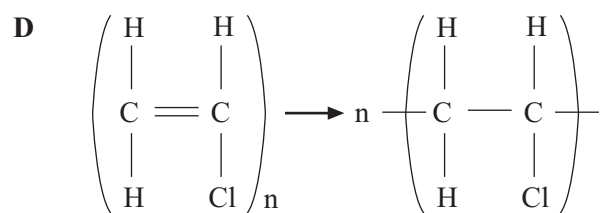
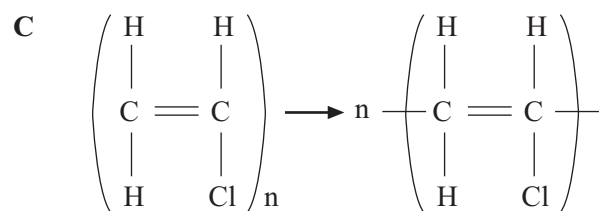
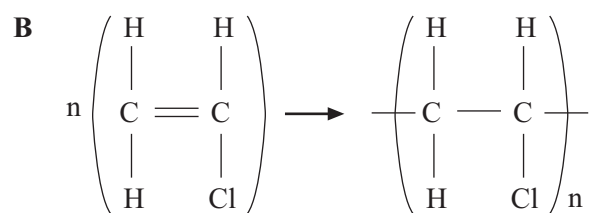
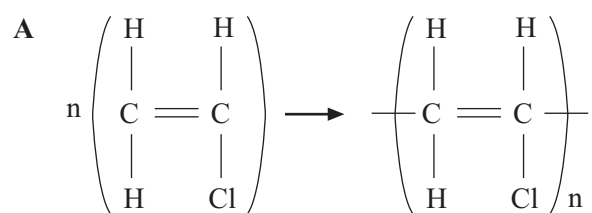
10.3 Monomer molecules can join together to form polymer molecules because

- A** they are reactive.
- B** they are saturated.
- C** they have a double carbon carbon bond.
- D** they have a single carbon carbon bond.

10.4 A vinyl chloride molecule can be represented like this:



Which is the correct equation for the formation of the polymer, polyvinylchloride?



END OF TEST

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE