

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2006



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

346015

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

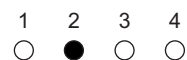
Instructions

- 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 '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.
- Do all rough work in this book, **not** on your answer sheet.

Instructions for recording answers

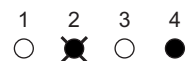
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

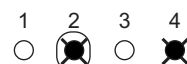


- Do **not** extend beyond the circles.

- 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 crude oil.

Match words from the list with the numbers **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 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 burning hydrocarbon fuels.

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

carbon dioxide

oxygen

sulphur dioxide

water (vapour)

When a hydrocarbon fuel burns, it is reacting with . . . **1**

Carbon in the fuel reacts to make . . . **2**


Hydrogen in the fuel reacts to make . . . **3**

Some hydrocarbon fuels also contain a little sulphur. So when they burn, they make . . . **4**

Turn over ►

QUESTION FOUR

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

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

The table is about metals.

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

aluminium

copper

sodium

tin

Metal	What we can say about the metal
1	it can be displaced from its oxide by both carbon and hydrogen
2	it can be displaced from its oxide by carbon but not by hydrogen
3	it cannot be displaced from its compounds by calcium
4	it is less reactive than calcium but it cannot be displaced from its compounds using carbon

QUESTION FIVE

The flow diagram shows how slaked lime is made.

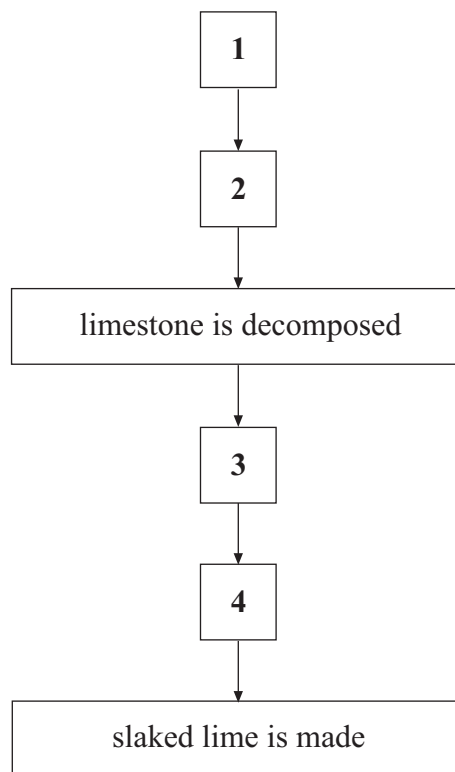
Match words from the list with the numbers 1–4 in the diagram.

carbon dioxide and quicklime are made

limestone is heated in a kiln

limestone is quarried and powdered

quicklime is reacted with water



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

This question is about iron.

Which **two** of the statements, **J**, **K**, **L**, **M** and **N**, are correct?

- J** iron corrodes faster if it is connected to a more reactive metal
- K** iron does not corrode if it is connected to a less reactive metal
- L** iron is extracted from haematite
- M** protection of iron against corrosion, by connecting it to another metal, is called sacrificial protection
- N** stainless steel is a mixture of chromium and magnesium

QUESTION SEVEN

This question is about the hydrocarbons in crude oil.

Which **two** of the statements, **P**, **Q**, **R**, **S** and **T**, are correct?

- P** all hydrocarbon molecules contain the same number of carbon atoms
- Q** the hydrocarbon molecules in crude oil vary in size
- R** the hydrocarbons in crude oil can be separated by fractional distillation
- S** the hydrocarbons with the lowest boiling points are those with the largest molecules
- T** the most viscous hydrocarbons are those with the smallest molecules

Turn over for the next question

Turn over ►

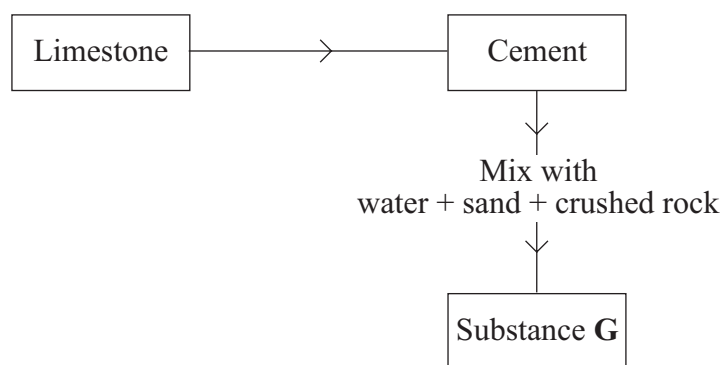
SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

The chart shows some of the substances that can be made from limestone.

**8.1** To make cement, powdered limestone is heated in a rotary kiln with . . .

- A clay.
- B quicklime.
- C sand.
- D soda.

8.2 Substance **G** is . . .

- A calcium hydroxide.
- B calcium oxide.
- C clay.
- D concrete.

- 8.3** Limestone (calcium carbonate) breaks down when it is heated strongly. Copper carbonate breaks down in a similar way.

What are the products from the breakdown of copper carbonate?

- A Copper + carbon dioxide
 - B Copper + water
 - C Copper oxide + carbon dioxide
 - D Copper oxide + water
- 8.4** This type of reaction, where a compound breaks down when it is heated strongly, is called . . .
- A fractional distillation.
 - B oxidation.
 - C reduction.
 - D thermal decomposition.

Turn over for the next question

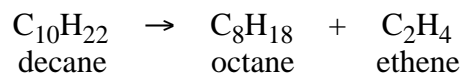
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QUESTION NINE

There is a hydrocarbon called decane.

Its formula is $C_{10}H_{22}$

A molecule of decane can be cracked to make two different hydrocarbons with smaller molecules.



9.1 Decane can be cracked by . . .

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

9.2 Octane is used as a fuel in car engines.

When octane burns in plenty of air, the products are . . .

- A carbon dioxide and oxygen.
- B carbon dioxide and water (vapour).
- C oxygen and water (vapour).
- D sulphur dioxide and oxygen.

9.3 Poly(ethene) is made from ethene by polymerisation.

Poly(ethene) is used for making . . .

- A cardboard.
- B crates.
- C plastic bags.
- D ropes.

- 9.4** In some hydrocarbon molecules, the carbon atoms are arranged in a chain. The more carbon atoms in the molecule, the longer the chain.

Which line correctly describes the change in the length of the chain, caused by cracking and polymerisation of hydrocarbons?

	Cracking	Polymerisation
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

Turn over for the next question

Turn over ►

QUESTION TEN

The diagram shows part of the periodic table.

Group 1		Group 2												Group 3	Group 4	Group 5	Group 6	Group 7	Group 0	
																				Ar
K																				

10.1 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.

10.2 Argon (Ar) is placed before potassium (K) in the table even though . . .

- A it does not oxidise easily.
- B it has a greater relative atomic mass.
- C it is more dense.
- D it reacts more vigorously with water.

10.3 In the periodic table, the transition elements are . . .

- 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.

10.4 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.

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**.

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QUESTION ONE

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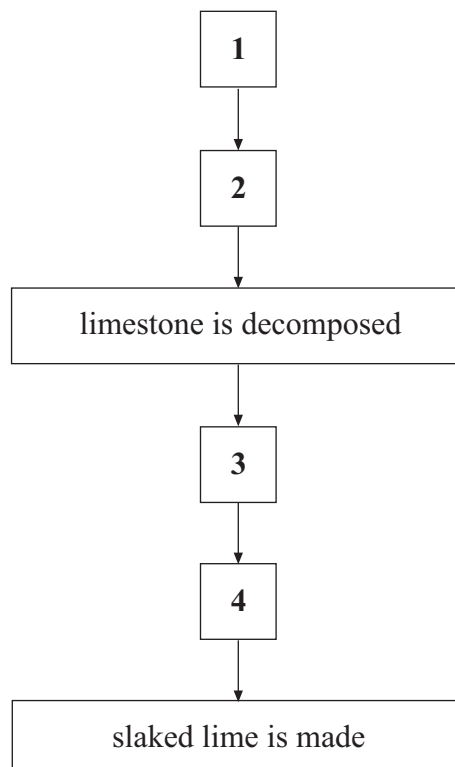
Match words from the list with the numbers **1–4** in the diagram.

carbon dioxide and quicklime are made

limestone is heated in a kiln

limestone is quarried and powdered

quicklime is reacted with water



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

carbon monoxide

copper

iron sulphate

... **1** ... + oxygen → carbon dioxide

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

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

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

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 hydrocarbons in crude oil.

Which **two** of the statements, **P**, **Q**, **R**, **S** and **T**, are correct?

- P** all hydrocarbon molecules contain the same number of carbon atoms
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QUESTION FOUR

This question is about a hydrocarbon.

The chemical formula for the hydrocarbon is C_2H_6 Which **two** statements about this hydrocarbon are correct?

- it is a saturated hydrocarbon**
- it is an alkene**
- it can be used to make polymers**
- the carbon atoms are joined by double bonds**
- the carbon atoms are joined to the hydrogen atoms by single bonds**

Turn over for the next question

Turn over ►

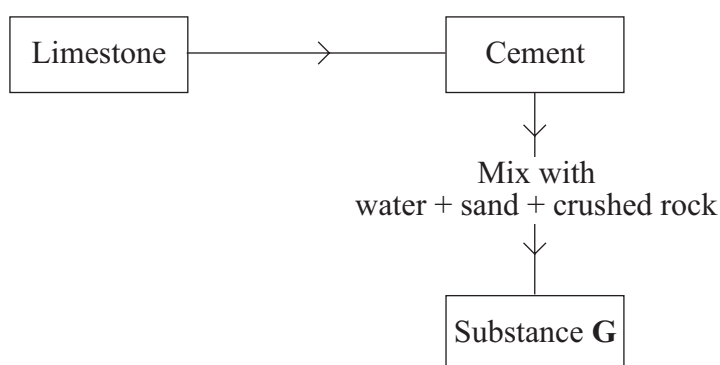
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QUESTION FIVE

The chart shows some of the substances that can be made from limestone.

**5.1** To make cement, powdered limestone is heated in a rotary kiln with . . .

- A** clay.
- B** coke.
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- D** sand.

5.2 Substance **G** is . . .

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- 5.3** Limestone (calcium carbonate) breaks down when it is heated strongly. Copper carbonate breaks down in a similar way.

What are the products from the breakdown of copper carbonate?

- A** Copper + carbon dioxide
 - B** Copper + water
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- 5.4** This type of reaction, where a compound breaks down when it is heated strongly, is called . . .
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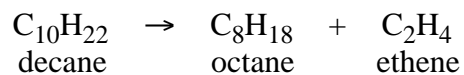
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QUESTION SEVEN

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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

Turn over ►

QUESTION EIGHT

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


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

- A calcium carbonate \rightarrow carbon dioxide + calcium oxide
- B carbon + oxygen \rightarrow carbon dioxide
- C carbon + oxygen \rightarrow carbon monoxide
- D carbon dioxide + carbon \rightarrow carbon monoxide

8.2 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 **8.3** and **8.4**.)

Reactivity Series	
Calcium	Most reactive
Magnesium	
Carbon	
Zinc	
Tin	
Lead	

8.3 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

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

- A** combination.
- B** neutralisation.
- C** oxidation.
- D** reduction.

Turn over for the next question

Turn over ►

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?



- 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 $\text{H}^+(\text{aq}) + \text{OH}^+(\text{aq}) \rightarrow \text{H}^+\text{OH}^-(\text{l})$
- B $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
- C $\text{H}^-(\text{aq}) + \text{OH}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
- D $\text{H}^-(\text{aq}) + \text{OH}^+(\text{aq}) \rightarrow \text{H}^{2+}\text{O}^-(\text{l})$

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** A molecule of nitric acid (HNO_3) has one hydrogen atom which can be replaced by a metal to form a neutral salt.

If an acid molecule has two or more replaceable hydrogen atoms, neutral and acid salts can be formed.

Which one of these acids can form acid salts?

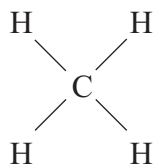
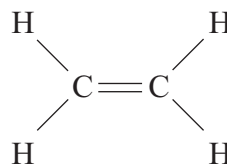
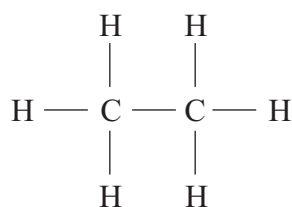
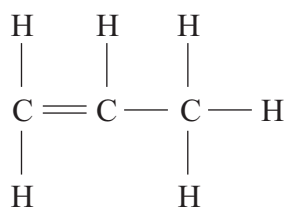
- A** Carbonic acid, H_2CO_3
- B** Hydriodic acid, HI
- C** Hydrobromic acid, HBr
- D** Hydrochloric acid, HCl

Turn over for the next question

Turn over ►

QUESTION TEN

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

Hydrocarbon J**Hydrocarbon K****Hydrocarbon L****Hydrocarbon M**

10.1 Which of these compounds can form polymers?

- A** Hydrocarbons **J** and **K**
- B** Hydrocarbons **K** and **M**
- C** Hydrocarbons **L** and **M**
- D** Hydrocarbon **K** only

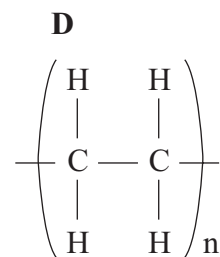
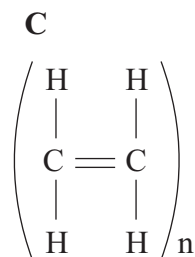
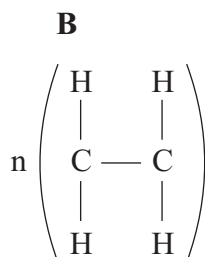
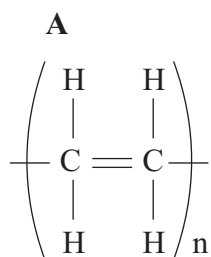
10.2 Each small hydrocarbon molecule from which a polymer is made is called . . .

- A** a monomer.
- B** an alkane.
- C** an ester.
- D** an oxide.

10.3 From which of the four hydrocarbons can poly(ethene) be made?

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

10.4 Which formula represents poly(ethene)?



END OF TEST

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