Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature							

General Certificate of Secondary Education
November 2006

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

ASSESSMENT and QUALIFICATIONS ALLIANCE

Thursday 23 November 2006 Morning Session

For this paper you must have:
- a black ball-point pen
- an objective test answer sheet

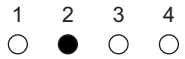
You may use a calculator.

Time allowed: 30 minutes

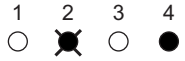
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Materials and Reactions' printed on it.
- Attempt **one Tier only**, **either** the Foundation 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

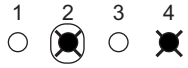
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 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 is produced in the thermal decomposition of magnesium carbonate
4	it reacts with carbon to form carbon dioxide

QUESTION TWO

This question is about limestone and products from limestone.

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

to make cement

to make quicklime

to make slaked lime

to make water less acidic

Limestone is added to lakes . . . **1** . . . .

Limestone is heated in a kiln . . . **2** . . . .

Limestone is mixed with clay and then heated . . . **3** . . . .

Calcium oxide is reacted with water . . . **4** . . . .

QUESTION THREE

This question is about elements found in compounds and mixtures.

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

air

haematite

hydrocarbon

quicklime

Compound or mixture	An element found in the compound or mixture
1	calcium
2	hydrogen
3	iron
4	nitrogen

QUESTION FOUR

This question is about elements and compounds.

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

atoms

ions

metals

ores

The 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** . . . .

Hydrogen . . . **3** . . . make solutions acidic.

Rocks containing enough of a metal compound to be worth mining are called . . . **4** . . . .

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 reacting the hot oxide 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 reacting the hot oxide with carbon.

You **cannot** displace metal **X** from its oxide by reacting the hot oxide with hydrogen.
You **cannot** displace metal **Y** from its oxide by reacting the hot oxide with carbon.

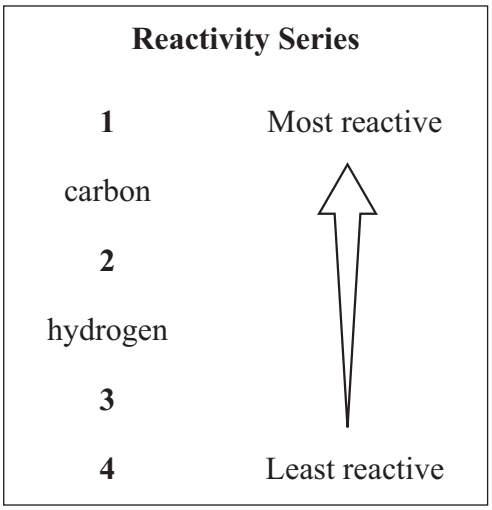
Match metals from the list with the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



Turn over for the next question

SECTION B

Questions **SIX** and **SEVEN**.

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

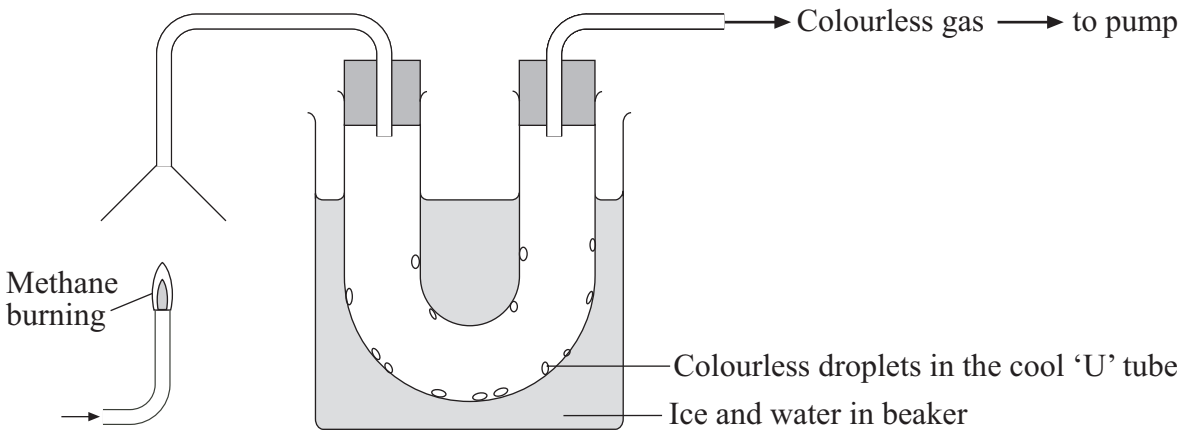
Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

Methane is a hydrocarbon.

The diagram shows an apparatus used to investigate methane burning in air.



Which **two** statements are correct?

all the products of burning methane are condensed in the cool 'U' tube

in this experiment, methane reacts with oxygen

methane burns in a limited supply of air to produce poisonous sulphur dioxide

the colourless droplets in the 'U' tube are water droplets

the colourless gas produced when methane burns is hydrogen

QUESTION SEVEN

This question is about gases.

Which **two** statements are correct?

ammonia dissolves in water to make an alkaline solution

argon is in Group 1 of the periodic table

hydrogen is released when an acid reacts with an alkali

oxidation of carbon monoxide produces carbon dioxide

oxygen is released when limestone is heated strongly

Turn over for the next question

SECTION C

Questions **EIGHT** to **TEN**.

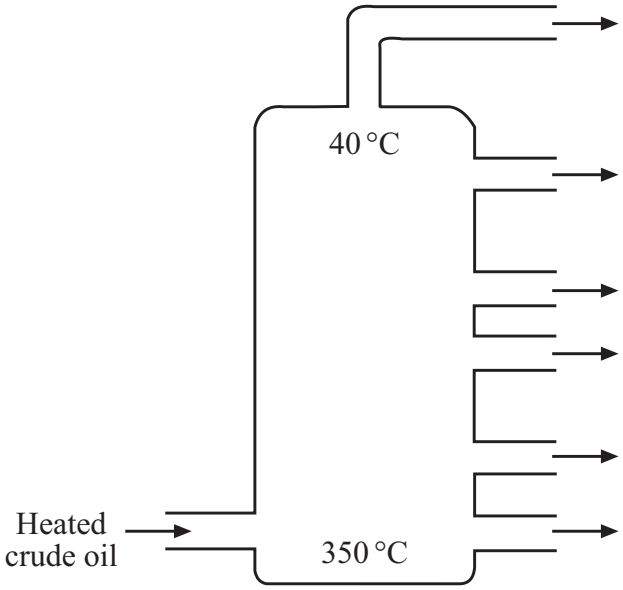
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

In a fractionating column, crude oil is separated into a number of fractions.



8.1 The crude oil vapour separates into fractions when it . . .

A condenses at different temperatures.

B condenses at 40 °C.

C condenses at 350 °C.

D falls under gravity in the column.

8.2 Fractional distillation works because the hydrocarbons in the crude oil have . . .

A different boiling points.

B different chemical properties.

C molecules containing carbon and hydrogen only.

D similar boiling points.

8.3 The hydrocarbon molecules in each fraction contain . . .

A a similar number of carbon atoms.

B a similar number of oxygen atoms.

C the same number of carbon atoms.

D the same number of hydrogen atoms.

8.4 Which of these hydrocarbons will have the highest boiling point?

A C_2H_6

B C_4H_{10}

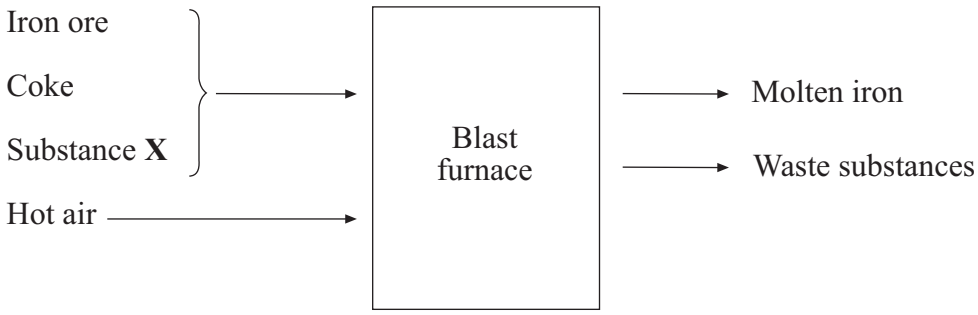
C C_8H_{18}

D $C_{12}H_{26}$

Turn over for the next question

QUESTION NINE

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



9.1 What is substance **X**?

A Bauxite

B Cryolite

C Limestone

D Sulphur

9.2 Which is the main element in coke?

A Carbon

B Iron

C Oxygen

D Sulphur

9.3 The hot air is blasted into the furnace . . .

A to mix the iron ore and coke.

B to react with the coke and release energy.

C to react with the iron ore.

D to sweep out the waste gases.

9.4 What collects at the bottom of the blast 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

QUESTION TEN

This question is about the corrosion of metals.

10.1 Iron (steel) is used as a structural material for bridges. Corrosion will weaken the iron.

Bridges made of iron are painted frequently.

This reduces corrosion because . . .

A oxygen and water cannot react with the iron.

B paint forms an oxide layer on the surface of the iron.

C paint makes the iron much harder.

D paint reflects the light.

10.2 Car exhaust pipes can corrode quickly. Corrosion can be prevented by making the exhaust pipes from stainless steel.

Stainless steel is an alloy made mainly of . . .

A aluminium and magnesium.

B iron and carbon.

C iron and magnesium.

D iron, chromium and nickel.

Iron in sea water rusts very quickly. The iron hull of a ship rusts more slowly if blocks of zinc are attached to it.

10.3 Why does iron react more slowly if zinc is attached to it?

A Iron is a harder metal than zinc.

B Zinc does not react with oxygen and water.

C Zinc is a transition metal.

D Zinc is more reactive than iron.

10.4 The zinc protects the iron hull of the ship by . . .

A electrolysis.

B forming an alloy.

C forming impurities in the iron.

D sacrificial protection.

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 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 reacting the hot oxide 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 reacting the hot oxide with carbon.

You **cannot** displace metal **X** from its oxide by reacting the hot oxide with hydrogen.
You **cannot** displace metal **Y** from its oxide by reacting the hot oxide with carbon.

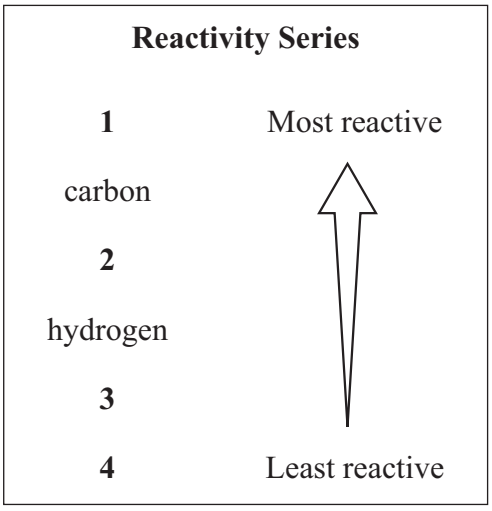
Match metals from the list with the numbers **1–4** in the reactivity series.

metal W

metal X

metal Y

metal Z



QUESTION TWO

This question is about the structural formulae of four hydrocarbons.

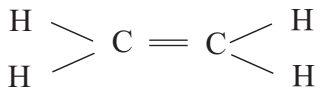
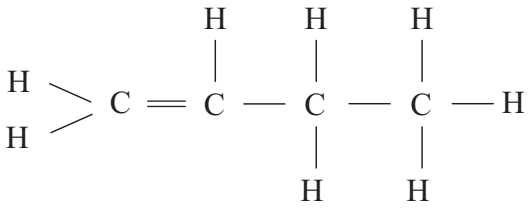
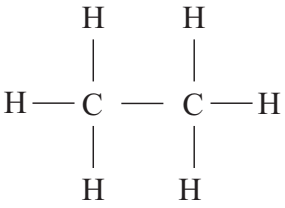
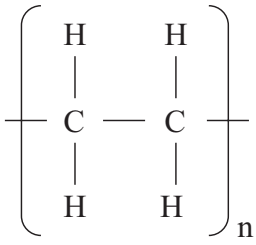
Match words, **E**, **F**, **G** and **H**, from the list with the numbers **1–4** below.

E **a polymer**

F **a saturated hydrocarbon with 2 carbon atoms in each molecule**

G **an unsaturated hydrocarbon with 4 carbon atoms in each molecule**

H **ethene**

Hydrocarbon	Formula for one molecule of the hydrocarbon
1	
2	
3	
4	

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

This question is about gases.

Which **two** statements are correct?

ammonia dissolves in water to make an alkaline solution

argon is in Group 1 of the periodic table

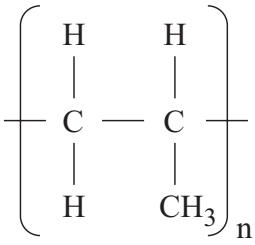
hydrogen is released when an acid reacts with an alkali

oxidation of carbon monoxide produces carbon dioxide

oxygen is released when limestone is heated strongly

QUESTION FOUR

This question is about poly(propene), which can be represented by the formula:



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

J **in landfill sites, poly(propene) is broken down quickly by microorganisms**

K **poly(propene) is biodegradable**

L **poly(propene) is made from propane, C_3H_8**

M **poly(propene) is made from propene, C_3H_6**

N **the carbon atoms in poly(propene) are linked by covalent bonds**

Turn over for the next question

SECTION C

Questions **FIVE** to **TEN**.

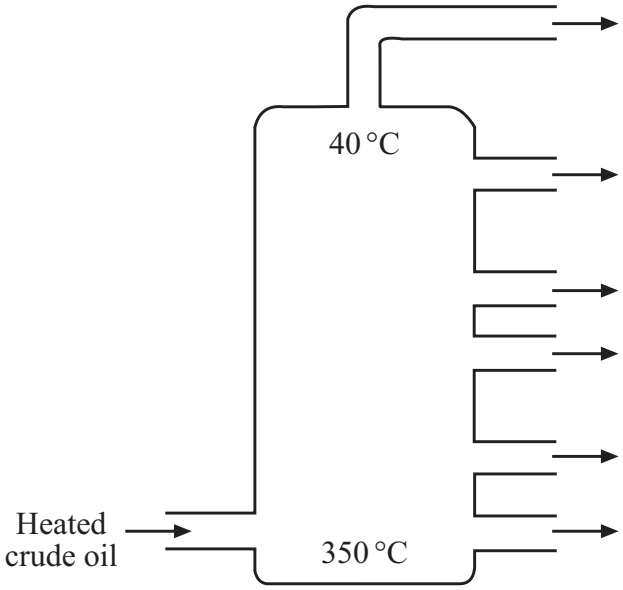
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

In a fractionating column, crude oil is separated into a number of fractions.



5.1 The crude oil vapour separates into fractions when it . . .

A condenses at different temperatures.

B condenses at 40 °C.

C condenses at 350 °C.

D falls under gravity in the column.

5.2 Fractional distillation works because the hydrocarbons in the crude oil have . . .

A different boiling points.

B different chemical properties.

C molecules containing carbon and hydrogen only.

D similar boiling points.

5.3 The hydrocarbon molecules in each fraction contain . . .

A a similar number of carbon atoms.

B a similar number of oxygen atoms.

C the same number of carbon atoms.

D the same number of hydrogen atoms.

5.4 Which of these hydrocarbons will have the highest boiling point?

A C_2H_6

B C_4H_{10}

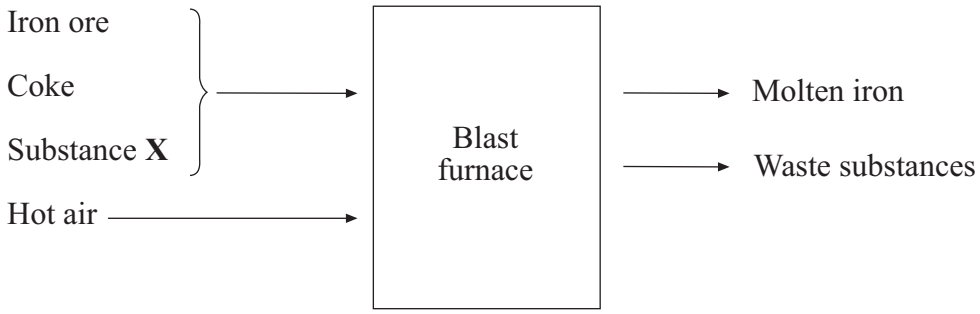
C C_8H_{18}

D $C_{12}H_{26}$

Turn over for the next question

QUESTION SIX

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



6.1 What is substance **X**?

A Bauxite

B Cryolite

C Limestone

D Sulphur

6.2 Which is the main element in coke?

A Carbon

B Iron

C Oxygen

D Sulphur

6.3 The hot air is blasted into the furnace . . .

A to mix the iron ore and coke.

B to react with the coke and release energy.

C to react with the iron ore.

D to sweep out the waste gases.

6.4 What collects at the bottom of the blast 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

QUESTION SEVEN

This question is about the corrosion of metals.

7.1 Iron (steel) is used as a structural material for bridges. Corrosion will weaken the iron.

Bridges made of iron are painted frequently.

This reduces corrosion because . . .

A oxygen and water cannot react with the iron.

B paint forms an oxide layer on the surface of the iron.

C paint makes the iron much harder.

D paint reflects the light.

7.2 Car exhaust pipes can corrode quickly. Corrosion can be prevented by making the exhaust pipes from stainless steel.

Stainless steel is an alloy made mainly of . . .

A aluminium and magnesium.

B iron and carbon.

C iron and magnesium.

D iron, chromium and nickel.

Iron in sea water rusts very quickly. The iron hull of a ship rusts more slowly if blocks of zinc are attached to it.

7.3 Why does iron react more slowly if zinc is attached to it?

A Iron is a harder metal than zinc.

B Zinc does not react with oxygen and water.

C Zinc is a transition metal.

D Zinc is more reactive than iron.

7.4 The zinc protects the iron hull of the ship by . . .

A electrolysis.

B forming an alloy.

C forming impurities in the iron.

D sacrificial protection.

Turn over for the next question

QUESTION EIGHT

Ammonium chloride is a salt.

Ammonium chloride can be made by the reaction of an acid with an alkali:

$$\text{acid} + \text{alkali} \rightarrow \text{ammonium chloride} + \text{water}$$

8.1 Which acid and alkali would you use to make ammonium chloride?

	Acid	**Alkali**
A	ethanoic acid	ammonia solution
B	ethanoic acid	sodium hydroxide
C	hydrochloric acid	ammonia solution
D	hydrochloric acid	sodium hydroxide

8.2 When the acid is neutralised by the alkali, the reaction can be written . . .

A $H^+(aq) + OH^+(aq) \rightarrow H_2O(l)$

B $H^-(aq) + OH^-(aq) \rightarrow H_2O(l)$

C $H^+(l) + OH^-(l) \rightarrow H_2O(aq)$

D $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

8.3 The salt, copper sulphate, **cannot** be made by the reaction of an acid with an alkali because . . .

A copper hydroxide does not react with sulphuric acid.

B copper hydroxide forms a neutral solution.

C copper hydroxide is a coloured compound.

D copper hydroxide is insoluble in water.

8.4 Which of these salts **cannot** be made by the reaction of an acid with an alkali?

A Ammonium sulphate

B Potassium chloride

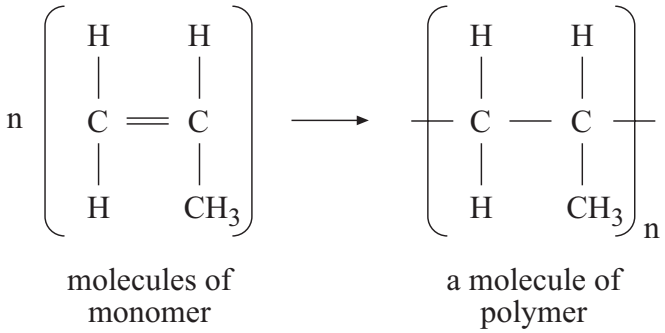
C Sodium nitrate

D Zinc sulphate

Turn over for the next question

QUESTION NINE

The equation shows a reaction to produce a polymer.



9.1 The letter 'n' before the formula for the monomer stands for . . .

A a large number.

B a small number.

C neutral.

D normal.

9.2 The formula for the monomer is . . .

A C_2H_2

B C_2H_4

C C_3H_6

D C_3H_8

9.3 The monomer is a very reactive substance because it is . . .

A a carbohydrate.

B a saturated hydrocarbon.

C a small molecule.

D an unsaturated hydrocarbon.

9.4 The monomer belongs to a group of hydrocarbons called alkenes.

What is the name of the simplest alkene and the polymer made from it?

	Simplest alkene	**Polymer**
A	ethane	poly(propene)
B	ethene	poly(propene)
C	ethene	poly(ethene)
D	methane	poly(ethene)

Turn over for the next question

QUESTION TEN

The hydrocarbon, pentane C_5H_{12}, can be cracked in different ways.

The equations show two possible cracking reactions.

$$C_5H_{12} \rightarrow C_3H_6 + C_2H_6$$

$$C_5H_{12} \rightarrow C_4H_8 + CH_4$$

10.1 Under what conditions does cracking occur?

A Pentane in liquid state, hot catalyst

B Pentane in vapour state, hot catalyst

C Pentane in liquid state, high pressure

D Pentane in vapour state, high pressure

10.2 What are the products of the two reactions?

A Four alkanes

B Four alkenes

C One alkane and three alkenes

D Two alkanes and two alkenes

10.3 Which of the products have structures with a double bond?

A C_2H_6 and CH_4

B C_3H_6 and C_2H_6

C C_3H_6 and C_4H_8

D C_4H_8 and CH_4

10.4 The compound C_2H_6 could be broken down further.

Which equation shows what could happen?

A $C_2H_6 \rightarrow CH_4 + H_2$

B $C_2H_6 \rightarrow C_2H_4 + H_2$

C $C_2H_6 \rightarrow CH_3 + CH_4$

D $C_2H_6 \rightarrow CH_4 + CH_2$

END OF TEST

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