Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
November 2006

SCIENCE A **CHY1B**
Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHEMISTRY
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Wednesday 22 November 2006 Morning Session

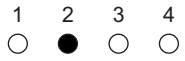
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

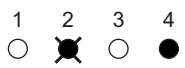
Time allowed: 30 minutes

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 'Oils, Earth and Atmosphere' 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.

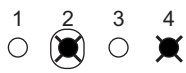
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 ONE

Questions **ONE** to **SIX**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about gases.

Match gases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A carbon dioxide

B helium

C nitrogen

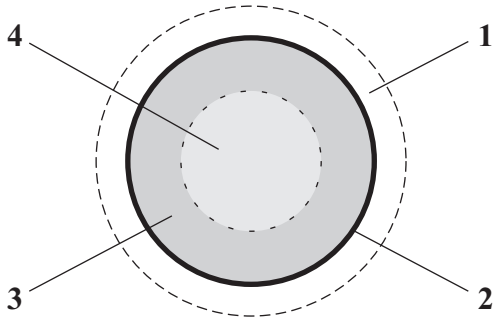
D oxygen

	What we can say about the gas
1	It is a noble gas, much less dense than air.
2	It is the main gas in the atmosphere of Venus.
3	It makes up about 20 % of Earth's atmosphere today.
4	It makes up about 80 % of Earth's atmosphere today.

QUESTION TWO

The diagram shows the layered structure of the Earth.

The outer dotted line marks a layer that is about 15 km above the Earth's surface.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A atmosphere

B core

C crust

D mantle

Turn over for the next question

QUESTION THREE

This question is about processes and events associated with tectonic plates.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A continental drift

B convection currents

C radioactive processes

D volcanic eruptions

A scientist called Alfred Wegener suggested that in the past there was a single, large landmass on Earth.

The large landmass split up and the smaller landmasses moved apart. This process is called . . . **1** . . . .

Tectonic plates move because of . . . **2** . . . in the Earth's mantle.

The heat required for this movement to occur comes from natural . . . **3** . . . .

At the boundaries between the tectonic plates there are sometimes . . . **4** . . . .

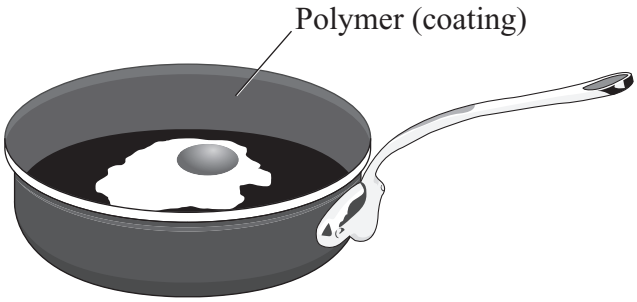
QUESTION FOUR

This question is about the properties of polymers and their uses.

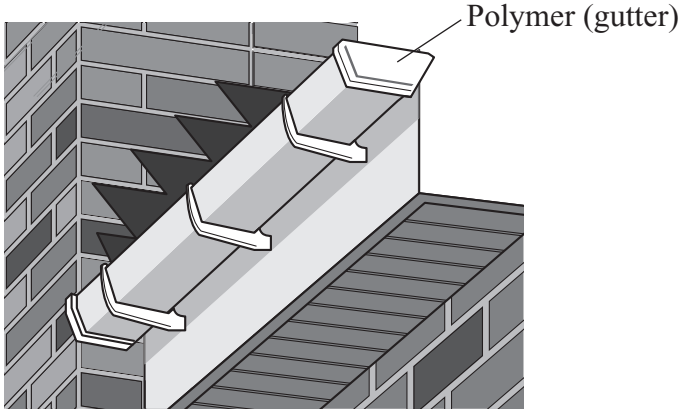
The drawings show four different uses of polymers.

A

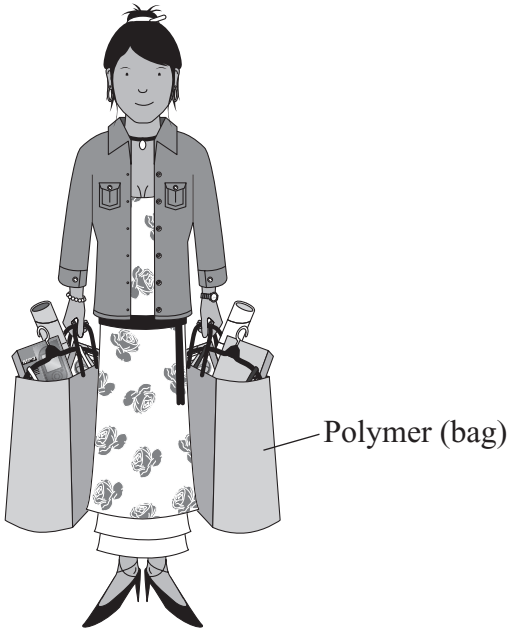
B



C



D



The table shows the properties of four different polymers.

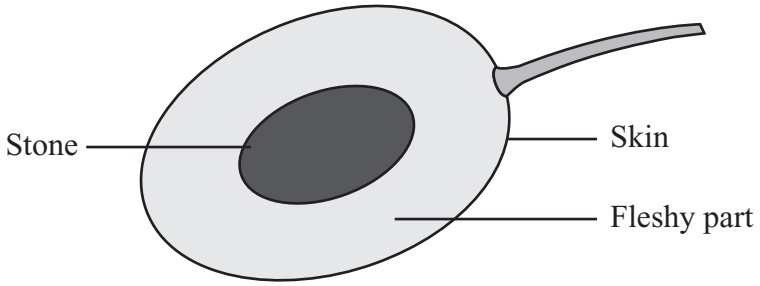
Match the drawings, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

	Properties of the polymer
1	forms a tough, slippery surface that can be heated strongly
2	lightweight and can be stretched into thin, tough film
3	resistant to chemical attack and can be moulded into rigid shapes
4	strong, does not rot and can be pulled into fibres

QUESTION FIVE

This question is about extracting oil from a fruit. Olives are fruits of the olive tree. Olive oil can be extracted from olives.

Olive fruit



The stages in the extraction are shown in the flow chart below.

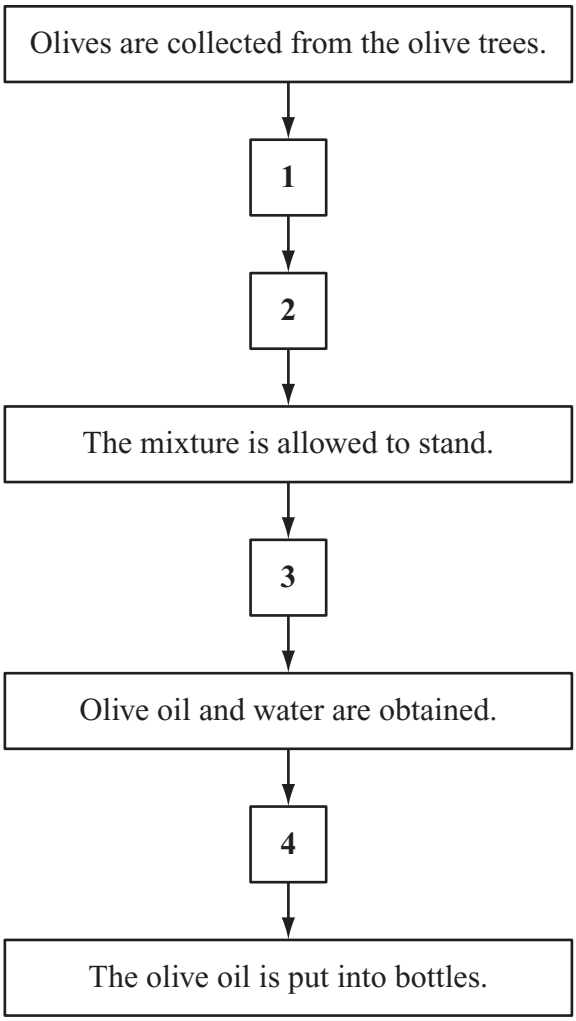
Match sentences, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Olive oil separates from the water.

B The mixture is pressed.

C Water is added and the mixture is stirred.

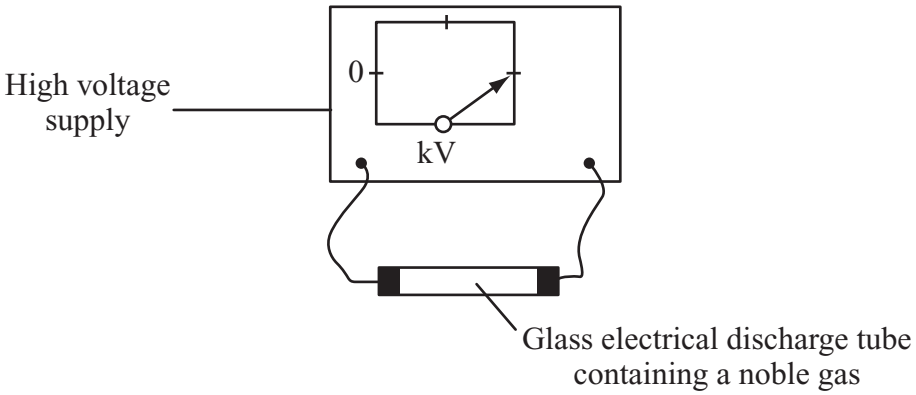
D The olives are crushed.



QUESTION SIX

A glass electrical discharge tube is filled with a noble gas.

When a high voltage is applied across it, a coloured light is produced.



This was done with four different noble gases, using the same voltage. The colour of the light is different for each noble gas.

Noble gas used	neon	argon	krypton	xenon
Colour produced	red	purple	light blue	dark blue

Match variables, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A the colour produced

B the noble gas used

C the thickness of the glass

D the voltage used

	Type of variable
1	It is the independent variable (the variable that is deliberately changed).
2	It is the dependent variable.
3	It is a variable that was controlled to make the investigation fair.
4	It is a variable that did not affect the result.

SECTION TWO

Questions **SEVEN** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SEVEN

The equation shows the thermal decomposition of a hydrocarbon.

$$C_6H_{14} \rightarrow C_3H_6 + \text{Substance } \mathbf{E}$$

7A What name is given to this process?

1 combustion

2 condensation

3 cracking

4 hydrogenation

7B In this process, . . .

1 hot gases are mixed with water.

2 hot vapours are passed over a hot catalyst.

3 liquids are mixed with water.

4 liquids are passed over a catalyst.

7C Substance **E** will have the formula . . .

1 CH_4

2 C_3H_8

3 C_6H_3

4 C_9H_{20}

7D The substance with the formula C_3H_6 is . . .

1 an alkane.

2 an alkene.

3 a saturated hydrocarbon.

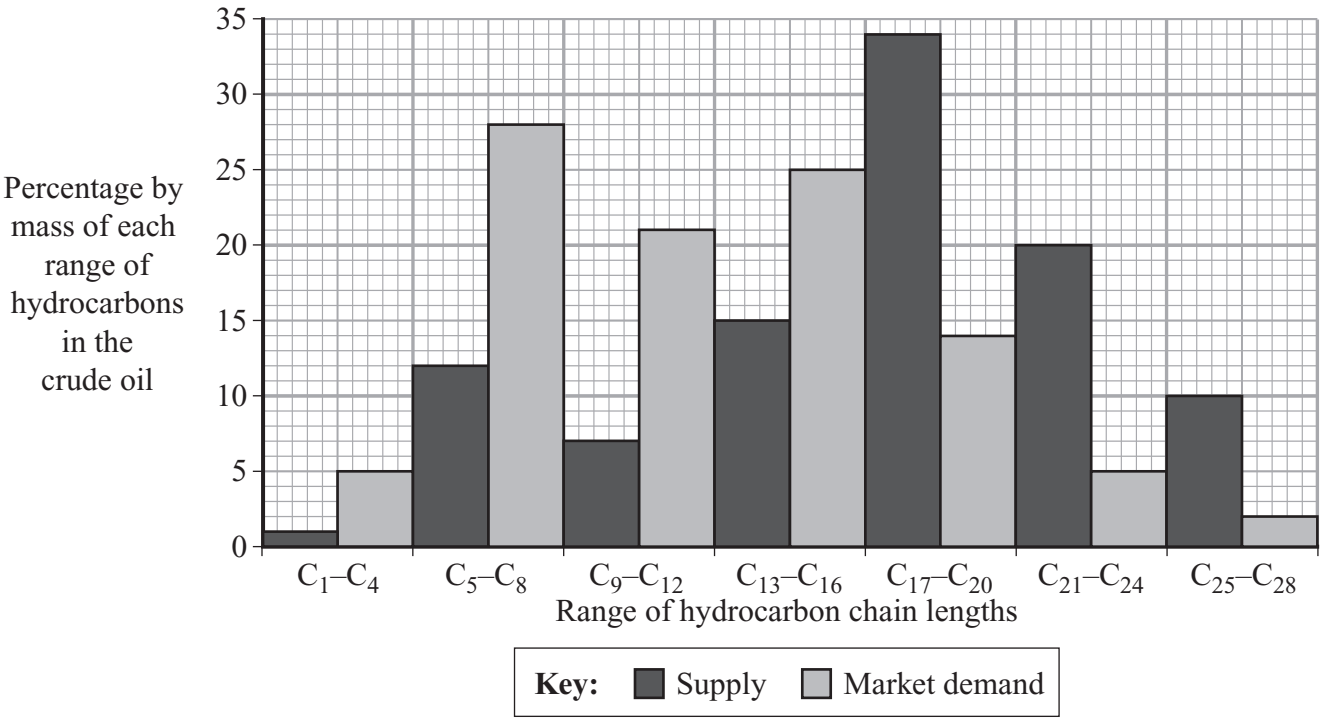
4 a polymer.

Turn over for the next question

QUESTION EIGHT

Crude oil can be separated into fractions.

The bar chart shows the relative amounts of supply and market demand for some hydrocarbon fractions.



8A For which range of hydrocarbon chain lengths is market demand three times the supply?

1 C_1–C_4

2 C_5–C_8

3 C_9–C_{12}

4 C_{13}–C_{16}

8B There is a high market demand for the C_5–C_8 range compared with the C_{21}–C_{24} range.

This is because the C_5–C_8 range . . .

1 is used as fuels.

2 has higher boiling points.

3 ignites at a higher temperature.

4 is used to make polymers.

The oil industry has to overcome the problem of low supply and high market demand for the C_5–C_8 range.

8C One way in which this can be achieved is . . .

1 by reacting together other hydrocarbons with longer chain lengths.

2 by polymerisation of hydrocarbons with longer chain lengths.

3 by saturation.

4 by breaking down the hydrocarbons with longer chain lengths.

8D Another way in which this can be achieved is . . .

1 by developing equipment which can use the low demand fractions as fuels.

2 by developing markets that use more of the C_1–C_4 range.

3 by developing markets for the high demand fractions.

4 by using the C_1–C_4 range for other purposes.

Turn over for the next question

QUESTION NINE

In Britain, we drink about 2 billion litres of bottled water per year.

Use the following information, which is part of a newspaper article about bottled water, to answer the questions.

> **Manufacturing the bottle**
> Many of the bottles are made from PET, a plastic which takes about 450 years to biodegrade. PET is made from substances obtained from crude oil.
>
> **Getting the water to our homes**
> About 25 % of the bottled water is imported. Lorries that deliver bottled water travel as much as 2000 km on a round trip.
>
> **The empties**
> About 4.5 % of household waste is plastic bottles, of which 10 % is PET water bottles. The majority of this ends up on landfill sites or is burned.

9A One problem suggested by the information is that the substances used to make PET . . .

1 are obtained from a non-renewable raw material.

2 are obtained from a renewable raw material.

3 are dangerous to use.

4 are too expensive.

9B What percentage of household waste is made up of PET water bottles?

1 0.045 %

2 0.45 %

3 14.5 %

4 45.0 %

9C An important reason for not putting PET bottles in landfill sites is that . . .

1 landfill sites are used only for glass bottles.

2 PET biodegrades very slowly.

3 PET is lightweight and blows over the countryside.

4 PET kills wildlife.

9D An environmental problem with importing bottled water by road is that . . .

1 it increases the amount of carbon dioxide in the atmosphere.

2 it increases the amount of oxygen in the atmosphere.

3 it takes a long time for the water to reach British households.

4 water from European countries is of poor quality.

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 ONE

Questions **ONE** and **TWO**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

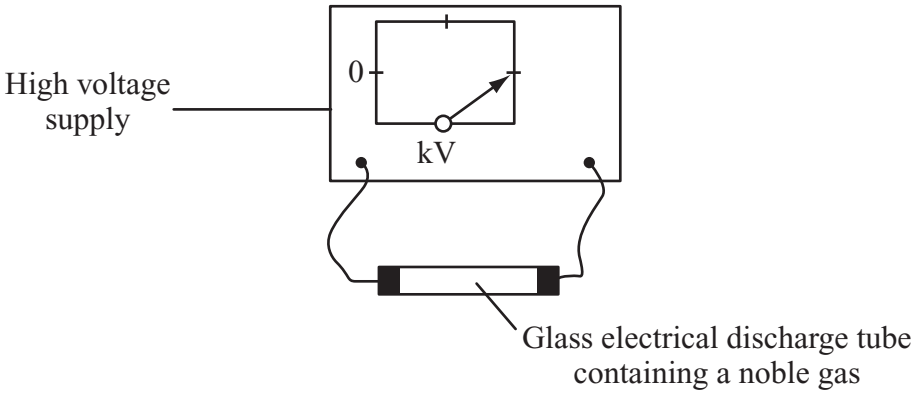
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

A glass electrical discharge tube is filled with a noble gas.

When a high voltage is applied across it, a coloured light is produced.



This was done with four different noble gases, using the same voltage. The colour of the light is different for each noble gas.

Noble gas used	neon	argon	krypton	xenon
Colour produced	red	purple	light blue	dark blue

Match variables, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A the colour produced

B the noble gas used

C the thickness of the glass

D the voltage used

	Type of variable
1	It is the independent variable (the variable that is deliberately changed).
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3	It is a variable that was controlled to make the investigation fair.
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Turn over for the next question

QUESTION TWO

The table gives information about four different substances.

The iodine number is a measure of how unsaturated a substance is.

The higher the iodine number, the more unsaturated the substance.

Substance	Iodine number	Melting point in °C
A	0	+ 1
B	54	+ 35
C	85	– 18
D	105	– 1

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

	What we can say about the substance
1	It has the highest number of double bonds.
2	It is a solid at room temperature (20 °C).
3	It has the lowest melting point.
4	It is a saturated compound.

Turn over for the next question

SECTION TWO

Questions **THREE** to **NINE**.

Each of these questions has four parts.

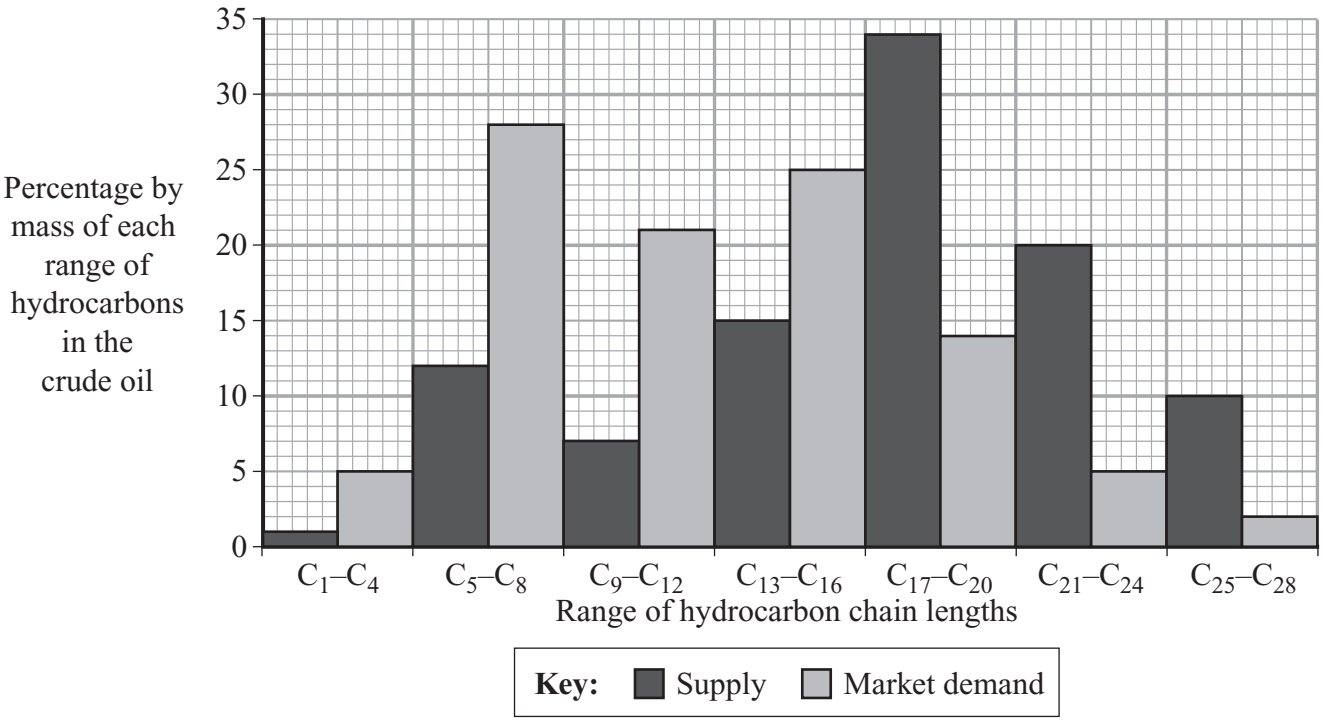
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Crude oil can be separated into fractions.

The bar chart shows the relative amounts of supply and market demand for some hydrocarbon fractions.



3A For which range of hydrocarbon chain lengths is market demand three times the supply?

1 C_1–C_4

2 C_5–C_8

3 C_9–C_{12}

4 C_{13}–C_{16}

3B There is a high market demand for the C_5–C_8 range compared with the C_{21}–C_{24} range.

This is because the C_5–C_8 range . . .

1 is used as fuels.

2 has higher boiling points.

3 ignites at a higher temperature.

4 is used to make polymers.

The oil industry has to overcome the problem of low supply and high market demand for the C_5–C_8 range.

3C One way in which this can be achieved is . . .

1 by reacting together other hydrocarbons with longer chain lengths.

2 by polymerisation of hydrocarbons with longer chain lengths.

3 by saturation.

4 by breaking down the hydrocarbons with longer chain lengths.

3D Another way in which this can be achieved is . . .

1 by developing equipment which can use the low demand fractions as fuels.

2 by developing markets that use more of the C_1–C_4 range.

3 by developing markets for the high demand fractions.

4 by using the C_1–C_4 range for other purposes.

Turn over for the next question

QUESTION FOUR

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Use the following information, which is part of a newspaper article about bottled water, to answer the questions.

> **Manufacturing the bottle**
> Many of the bottles are made from PET, a plastic which takes about 450 years to biodegrade. PET is made from substances obtained from crude oil.
>
> **Getting the water to our homes**
> About 25 % of the bottled water is imported. Lorries that deliver bottled water travel as much as 2000 km on a round trip.
>
> **The empties**
> About 4.5 % of household waste is plastic bottles, of which 10 % is PET water bottles. The majority of this ends up on landfill sites or is burned.

4A One problem suggested by the information is that the substances used to make PET . . .

1 are obtained from a non-renewable raw material.

2 are obtained from a renewable raw material.

3 are dangerous to use.

4 are too expensive.

4B What percentage of household waste is made up of PET water bottles?

1 0.045 %

2 0.45 %

3 14.5 %

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4C An important reason for not putting PET bottles in landfill sites is that . . .

1 landfill sites are used only for glass bottles.

2 PET biodegrades very slowly.

3 PET is lightweight and blows over the countryside.

4 PET kills wildlife.

4D An environmental problem with importing bottled water by road is that . . .

1 it increases the amount of carbon dioxide in the atmosphere.

2 it increases the amount of oxygen in the atmosphere.

3 it takes a long time for the water to reach British households.

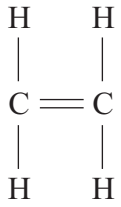
4 water from European countries is of poor quality.

Turn over for the next question

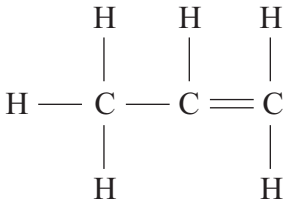
QUESTION FIVE

This question is about four hydrocarbons.

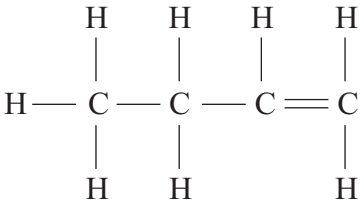
Alkene K



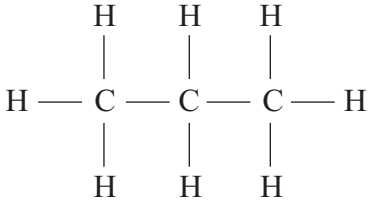
Alkene L



Alkene M



Alkane



5A The general formula for the alkenes is . . .

1 C_nH_n

2 C_nH_{2n}

3 C_nH_{2n+1}

4 C_nH_{2n+2}

5B Alkene **L** can be represented by . . .

1 C_3H_3

2 C_3H_6

3 C_3H_7

4 C_3H_8

5C Which row in the table correctly describes the bonding in hydrocarbon molecules?

	Number of bonds to each carbon atom	**Number of bonds to each hydrogen atom**
1	1	1
2	1	4
3	4	1
4	4	4

5D The main difference between alkenes and alkanes is that alkenes have . . .

1 more carbon atoms.

2 more hydrogen atoms.

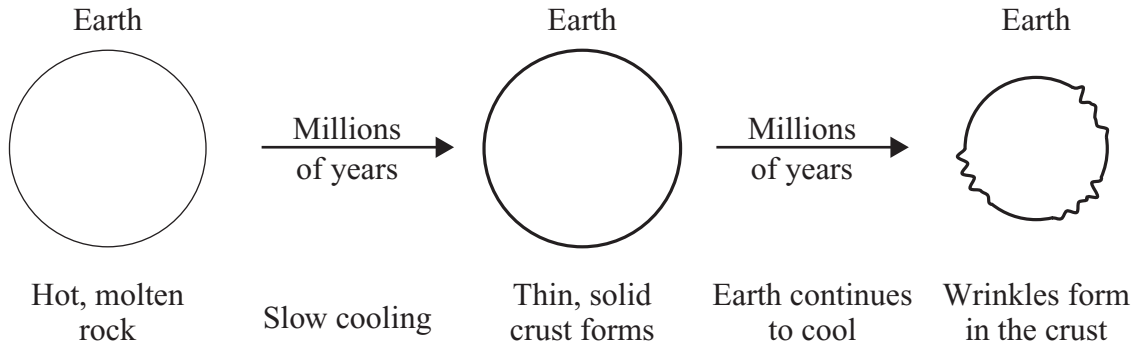
3 more single bonds.

4 at least one double bond.

Turn over for the next question

QUESTION SIX

The diagram shows how one early theory attempted to explain the formation of mountains on the Earth.



6A This early theory suggests that the mountains are formed . . .

1 as low density rock rises from the core.

2 as molten rock escapes from the core.

3 by the shrinking of the Earth.

4 by volcanic eruptions.

6B According to this theory, . . .

1 mountains rose up from the sea bed.

2 mountains were formed by earthquakes.

3 mountains were formed by a rising tectonic plate.

4 the high points of the wrinkles formed the mountains.

6C One reason why this theory is **not** accepted now is because . . .

1 radioactive processes in the Earth release heat.

2 the earth is spherical.

3 there are convection currents in the Earth's crust.

4 the material in the Earth's interior is less dense than the crust.

6D Scientists now think that mountains are formed . . .

1 because the Earth is expanding as it heats up.

2 by earthquakes at plate boundaries.

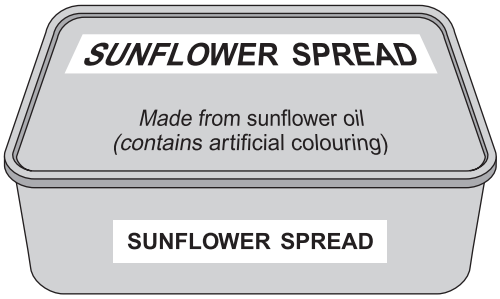
3 by large-scale movements of the Earth's crust.

4 by weathering and erosion of older mountain ranges.

Turn over for the next question

QUESTION SEVEN

This question is about a type of spread made from sunflower oil.



To make this spread, sunflower oil is converted into a fat.

The equation shows the reaction:

$$\text{oil} + \text{hydrogen} \xrightarrow[\text{at } 60\,^{\circ}\text{C}]{\text{finely divided nickel}} \text{fat}$$

7A The fat produced by this reaction is a . . .

1 homogenated oil.

2 hydrated oil.

3 hydrogenated oil.

4 liquidised oil.

7B Nickel is used in the process . . .

1 so that the fat will store for longer.

2 to give colour to the fat.

3 to give the fat a better taste.

4 to speed up the reaction.

7C Oils are liquid at room temperature.

Fats are solid at room temperature because they . . .

1 contain finely divided nickel.

2 contain less water.

3 have higher melting points.

4 have lower melting points.

7D Any artificial colouring in the margarine could be detected by . . .

1 adding bromine water.

2 distillation.

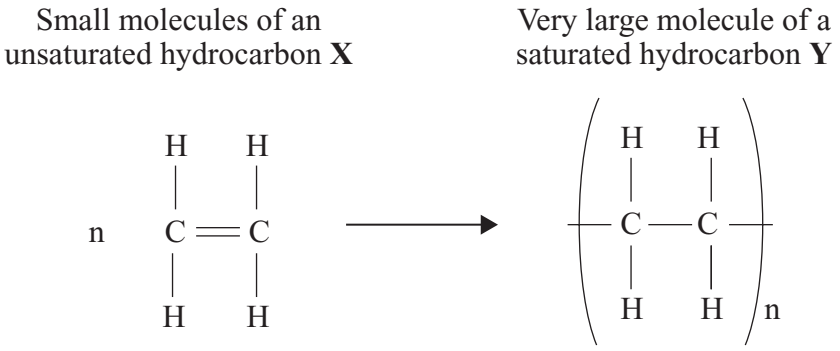
3 emulsification.

4 chromatography.

Turn over for the next question

QUESTION EIGHT

This question is about small molecules combining to produce very large molecules.



8A Each small molecule of the unsaturated hydrocarbon **X** is called . . .

1 a catalyst.

2 a monomer.

3 a polymer.

4 an alkane.

8B Hydrocarbon **Y** is . . .

1 a monomer.

2 a polymer.

3 an alkene.

4 an ethene.

8C In the equation, letter ‘n’ stands for . . .

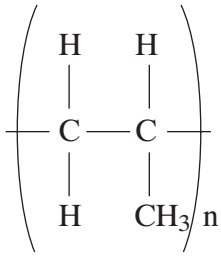
1 a large number.

2 a number less than nine.

3 a small number.

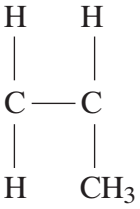
4 nine.

8D Poly(propene) has the formula:



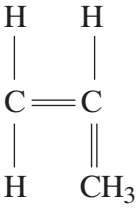
The formula for the hydrocarbon from which it is produced is . . .

1

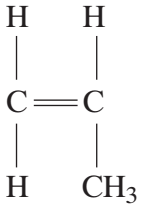


2

3



4



Turn over for the next question

QUESTION NINE

Ethanol is produced by two different processes.

Process 1	Process 2
Fermentation of a sugar solution by yeast in a reaction vessel This is a batch process because the reaction vessel has to be emptied and refilled every few days. Makes 15 % alcohol	Reaction of ethene (from crude oil) with steam This process runs continuously for several years as ethanol is constantly made. Makes 100 % ethanol

9A Ethene for **Process 2** is obtained from hydrocarbons in crude oil by . . .

1 thermal decomposition.

2 hydration.

3 fractional distillation.

4 polymerisation.

9B One advantage of **Process 1** over **Process 2** is that . . .

1 the ethanol is colourless.

2 the raw materials are renewable.

3 there are no additives in the ethanol.

4 yeast is a living organism.

9C One advantage of **Process 2** over **Process 1** is that . . .

1 crude oil is readily available.

2 lower temperatures are required for the reaction.

3 no expensive catalysts are required.

4 the ethanol is purer.

9D It is more economic to produce a large quantity of ethanol in a given time by **Process 2** because . . .

1 crude oil is more easily transported than sugar.

2 it is a batch process.

3 the reaction is faster and is run as a continuous process.

4 the reaction vessel is larger.

END OF TEST

There are no questions printed on this page