

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2003



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

346015

Thursday 27 November 2003 Morning Session

In addition to this paper you will require:

- a black ball-point pen;
- 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.
- 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

This question is about gases.

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

carbon dioxide

oxygen

sulphur dioxide

water (vapour)

Gas	What we can say about the gas
1	it is an oxide of hydrogen
2	it is formed when sulphur burns in air
3	it reacts with carbon to form carbon dioxide
4	it is produced in the thermal decomposition of magnesium carbonate

QUESTION TWO

These sentences are about elements, compounds and mixtures.

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

alloys

atoms

metals

ores

Elements can be arranged in order of the relative mass of their **1** to produce a periodic table.

More than $\frac{3}{4}$ of the elements in the periodic table are **2**

Carbon can be used to extract some metals from their **3**

Mixtures of metals are called **4**

QUESTION THREE

This question is about crude oil.

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

compound

element

fraction

mixture

Crude oil is a **1** made up mainly of hydrocarbons.

A hydrocarbon is a **2**

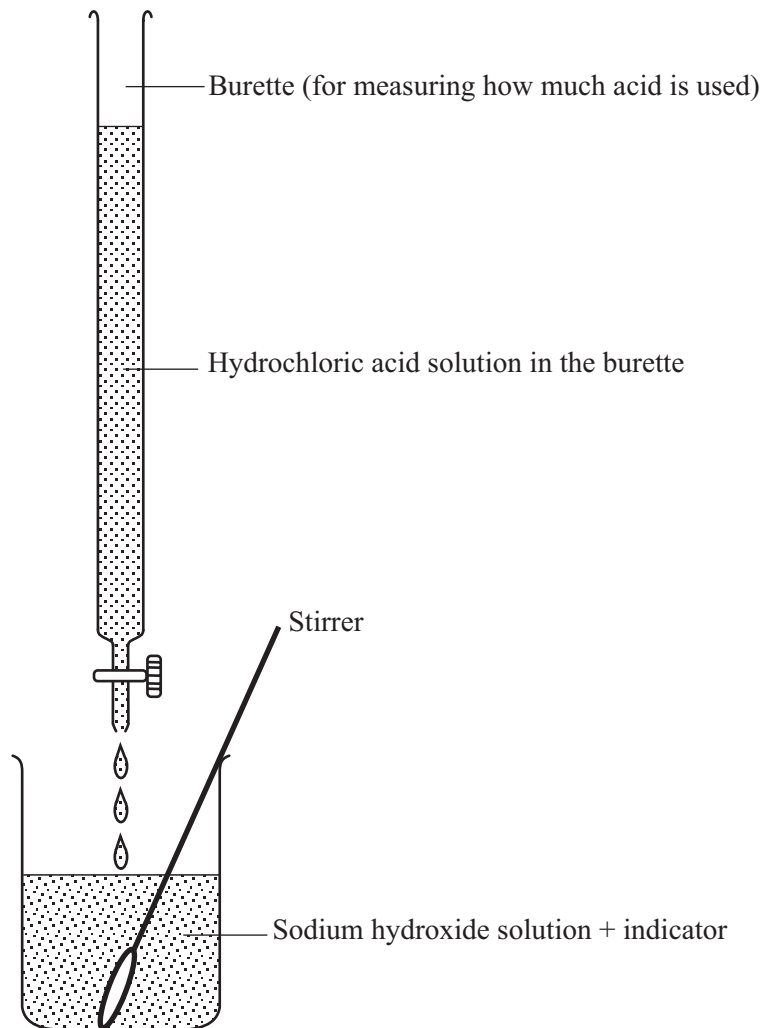
Hydrocarbons are made up of carbon combined with the **3** hydrogen.

When crude oil is distilled, each **4** contains hydrocarbons with similar boiling points.

Turn over ►

QUESTION FOUR

The diagram shows how we can make a solution of the salt, sodium chloride.



Universal indicator						
pH	0	7	14	
	Red	Orange	Yellow	Green	Blue	Purple

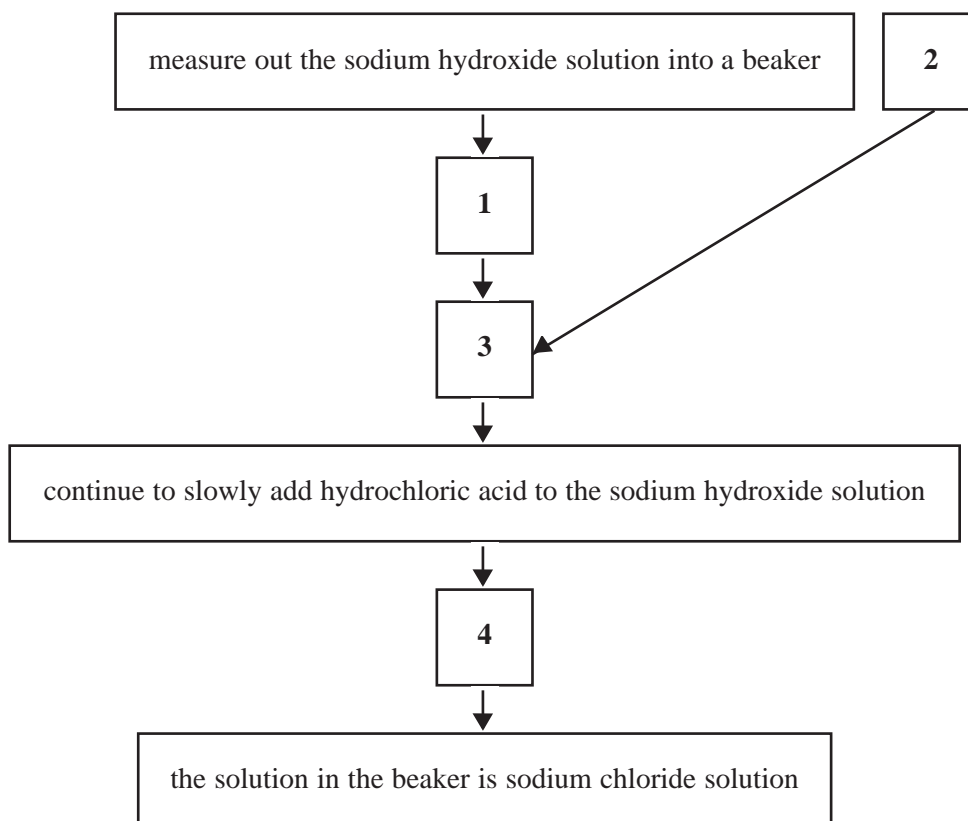
Match words from the list with the spaces **1 – 4** to explain how to make a solution of the salt sodium chloride.

add a few drops of indicator which turns purple

fill the burette with the acid

slowly add the hydrochloric acid to the alkali with stirring

stop adding acid when the indicator turns green



Turn over ►

QUESTION FIVE

This question is about the positions of four metals, **W**, **X**, **Y** and **Z** in the reactivity series.

You can displace Metal **W** from its oxide by heating with hydrogen.

You can use Metal **W** to displace Metal **Z** from one of its compounds.

You can displace Metal **X** from its oxide by heating with carbon, but not by heating with hydrogen.

You cannot displace Metal **Y** from its oxide with carbon.

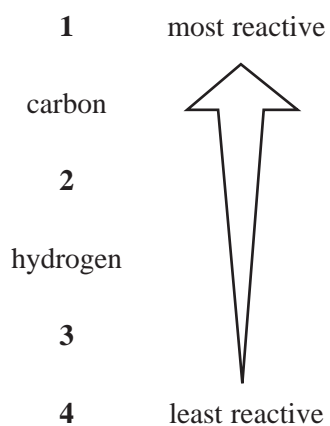
Match metals from the list with the numbers **1 – 4** in the reactivity series.

metal W

metal X

metal Y

metal Z



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 the hydrocarbons in crude oil.

Choose from the list the **two** statements that are correct.**all hydrocarbon molecules in crude oil are similar in size****hydrocarbons with small molecules flow easily****hydrocarbons with the largest molecules are easiest to ignite****hydrocarbons with the smallest molecules have the lowest boiling points****hydrocarbons with very large molecules are useful as fuels****QUESTION SEVEN**

This question is about iron.

Choose from the list the **two** statements that are correct.**haematite contains an oxide of iron****in the blast furnace, iron oxide is reduced by limestone****iron can be extracted from haematite****iron does not react with oxygen or water****iron is in Group 2 of the periodic table****TURN OVER FOR THE NEXT QUESTION****Turn over ►**

SECTION CQuestions **EIGHT** to **TEN**.

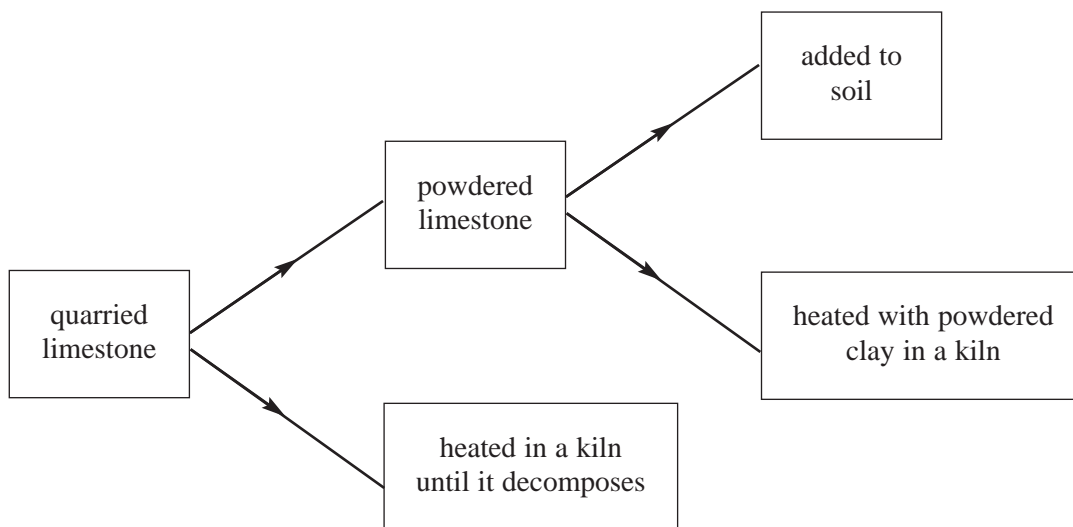
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows some of the ways in which limestone can be used.

**8.1** Powdered limestone is added to soil

- A to improve the drainage.
- B to make the soil fertile.
- C to make the soil less acid.
- D to make the soil less alkaline.

8.2 Powdered limestone is heated with powdered clay to produce

- A cement.
- B glass.
- C quicklime.
- D soda.

8.3 Which word equation shows what happens when limestone decomposes?

- A calcium carbonate \longrightarrow calcium hydroxide + water
- B calcium carbonate \longrightarrow calcium oxide + water
- C calcium carbonate \longrightarrow calcium oxide + water + carbon dioxide
- D calcium carbonate \longrightarrow calcium oxide + carbon dioxide

8.4 Slaked lime is made by the reaction of water with

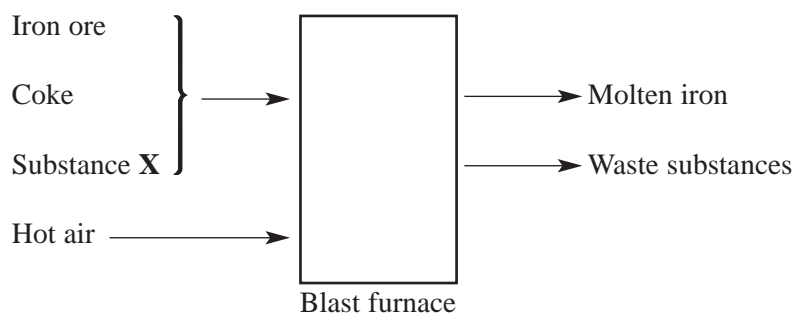
- A calcium carbonate.
- B calcium hydroxide.
- C calcium oxide.
- D cement.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The diagram shows most of the substances used in the blast furnace to produce iron.



9.1 The mixture containing iron ore and coke put into the blast furnace also contains Substance X.

What is Substance X?

- A Bauxite
- B Cryolite
- C Limestone
- D Sulphur

9.2 Which element does the coke provide for the reactions in the blast furnace?

- A Carbon
- B Iron
- C Oxygen
- D Sulphur

9.3 The hot air is blasted into the furnace

- A to circulate and thoroughly mix the iron ore and coke.
- B to react with coke and release energy.
- C to react with the iron ore.
- D to sweep out the waste gases.

9.4 Which two substances collect at the bottom of the furnace?

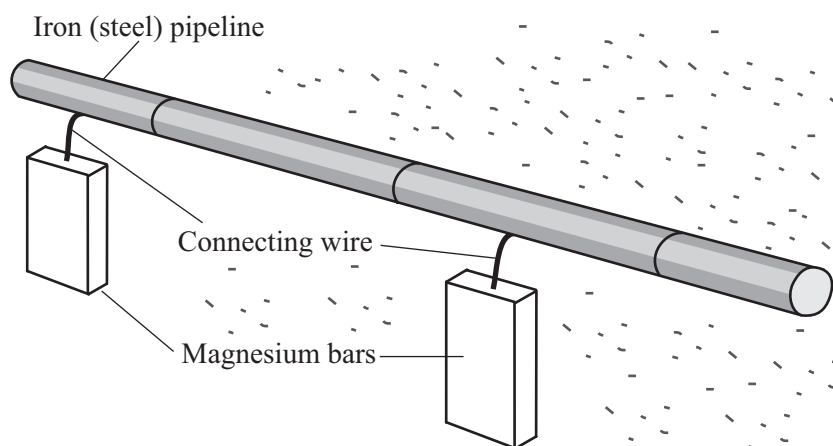
- A** Molten iron floating on molten slag
- B** Molten slag floating on molten iron
- C** Molten slag floating on solid iron
- D** Solid slag floating on molten iron

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

Iron, in the form of steel, is used to make underground pipelines to carry gas and oil.



magnesium	most reactive
aluminium	
carbon	
zinc	
iron	
tin	
lead	
copper	least reactive

10.1 Iron (steel) will corrode faster than most other transition metals because

- A it combines with carbon dioxide in the air.
- B it does not have a shiny surface.
- C it has only a thin oxide layer.
- D it reacts more quickly with oxygen and water.

10.2 The magnesium bars are attached to the iron

- A to neutralise acid solutions in the soil.
- B to neutralise alkaline solutions in the soil.
- C to prevent the pipes sinking further into the ground.
- D to stop the iron (steel) corroding.

10.3 A metal that could successfully be used in place of the magnesium is

- A copper.
- B lead.
- C tin.
- D zinc.

10.4 A metal mixed with iron to produce stainless steel is

- A chromium.
- B lead.
- C sodium.
- D tin.

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.

You can displace Metal **W** from its oxide by heating with hydrogen.

You can use Metal **W** to displace Metal **Z** from one of its compounds.

You can displace Metal **X** from its oxide by heating with carbon, but not by heating with hydrogen.

You cannot displace Metal **Y** from its oxide with carbon.

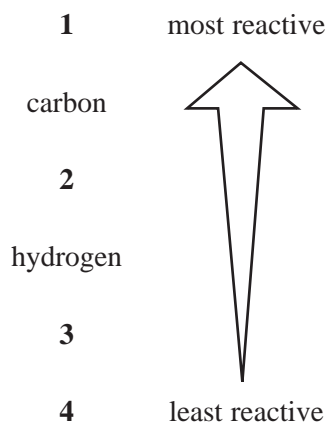
Match metals from the list with each of the numbers **1 – 4** in the reactivity series.

metal W

metal X

metal Y

metal Z



QUESTION TWO

This question is about the structural formulae of four hydrocarbons.

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

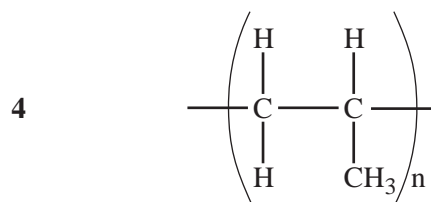
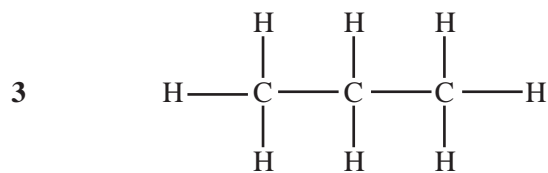
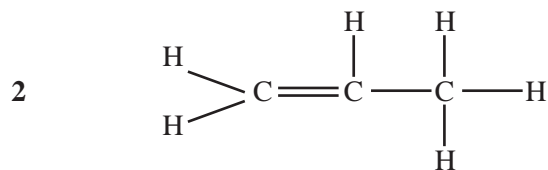
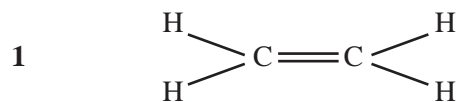
a polymer

a saturated hydrocarbon with 3 carbon atoms in each molecule

an unsaturated hydrocarbon with 3 carbon atoms in each molecule

ethene

Hydrocarbon **Formula for one molecule of the hydrocarbon**



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

This question is about iron.

Choose from the list the **two** statements that are correct.**haematite contains an oxide of iron****in the blast furnace, iron oxide is reduced by limestone****iron can be extracted from haematite****iron does not react with oxygen or water****iron is in Group 2 of the periodic table**

QUESTION FOUR

This question is about poly(ethene).

Which **two** statements are correct?

in poly(ethene), the carbon atoms are linked by double bonds

in poly(ethene), the carbon atoms are linked by ionic bonds

poly(ethene) can be produced during the cracking of large hydrocarbon molecules

poly(ethene) can be produced by joining together alkene monomers

poly(ethene) is not biodegradable

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION CQuestions **FIVE** to **TEN**.

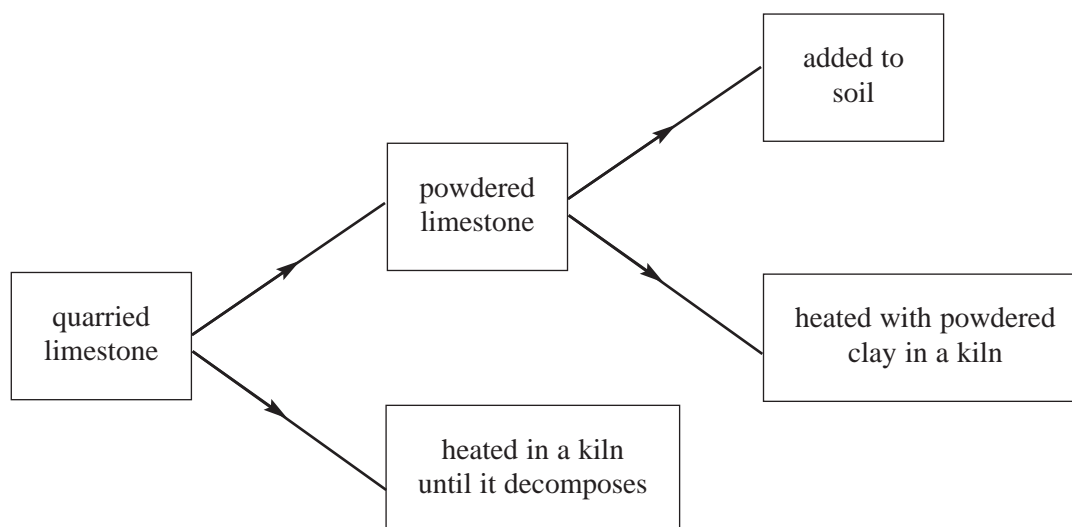
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows some of the ways in which limestone can be used.

**5.1** Powdered limestone is added to soil

- A to improve the drainage.
- B to make the soil fertile.
- C to make the soil less acid.
- D to make the soil less alkaline.

5.2 Powdered limestone is heated with powdered clay to produce

- A cement.
- B glass.
- C quicklime.
- D soda.

5.3 Which word equation shows what happens when limestone decomposes?

- A calcium carbonate \longrightarrow calcium hydroxide + water
- B calcium carbonate \longrightarrow calcium oxide + water
- C calcium carbonate \longrightarrow calcium oxide + water + carbon dioxide
- D calcium carbonate \longrightarrow calcium oxide + carbon dioxide

5.4 Slaked lime is made by the reaction of water with

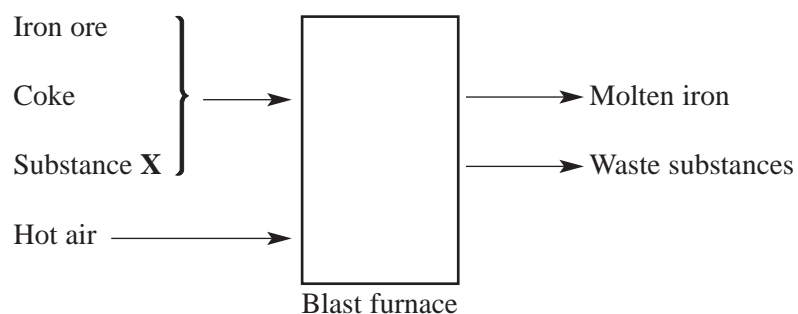
- A calcium carbonate.
- B calcium hydroxide.
- C calcium oxide.
- D cement.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

The diagram shows most of the substances used in the blast furnace to produce iron.



6.1 The mixture containing iron ore and coke put into the blast furnace also contains Substance X.

What is Substance X?

- A Bauxite
- B Cryolite
- C Limestone
- D Sulphur

6.2 Which element does the coke provide for the reactions in the blast furnace?

- A Carbon
- B Iron
- C Oxygen
- D Sulphur

6.3 The hot air is blasted into the furnace

- A to circulate and thoroughly mix the iron ore and coke.
- B to react with coke and release energy.
- C to react with the iron ore.
- D to sweep out the waste gases.

6.4 Which two substances collect at the bottom of the furnace?

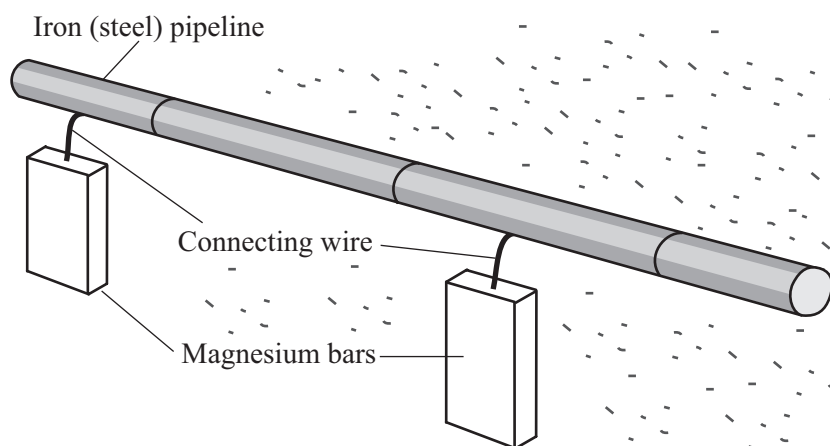
- A** Molten iron floating on molten slag
- B** Molten slag floating on molten iron
- C** Molten slag floating on solid iron
- D** Solid slag floating on molten iron

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

Iron, in the form of steel, is used to make underground pipelines to carry gas and oil.



magnesium	most reactive
aluminium	
carbon	
zinc	
iron	
tin	
lead	
copper	least reactive

7.1 Iron (steel) will corrode faster than most other transition metals because

- A** it combines with carbon dioxide in the air.
- B** it does not have a shiny surface.
- C** it has only a thin oxide layer.
- D** it reacts more quickly with oxygen and water.

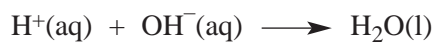
- 7.2** The magnesium bars are attached to the iron
- A** to neutralise acid solutions in the soil.
 - B** to neutralise alkaline solutions in the soil.
 - C** to prevent the pipes sinking further into the ground.
 - D** to stop the iron (steel) corroding.
- 7.3** A metal that could successfully be used in place of the magnesium is
- A** copper.
 - B** lead.
 - C** tin.
 - D** zinc.
- 7.4** A metal mixed with iron to produce stainless steel is
- A** chromium.
 - B** lead.
 - C** sodium.
 - D** tin.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The ionic equation shown can be used to represent a type of chemical reaction.



8.1 What type of reaction does this equation represent?

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

8.2 Which of the following is correct for the two ions in the equation?

	H⁺(aq) ions make the solution	OH⁻(aq) ions make the solution
A	acidic	alkaline
B	alkaline	acidic
C	alkaline	basic
D	more concentrated	more dilute

8.3 Which of these reactions could be represented by the ionic equation $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow \text{H}_2\text{O}(\text{l})$?

- A copper oxide + sulphuric acid \longrightarrow copper sulphate + water
- B copper oxide + zinc \longrightarrow zinc oxide + copper
- C sodium hydroxide + hydrochloric acid \longrightarrow sodium chloride + water
- D sodium sulphate + lead chloride \longrightarrow sodium chloride + lead sulphate

8.4 Ammonia dissolves in water to form

- A ammonium sulphate.
- B ammonium chloride.
- C an acid solution.
- D an alkaline solution.

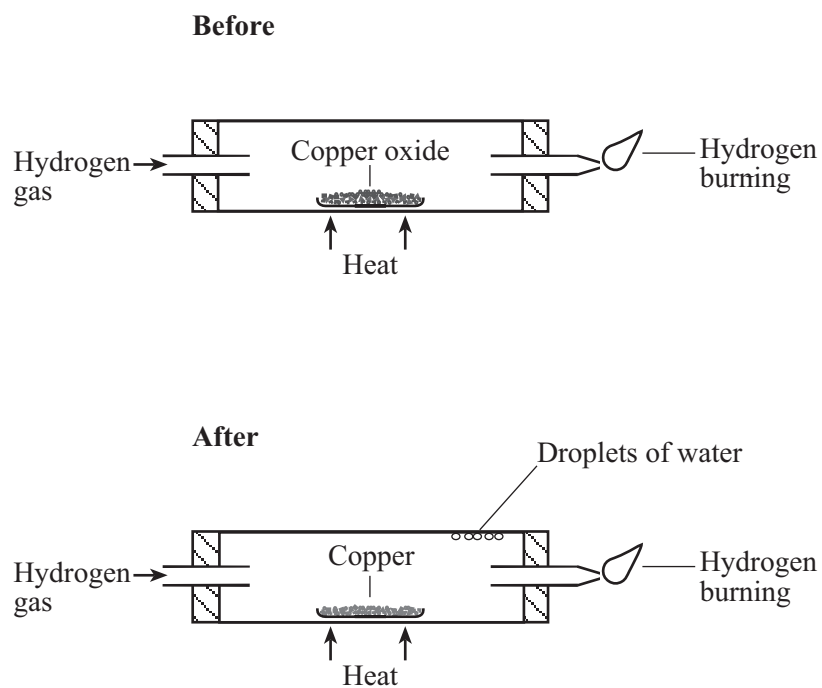
NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The drawings show how hydrogen can be used to displace a metal from one of its compounds.



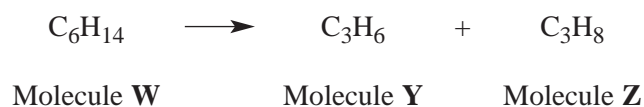
sodium	most reactive
magnesium	
aluminium	
carbon	
zinc	
iron	
tin	
lead	
hydrogen	
copper	
silver	least reactive

- 9.1** In the reaction shown, the hydrogen is
- A dehydrated.
 - B neutralised.
 - C oxidised.
 - D reduced.
- 9.2** The word equation for the reaction is
- A copper + hydrogen \longrightarrow copper oxide
 - B copper + hydrogen \longrightarrow copper oxide + water
 - C copper oxide + hydrogen \longrightarrow copper + water
 - D copper oxide + water \longrightarrow copper + hydrogen
- 9.3** Which of these metals could be displaced from its oxide by carbon but not by hydrogen?
- A Aluminium
 - B Lead
 - C Magnesium
 - D Sodium
- 9.4** In the blast furnace, iron is displaced from its iron oxide by
- A carbon dioxide.
 - B carbon monoxide.
 - C hydrogen.
 - D nitrogen.

Turn over ►

QUESTION TEN

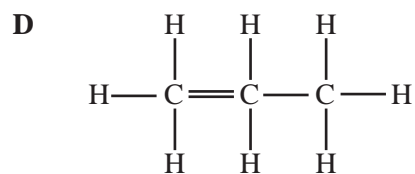
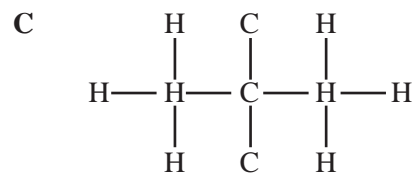
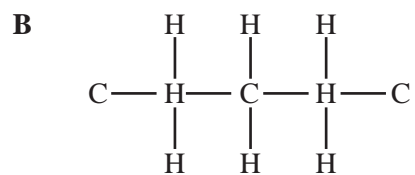
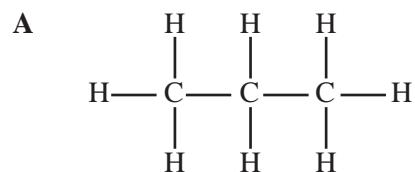
A molecule of a hydrocarbon, formula C_6H_{14} can be cracked to produce two different hydrocarbons with smaller molecules.



10.1 The large hydrocarbon molecule can be cracked by

- A distillation.
- B polymerisation.
- C thermal decomposition.
- D vaporisation.

10.2 The structural formula for molecule **Z** is



10.3 Which of the three molecules **W**, **Y** and **Z**, have double bonds?

- A** **W** and **Y**
- B** **W** and **Z**
- C** **W** only
- D** **Y** only

10.4 What types of hydrocarbons are molecules **Y** and **Z**?

- | | Molecule Y | Molecule Z |
|----------|-------------------|-------------------|
| A | saturated | saturated |
| B | saturated | unsaturated |
| C | unsaturated | saturated |
| D | unsaturated | unsaturated |

END OF TEST

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE