

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2004



**SCIENCE: SINGLE AWARD (MODULAR)
Materials & Reactions (Module 15)**

346015

Thursday 18 November 2004 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 & 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 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

The diagram shows a blast furnace.

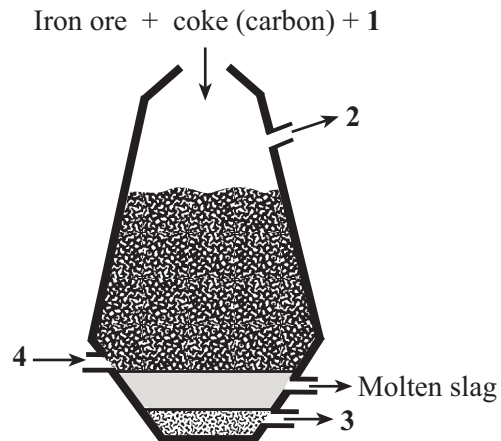
Match words from the list with the numbers 1–4 in the diagram.

hot air

limestone

molten iron

waste gases



QUESTION TWO

This question is about hydrocarbons.

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

compound

element

mixture

molecule

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

A hydrocarbon is a **2** of carbon and hydrogen only.

The larger a hydrocarbon **3** is, the more carbon atoms it will contain.

Crude oil may also contain the **4** sulphur as an impurity.

QUESTION THREE

When acids react with alkalis, salts are formed.

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

hydrochloric acid

potassium hydroxide

sodium chloride

sulphuric acid

Acid	+	Alkali	Salt formed
hydrochloric acid	+	sodium hydroxide	1
2	+	potassium hydroxide	potassium chloride
3	+	sodium hydroxide	sodium sulphate
nitric acid	+	4	potassium nitrate

Turn over ►

QUESTION FOUR

This question is about four elements.

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

argon

carbon

iron

potassium

Element	What we can say about the element
1	it is in Group 0 of the periodic table
2	it is obtained mainly from the ore haematite
3	it is a non-metal, above iron in the reactivity series
4	it is in Group 1 of the periodic table

QUESTION FIVE

The flow diagram shows how some chemical substances are made from limestone.

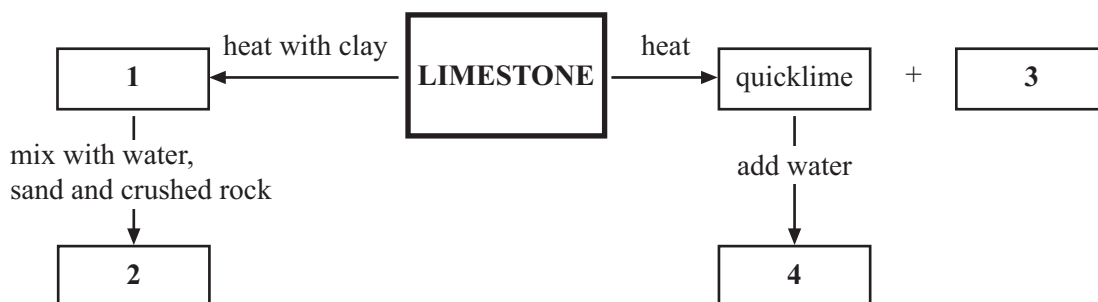
Match words from the list with the labels 1–4 on the diagram.

carbon dioxide

cement

concrete

slaked lime



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 mixtures.

Which **two** of the following are mixtures?**air****calcium carbonate****concrete****ethene****quicklime****QUESTION SEVEN**

This question is about the periodic table.

Which **two** of the following statements are correct?**about half the elements are metals****columns of elements with similar properties are called Groups****most of the elements are arranged in order of their relative atomic masses****the metals are in Groups 4 and 7****the transition elements are in Group 0**

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

Some large hydrocarbon molecules are broken down (cracked) to produce smaller molecules.

8.1 The process of cracking large hydrocarbon molecules is an example of

- A fractional distillation.
- B neutralisation.
- C polymerisation.
- D thermal decomposition.

8.2 In the cracking process

- A hot gases are mixed with water.
- B hot vapours are passed over a hot catalyst.
- C liquids are mixed with water.
- D liquids are passed over a catalyst.

8.3 The smaller molecules produced in the cracking process are usually.

- A equally as useful as the large, uncracked molecules.
- B less useful than the large, uncracked molecules.
- C more useful than the large, uncracked molecules.
- D of no use and are burned to get rid of them.

- 8.4** The different products of cracking can be used
- A** for many purposes, including making poly(ethene) and as fuels.
 - B** only as fuels.
 - C** only to make poly(ethene).
 - D** only to make poly(propene).

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

This question is about some reactions of iron.

9.1 Some metals, including iron, react slowly with gases in the atmosphere.

This process is called

- A alloying.
- B catalysis.
- C corrosion.
- D reduction.

9.2 Iron reacts more slowly with oxygen and water from the air if it is attached to a piece of zinc.

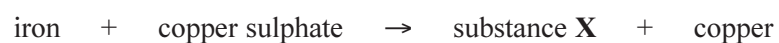
This is called

- A alloying.
- B decomposition.
- C sacrificial protection.
- D transition.

9.3 Zinc can be attached to iron to prevent rusting, because zinc is

- A a harder metal.
- B a transition metal.
- C more reactive.
- D more shiny.

9.4 Iron will react with a solution of copper sulphate.



Substance **X** is

- A iron chloride.
- B iron hydroxide.
- C iron oxide.
- D iron sulphate.

TURN OVER FOR THE NEXT QUESTION

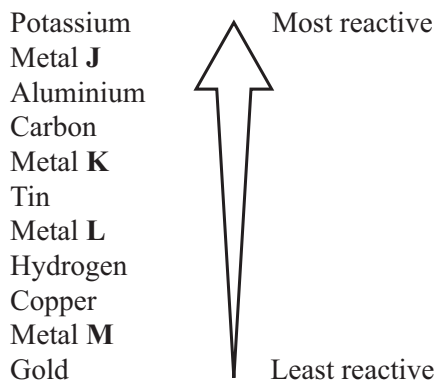
Turn over ►

QUESTION TEN

This question is about some of the metals in the reactivity series.

Four of the metals are represented by the letters **J**, **K**, **L** and **M**.

The non-metals carbon and hydrogen are also shown.



10.1 Which metals are most likely to be extracted from their ores by heating with carbon?

- A Metals **J**, **K** and **L**
- B Metals **J**, **K** and **M**
- C Metals **J**, **L** and **M**
- D Metals **K**, **L** and **M**

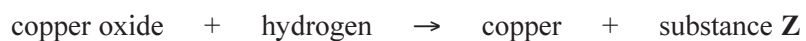
10.2 Which metal could be extracted from its ore by heating with hydrogen?

- A Metal **J**
- B Metal **K**
- C Metal **L**
- D Metal **M**

10.3 Which metals could displace tin from tin oxide?

- A Metals **J** and **K**
- B Metals **J** and **L**
- C Metals **K** and **L**
- D Metals **L** and **M**

10.4 The word equation shows the reaction when hydrogen reacts with copper oxide.



Substance **Z** is

- A carbon dioxide.
- B carbon monoxide.
- C oxygen.
- D water.

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**.

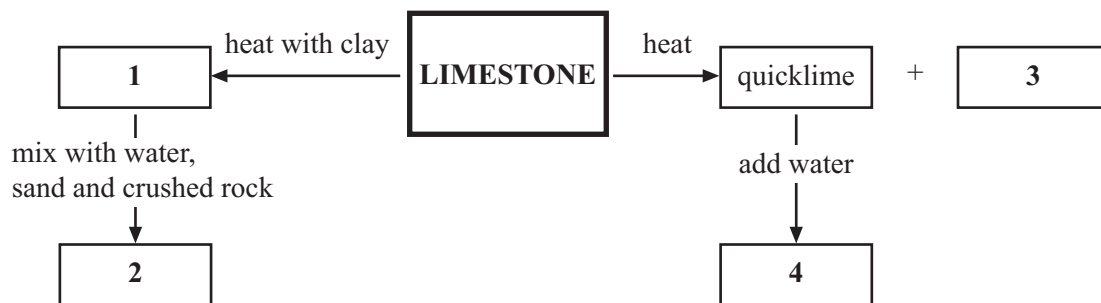
In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

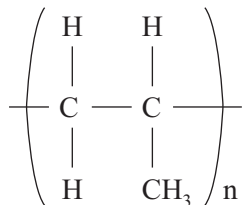
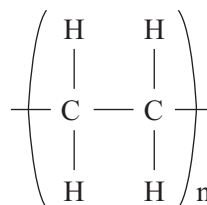
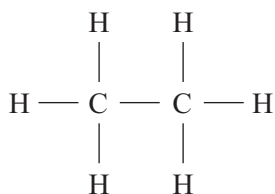
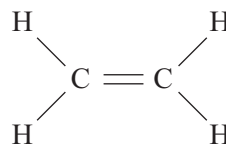
The flow diagram shows how some chemical substances are made from limestone.

Match words from the list with the labels **1–4** on the diagram.**carbon dioxide****cement****concrete****slaked lime**

QUESTION TWO

This question is about the structures of hydrocarbon molecules.

Match the structures **P**, **Q**, **R** and **S** with the numbers **1–4** in the table.

**P****Q****R****S**

Structure	Hydrocarbon molecule
1	a saturated hydrocarbon with two carbon atoms
2	ethene
3	the polymer formed from the compound $\begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{C} = \text{C} \\ & \\ \text{H} & \text{CH}_3 \end{array}$
4	the polymer, poly(ethene)

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

This question is about the periodic table.

Which **two** of the following statements are correct?**about half the elements are metals****columns of elements with similar properties are called Groups****most of the elements are arranged in order of their relative atomic masses****the metals are in Groups 4 and 7****the transition elements are in Group 0****QUESTION FOUR**Which **two** word equations are examples of thermal decomposition?**calcium carbonate → calcium oxide + carbon dioxide****calcium oxide + water → calcium hydroxide****decane (C₁₀H₂₂) → ethene + octane (C₈H₁₈)****ethane + oxygen → carbon dioxide + water****ethene → poly(ethene)**

NO QUESTIONS APPEAR ON THIS PAGE

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

Some large hydrocarbon molecules are broken down (cracked) to produce smaller molecules.

5.1 The process of cracking large hydrocarbon molecules is an example of

- A fractional distillation.
- B neutralisation.
- C polymerisation.
- D thermal decomposition.

5.2 In the cracking process

- A hot gases are mixed with water.
- B hot vapours are passed over a hot catalyst.
- C liquids are mixed with water.
- D liquids are passed over a catalyst.

5.3 The smaller molecules produced in the cracking process are usually.

- A equally as useful as the large, uncracked molecules.
- B less useful than the large, uncracked molecules.
- C more useful than the large, uncracked molecules.
- D of no use and are burned to get rid of them.

- 5.4** The different products of cracking can be used
- A** for many purposes, including making poly(ethene) and as fuels.
 - B** only as fuels.
 - C** only to make poly(ethene).
 - D** only to make poly(propene).

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

This question is about some reactions of iron.

6.1 Some metals, including iron, react slowly with gases in the atmosphere.

This process is called

- A alloying.
- B catalysis.
- C corrosion.
- D reduction.

6.2 Iron reacts more slowly with oxygen and water from the air if it is attached to a piece of zinc.

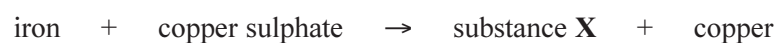
This is called

- A alloying.
- B decomposition.
- C sacrificial protection.
- D transition.

6.3 Zinc can be attached to iron to prevent rusting, because zinc is

- A a harder metal.
- B a transition metal.
- C more reactive.
- D more shiny.

6.4 Iron will react with a solution of copper sulphate.



Substance **X** is

- A** iron chloride.
- B** iron hydroxide.
- C** iron oxide.
- D** iron sulphate.

TURN OVER FOR THE NEXT QUESTION

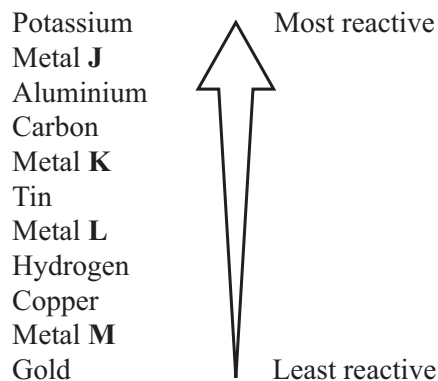
Turn over ►

QUESTION SEVEN

This question is about some of the metals in the reactivity series.

Four of the metals are represented by the letters **J**, **K**, **L** and **M**.

The non-metals carbon and hydrogen are also shown.



7.1 Which metals are most likely to be extracted from their ores by heating with carbon?

- A** Metals **J**, **K** and **L**
- B** Metals **J**, **K** and **M**
- C** Metals **J**, **L** and **M**
- D** Metals **K**, **L** and **M**

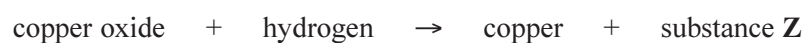
7.2 Which metal could be extracted from its ore by heating with hydrogen?

- A** Metal **J**
- B** Metal **K**
- C** Metal **L**
- D** Metal **M**

7.3 Which metals could displace tin from tin oxide?

- A** Metals **J** and **K**
- B** Metals **J** and **L**
- C** Metals **K** and **L**
- D** Metals **L** and **M**

7.4 The word equation shows the reaction when hydrogen reacts with copper oxide.



Substance **Z** is

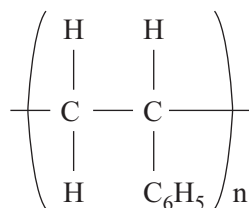
- A carbon dioxide.
- B carbon monoxide.
- C oxygen.
- D water

TURN OVER FOR THE NEXT QUESTION

Turn over ►

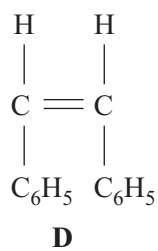
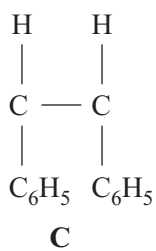
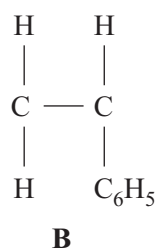
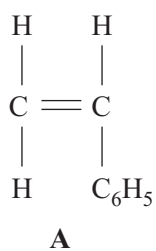
QUESTION EIGHT

The diagram represents a long chain molecule of a polymer called poly(styrene).



The molecules of poly(styrene) are built up from small molecules of styrene.

8.1 What is the formula for a molecule of styrene?



8.2 Each small molecule, from which the large poly(styrene) molecule is built up, is called

- A** an alkane.
- B** a fraction.
- C** a monomer.
- D** a polymer.

8.3 Molecules of styrene are able to join together to form long chain molecules because

- A they are hydrocarbons.
- B they are unsaturated.
- C they have carbon carbon bonds.
- D they have covalent bonds.

8.4 What other product is formed when styrene molecules combine to produce poly(styrene)?

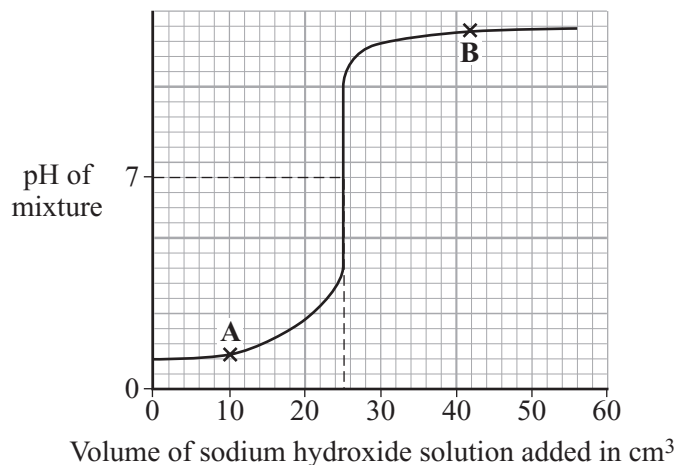
- A Carbon dioxide
- B Hydrogen
- C Water
- D No other product is formed

TURN OVER FOR THE NEXT QUESTION

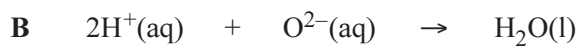
Turn over ►

QUESTION NINE

Sodium hydroxide solution was carefully added to 25 cm³ dilute hydrochloric acid. After each addition, the mixture was stirred and its pH taken using an accurate instrument. The graph shows how the pH changed as the alkali was added.



9.1 The reaction between the sodium hydroxide solution and the hydrochloric acid solution can be represented by



9.2 What volume of sodium hydroxide solution exactly neutralised the sample of hydrochloric acid?

A 7 cm³

B 10 cm³

C 25 cm³

D 40 cm³

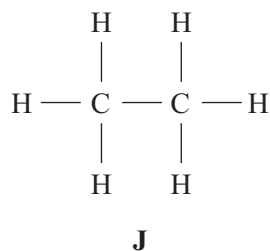
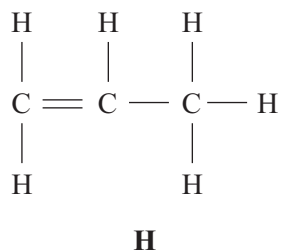
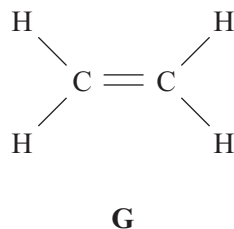
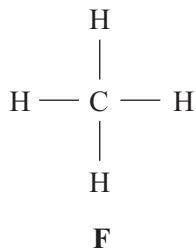
- 9.3** At the neutral point, the mixture would contain water and
- A** hydrochloric acid only.
 - B** sodium chloride and hydrochloric acid.
 - C** sodium chloride only.
 - D** sodium hydroxide only.
- 9.4** Which of the following correctly describes the ion concentrations at points **A** and **B**?
- A** The concentration of H^+ ions is equal at **A** and **B**
 - B** The concentration of H^+ ions is greater at **A** than at **B**
 - C** The concentration of H^+ ions is greater at **B** than at **A**
 - D** The concentration of OH^- ions is greater at **A** than at **B**

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The diagrams show the formulae for four different hydrocarbons.



10.1 Which hydrocarbons are unsaturated?

- A **F and G**
- B **F and J**
- C **G and H**
- D **H and J**

10.2 Which hydrocarbon has the lowest boiling point?

- A **F**
- B **G**
- C **H**
- D **J**

10.3 Molecules of **G** can link together to form a polymer.

What is the name of this polymer?

- A Poly(ethene)
- B Poly(propene)
- C Poly(styrene)
- D Poly(vinyl chloride)

10.4 Which polymer is most commonly used for making crates and ropes?

- A Poly(ethene)
- B Poly(propene)
- C Poly(styrene)
- D Poly(vinyl chloride)

END OF TEST