Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2003

ASSESSMENT and QUALIFICATIONS ALLIANCE

SCIENCE: SINGLE AWARD (MODULAR) 346015
Materials and Reactions (Module 15)

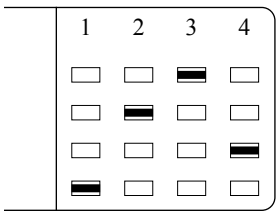
Tuesday 24 June 2003 Morning Session

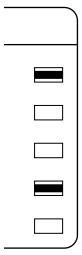
In addition to this paper you will require:
- an HB pencil and a rubber;
- an answer sheet.

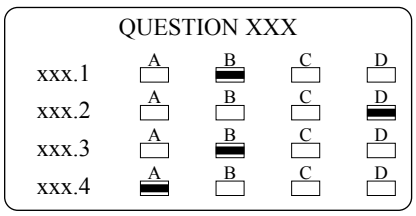
Time allowed: 30 minutes

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.
- 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 hydrocarbon fuels.

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

hydrogen

oxygen

sulphur

water

Hydrocarbons are compounds of the elements carbon and . . . . . **1** . . . . . .

One other element that is sometimes found in these fuels is . . . . . **2** . . . . . .

When hydrocarbon fuels burn in air, carbon and . . . . . **3** . . . . . combine to form carbon dioxide.

Another oxide that is formed is . . . . . **4** . . . . . .

QUESTION TWO

This question is about crude oil.

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

atoms

fractions

hydrocarbons

molecules

Crude oil is a mixture that contains a large number of compounds called . . . . . **1** . . . . . .

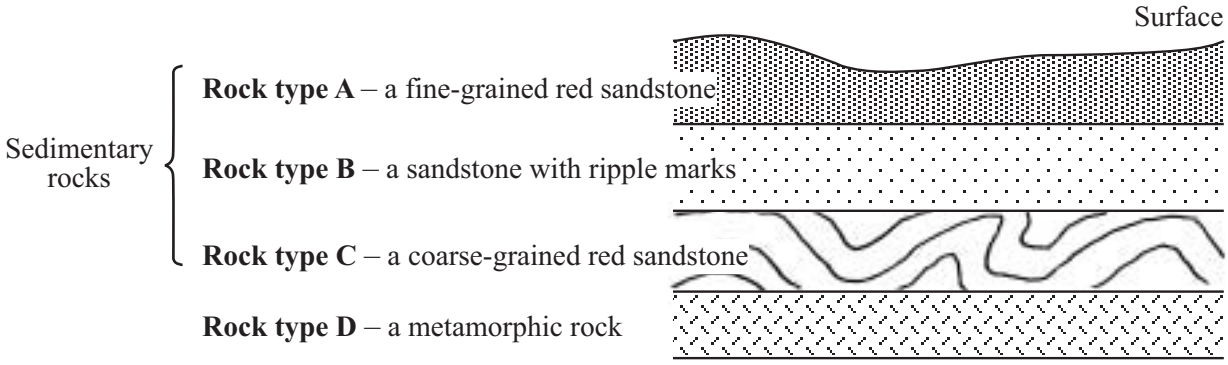
The crude oil is separated by fractional distillation into a number of parts called . . . . . **2** . . . . . .

In each of these parts, the compounds have . . . . . **3** . . . . . with similar numbers of carbon . . . . . **4** . . . . . .

QUESTION THREE

This question is about rocks in the Earth's crust.

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



Rock type	What we can say about the rock
1	it has been folded
2	it is probably the youngest rock
3	it was formed under high temperature and pressure
4	it was deposited under water

QUESTION FOUR

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

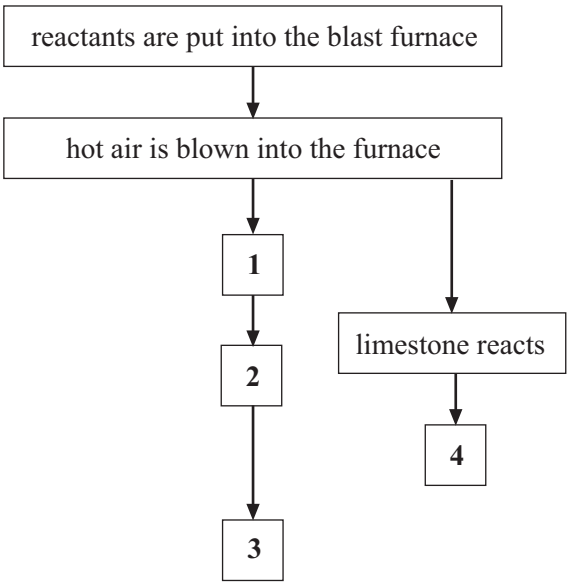
Match each word equation, **P**, **Q**, **R** and **S** from the list with the spaces **1 – 4**, to explain what happens in this process.

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 but metal **Z** cannot.

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.

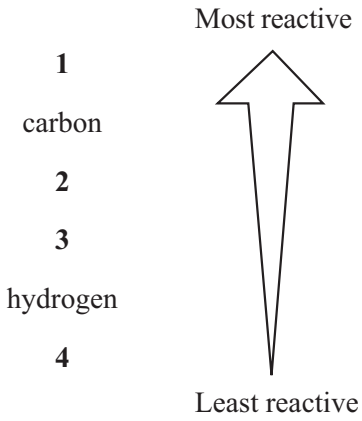
Match metals from the list with each of the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



TURN OVER FOR THE NEXT QUESTION

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

This question is about plastics (polymers).

Choose from the list the **two** statements that are correct.

plastics (polymers) are formed in cracking reactions

microorganisms break down waste polythene

most plastics (polymers) are not biodegradable

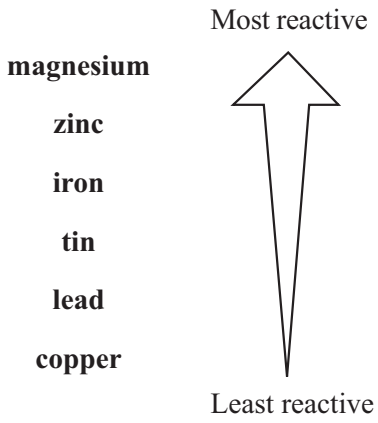
poly(ethene) is a plastic used for making plastic bags and bottles

plastics (polymers) have small molecules

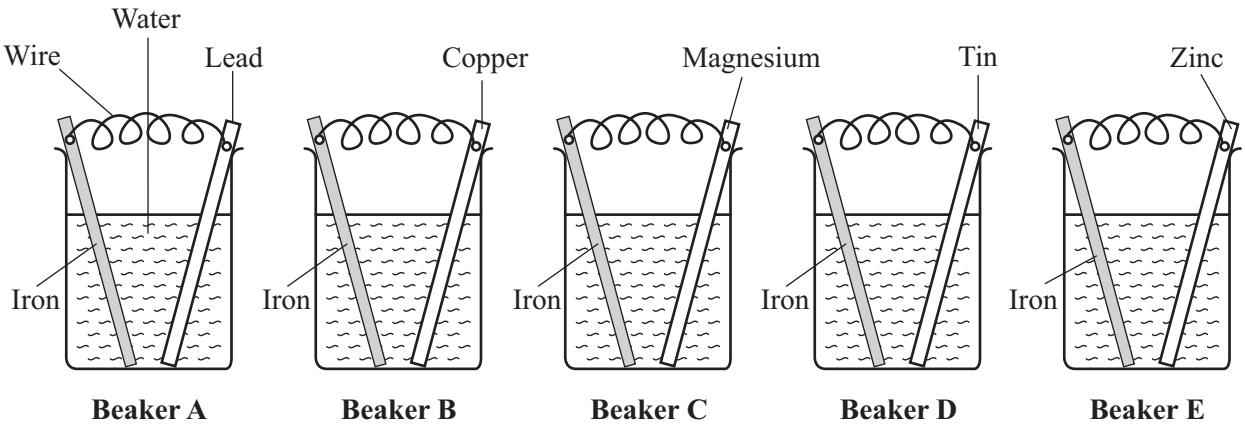
QUESTION SEVEN

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**.

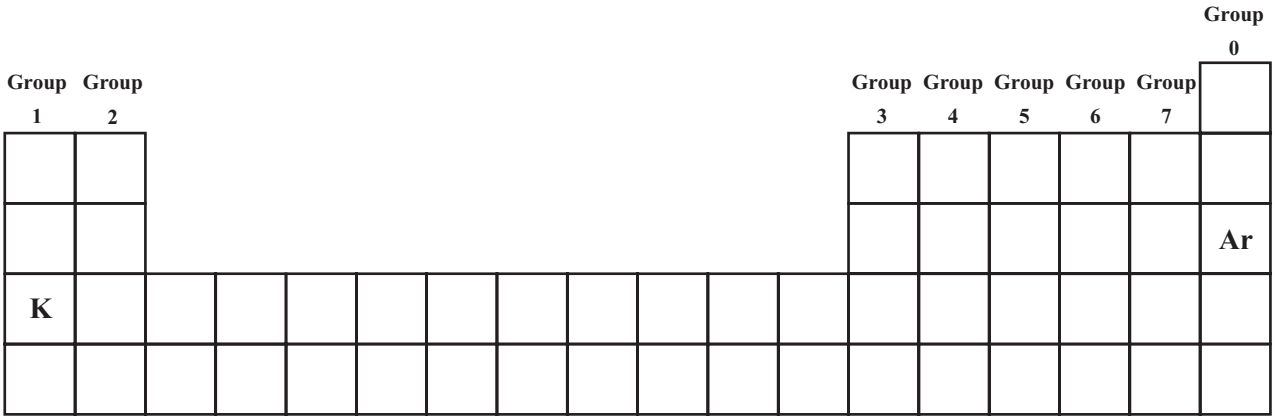
Each of these questions has four parts.

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

9.1 The word equation shows the reaction of calcium oxide with water.

calcium oxide + water ⟶ substance **Y**

What is substance **Y**?

A Calcium chloride

B Calcium hydride

C Calcium hydrogencarbonate

D Calcium hydroxide

9.2 The common name for calcium oxide is . . . . .

A cement.

B concrete.

C glass.

D quicklime.

9.3 Calcium oxide is manufactured by . . . . .

A heating limestone in a kiln.

B the combination of calcium metal with oxygen.

C the electrolysis of calcium carbonate.

D the reduction of calcium hydroxide.

9.4 Most plants grow best in neutral soil.

To which type of soil should a gardener add crushed limestone?

A Acid soil

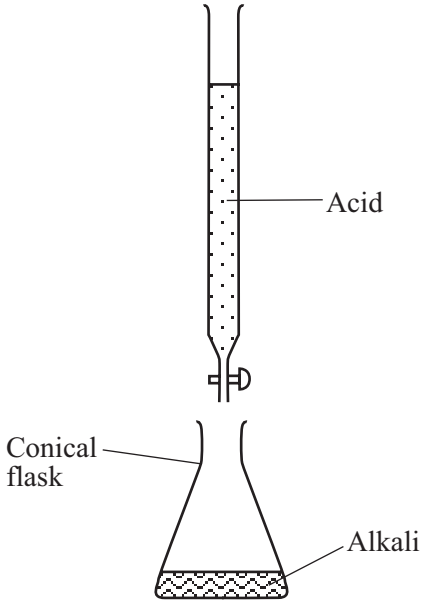
B Alkaline soil

C Organic soil

D Sandy soil

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 a substitution reaction.

D an addition 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 but metal **Z** cannot.

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.

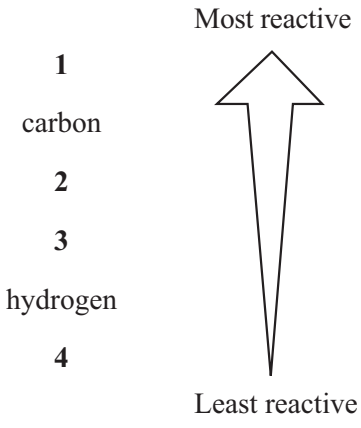
Match metals from the list with each of the numbers **1–4** in the reactivity series.

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 **calcium carbonate breaks down on heating to form calcium oxide and carbon dioxide**

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

N **a hydrocarbon burns in oxygen to form carbon dioxide and water**

P **iron oxide reacts with carbon monoxide to form iron**

Chemical reaction	Type of reaction
1	combustion
2	neutralisation
3	reduction
4	thermal decomposition

TURN OVER FOR THE NEXT QUESTION

SECTION B

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

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

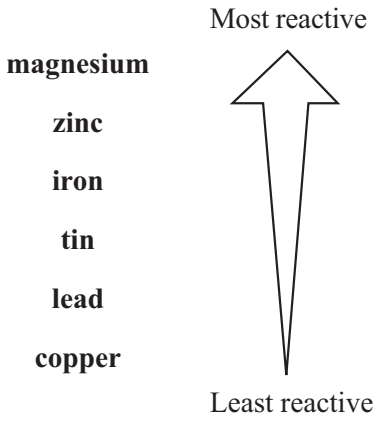
Do **not** choose more than two.

Mark your choices on the answer sheet.

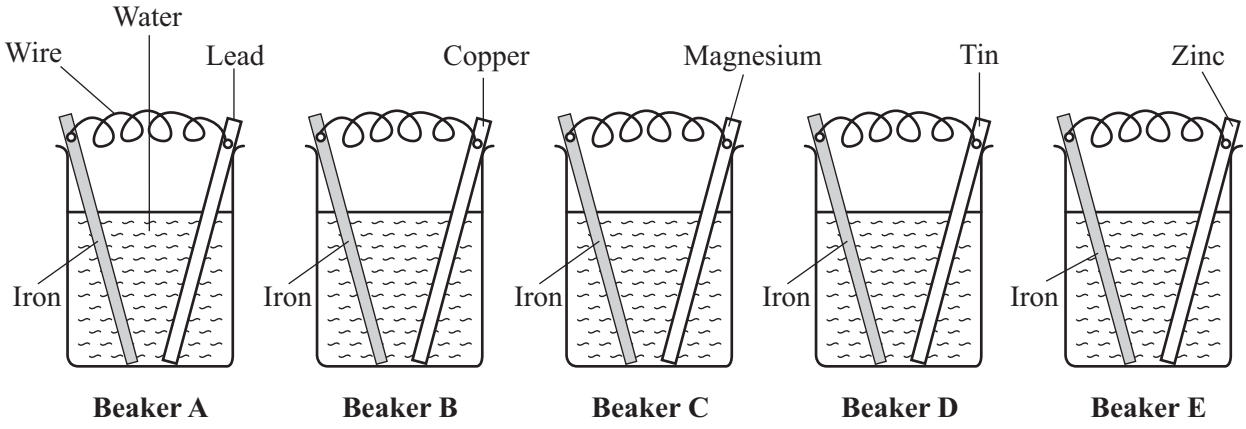
QUESTION THREE

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 **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**.

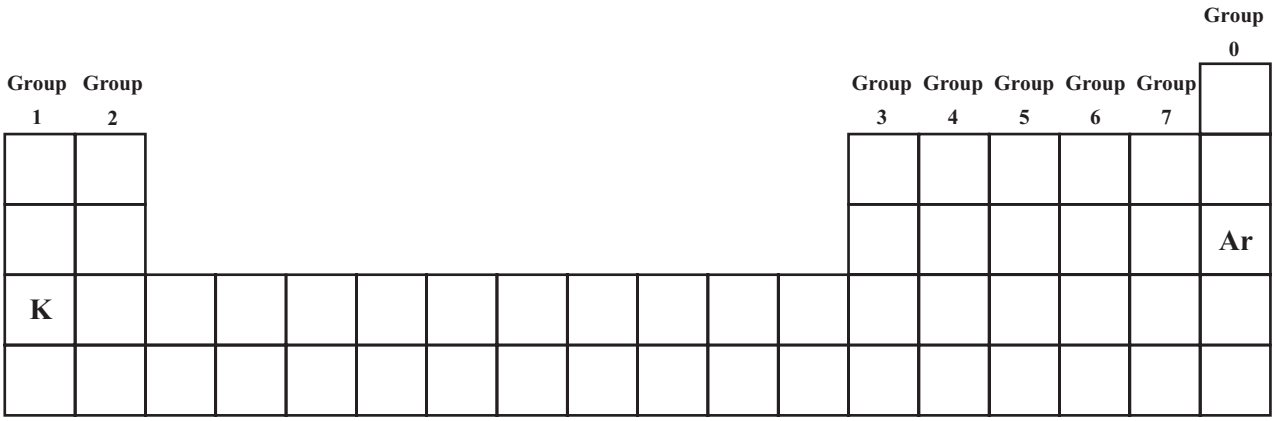
Each of these questions has four parts.

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.

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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.

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

A in a block on the right-hand side.

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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

6.1 The word equation shows the reaction of calcium oxide with water.

calcium oxide + water ⟶ substance **Y**

What is substance **Y**?

A Calcium chloride

B Calcium hydride

C Calcium hydrogencarbonate

D Calcium hydroxide

6.2 The common name for calcium oxide is . . . . .

A cement.

B concrete.

C glass.

D quicklime.

6.3 Calcium oxide is manufactured by . . . . .

A heating limestone in a kiln.

B the combination of calcium metal with oxygen.

C the electrolysis of calcium carbonate.

D the reduction of calcium hydroxide.

6.4 Most plants grow best in neutral soil.

To which type of soil should a gardener add crushed limestone?

A Acid soil

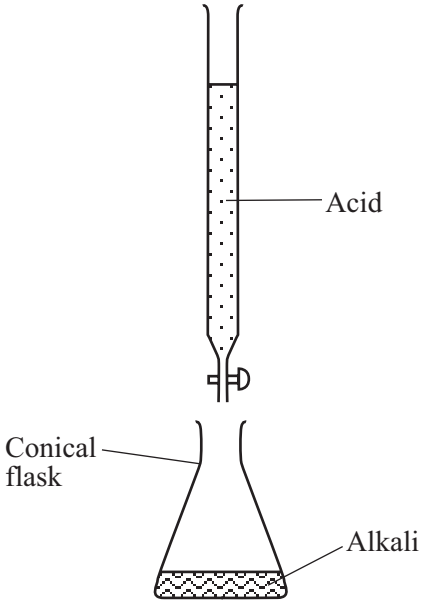
B Alkaline soil

C Organic soil

D Sandy soil

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 a substitution reaction.

D an addition 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.

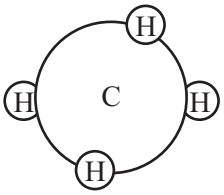
B H^+ (aq) ions.

C Na^+ ions.

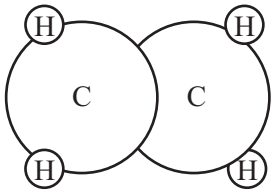
D OH^- (aq) ions.

QUESTION EIGHT

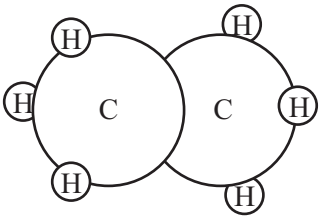
The drawings represent four different hydrocarbon molecules.



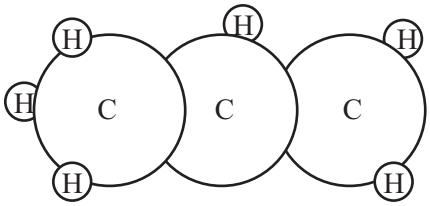
Molecule **W**



Molecule **X**



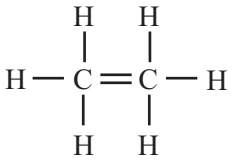
Molecule **Y**



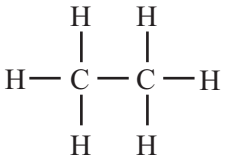
Molecule **Z**

8.1 The structural formula for hydrocarbon **Y** is . . . . .

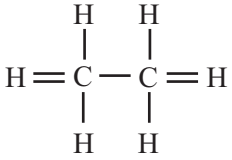
A



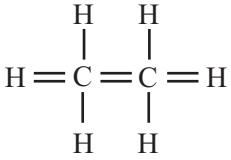
B



C



D



8.2 Which of the hydrocarbons belong to the alkene family?

A Molecules **W** and **X**

B Molecules **W** and **Y**

C Molecules **X** and **Y**

D Molecules **X** and **Z**

8.3 Which types of bonds link the carbon and hydrogen atoms in molecule **X**?

	carbon atom to carbon atom	**carbon atoms to hydrogen atoms**
A	double bond	double bonds
B	double bond	single bonds
C	single bond	double bonds
D	single bond	single bonds

8.4 Hydrocarbon **Z** will burn in a plentiful supply of air to produce . . . . .

A carbon and carbon dioxide.

B carbon and carbon monoxide.

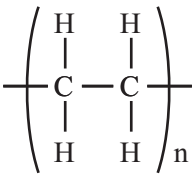
C carbon and hydrogen.

D carbon dioxide and water.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

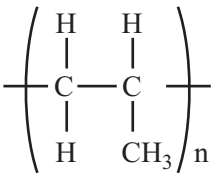
The diagrams show the structural formulae of the molecules of four compounds, **J**, **K**, **L** and **M**.



Molecule J

Molecule K

Molecule L



Molecule M

9.1 Which of these are polymer molecules?

A Molecule **K** only

B Molecules **J** and **K**

C Molecules **J** and **M**

D Molecules **K** and **M**

9.2 The monomers from which polymer molecules are formed are . . . . .

A acidic.

B saturated.

C unreactive.

D unsaturated.

9.3 Which of the molecules **J**, **K**, **L** or **M** is a monomer that could be polymerised?

A Molecule **J**

B Molecule **K**

C Molecule **L**

D Molecule **M**

9.4 Polymers are made by polymerisation.

In addition polymerisation, the products are . . . . .

A the polymer and carbon dioxide.

B the polymer and hydrogen.

C the polymer and water.

D the polymer only.

QUESTION TEN

This question is about the blast furnace.
Iron is extracted from its ore, iron oxide.

10.1 Which reaction produces the main reducing agent in the blast furnace?

A calcium carbonate → carbon dioxide + calcium oxide

B carbon + oxygen → carbon dioxide

C carbon + oxygen → carbon monoxide

D carbon dioxide + carbon → carbon monoxide

10.2 The main waste gases leaving the blast furnace are . . . . .

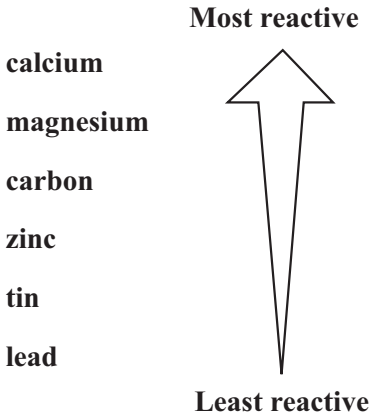
A carbon dioxide and carbon monoxide.

B carbon dioxide and nitrogen.

C carbon monoxide and nitrogen.

D methane and nitrogen.

You may find this part of the reactivity series of the metals useful for parts 10.3 and 10.4.



10.3 Which metals could be extracted from their ores in a similar way to the extraction of iron?

A Calcium and tin

B Magnesium and lead

C Magnesium and zinc

D Tin and zinc

10.4 The removal of oxygen from a metal oxide is called . . . . .

A combination.

B neutralisation.

C oxidation.

D reduction.

END OF TEST