

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
March 2007



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

**CHY1B**

**CHEMISTRY**  
**Unit C1b (Oils, Earth and Atmosphere)**

Monday 12 March 2007 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:

1 2 3 4  
○ ● ○ ○

- 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  
○ ~~●~~ ○ ●

- 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  
○ ~~●~~ ○ ~~●~~

**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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Higher Tier starts on page 14 of this booklet.

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**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.

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**QUESTION ONE**

This question is about hydrocarbons.

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

**A** alkanes

**B** fuels

**C** monomers

**D** polymers

Hydrocarbons are cracked to produce smaller molecules.

Some of the products of cracking can be used in cars as . . . **1** . . . .

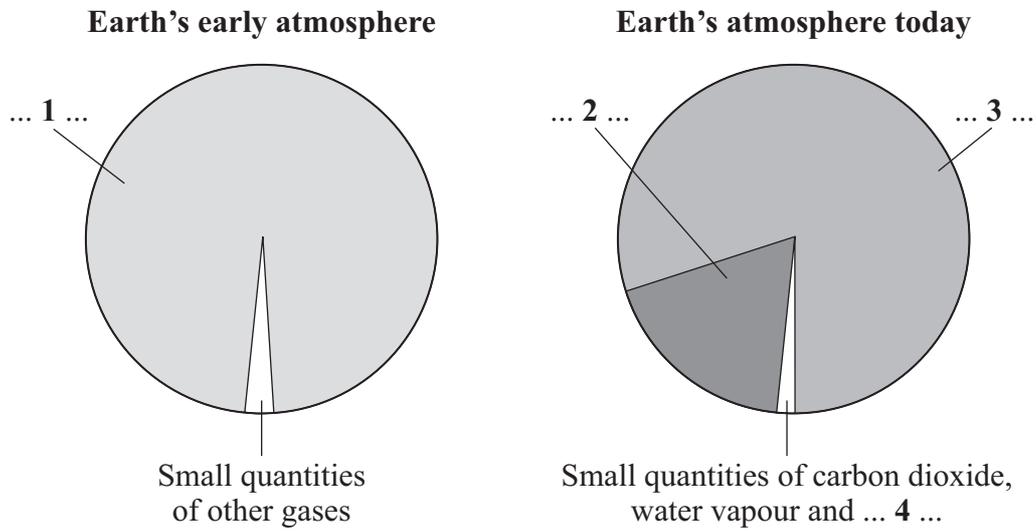
The products of cracking include alkenes and saturated hydrocarbons called . . . **2** . . . .

Alkenes can be used in reactions to make . . . **3** . . . such as poly(ethene) and poly(propene).

In these reactions, many small molecules known as . . . **4** . . . join together to form very large molecules.

**QUESTION TWO**

The pie charts show the gases in Earth's early atmosphere and in Earth's atmosphere today.



Match gases, **A**, **B**, **C** and **D**, with the labels **1–4** on the pie charts.

- A** carbon dioxide
- B** nitrogen
- C** noble gases
- D** oxygen

**Turn over for the next question**

**Turn over ►**

**QUESTION THREE**

This question is about four chemical substances.

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

- A** ethanol
- B** ethene
- C** helium
- D** poly(propene)

	What we can say about the substance
<b>1</b>	It is an unreactive gas.
<b>2</b>	It is produced when an alkene reacts with steam.
<b>3</b>	It is a polymer.
<b>4</b>	It belongs to a group of hydrocarbons with the general formula $C_nH_{2n}$

**QUESTION FOUR**

This question is about vegetable oils.

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

- A** bromine
- B** hydrogen
- C** nickel
- D** water

Oils can form an emulsion when mixed with . . . **1** . . . and shaken.

Unsaturated oils can react to turn red-brown . . . **2** . . . to colourless.

Unsaturated oils are hardened when they react with . . . **3** . . . , and this reaction takes place at 60 °C with a . . . **4** . . . catalyst.

**QUESTION FIVE**

This question is about four processes.

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

**A** analysis

**B** combustion

**C** condensation

**D** convection

Tectonic plates are moved by . . . **1** . . . in the mantle.

Additives in food can be identified by chemical . . . **2** . . . .

Oceans were formed by . . . **3** . . . of the water vapour in the atmosphere.

The amount of carbon dioxide in the atmosphere has been increased by . . . **4** . . . of fossil fuels.

**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

The flow chart shows the stages in the breakdown of large hydrocarbon molecules.

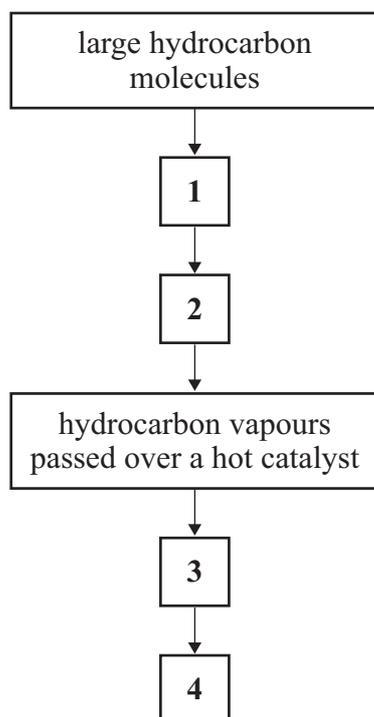
Match phrases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

**A** hydrocarbons undergo thermal decomposition

**B** hydrocarbons are heated

**C** hydrocarbons vaporise

**D** small hydrocarbon molecules



**Turn over for the next question**

**Turn over ►**

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**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.

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**QUESTION SEVEN**

Alfred Wegener was a German scientist who worked in the early part of the 20<sup>th</sup> century.

His theory was that about 250 million years ago all the continents were connected together in a single 'super continent' which he called Pangaea.

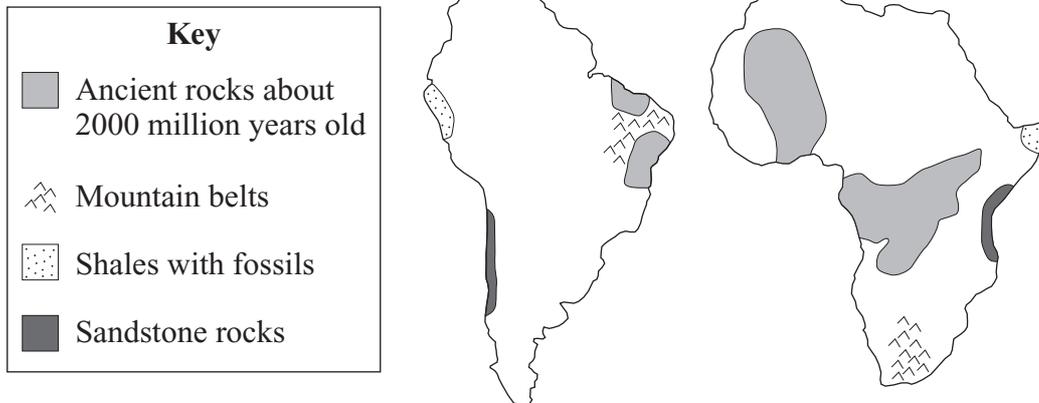
He suggested that the super continent split up and separate continents drifted apart.



**7A** One piece of evidence that Wegener used was that some continents . . .

- 1** have similar shapes.
- 2** have similar weather patterns.
- 3** have coastlines which fit quite closely together.
- 4** have similar vegetation.

**7B** When Wegener examined the African and South American continents, he found other evidence that these continents had once been connected.



One piece of evidence suggested on this diagram is that the two continents have . . .

- 1 ancient rocks in matching positions.
- 2 similar patterns of fossils.
- 3 similar patterns of mountain belts.
- 4 similar sandstone rocks.

**7C** Many scientists did not accept Wegener's theory because . . .

- 1 the continents did not have all the same animals.
- 2 the continents did not have all the same plants.
- 3 there was no way to explain how continents could move.
- 4 the Earth's crust stayed the same.

**7D** About 50 years after Wegener put forward his theory, scientists began to accept the possibility that continents could move.

This was because of evidence that . . .

- 1 the Earth's crust was shrinking.
- 2 the Earth's crust was cooling.
- 3 the Earth's crust was separated into tectonic plates.
- 4 there was volcanic activity on most coastlines.

**Turn over ►**

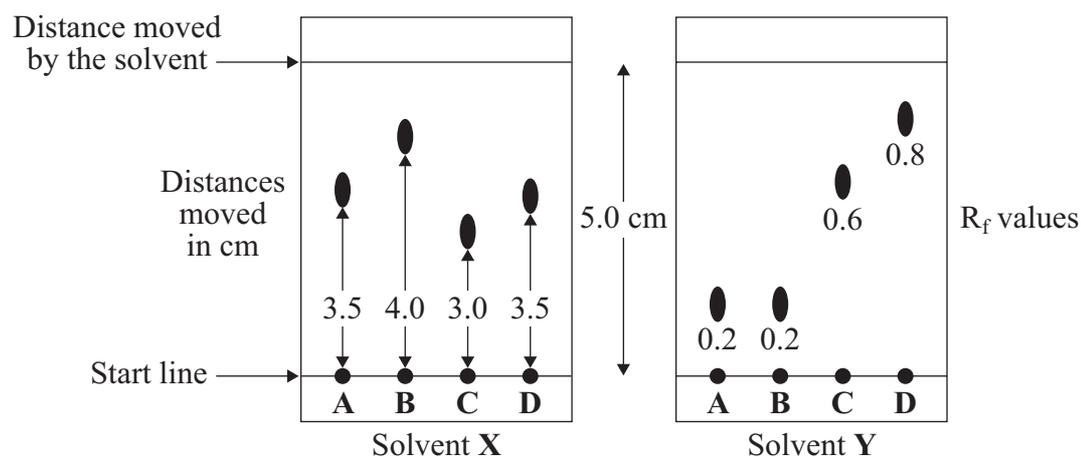
## QUESTION EIGHT

In chromatography, substances can be identified by their  $R_f$  value.

The  $R_f$  value can be calculated using the formula:

$$R_f = \frac{\text{distance moved by the substance}}{\text{distance moved by the solvent}}$$

The  $R_f$  value for a substance is different in different solvents.



Four red substances, **A**, **B**, **C** and **D**, were tested. The test was done using two different solvents, **X** and **Y**.

For solvent **X**, the distances the substances moved and the distance the solvent moved are shown (in cm). For solvent **Y**, the  $R_f$  values are shown.

**8A** What is the  $R_f$  value of substance **B** in solvent **X**?

- 1 0.6
- 2 0.7
- 3 0.8
- 4 1.25

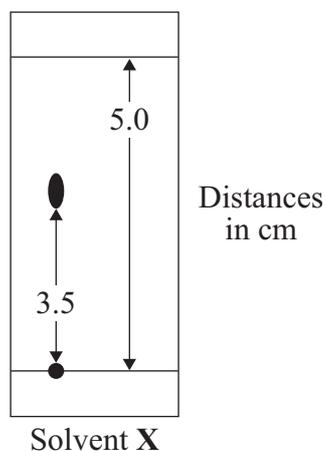
**8B** Which statement is true?

- 1 Substances **A** and **B** are the same.
- 2 Substances **A** and **D** are the same.
- 3 Substances **B** and **D** are the same.
- 4 The four substances are different.

**8C** Which statement about chromatography is true?

- 1 Chromatography works only on added artificial colouring.
- 2 Chromatography works only on added natural colouring.
- 3 Chromatography works only on natural colouring already in the food.
- 4 Chromatography works on any soluble colouring.

**8D** A red substance was tested. The chromatography strip using solvent **X** is shown.



The  $R_f$  value in solvent **Y** is 0.2.

Which statement is true?

- 1 The red substance could be **A**.
- 2 The red substance could be **B**.
- 3 The red substance could be **C**.
- 4 The red substance could be **D**.

**Turn over ►**

**QUESTION NINE**

This information is on a packet of crisps.

<b>Typical nutritional values per 34.5 gram packet of crisps</b>	
Energy	183 kJ
Carbohydrate	17.1 grams
Fat – saturates	0.9 grams
monounsaturates	9.3 grams
polyunsaturates	1.0 grams
Salt	0.5 grams

**9A** What is the total amount of unsaturated fat in a packet of these crisps?

- 1 9.3 g
- 2 10.3 g
- 3 11.2 g
- 4 11.7 g

**9B** Unsaturated fats are different from saturated fats because unsaturated fats . . .

- 1 contain less iodine.
- 2 contain double carbon carbon bonds.
- 3 have higher melting points.
- 4 dissolve in water.

**9C** Approximately how much energy would be provided by 100 grams of these crisps?

- 1 400 kJ
- 2 530 kJ
- 3 720 kJ
- 4 1830 kJ

**9D**

- a packet of crisps contains 0.5 g of salt
- a slice of bread contains about 0.5 g of salt
- many processed foods contain salt
- the guideline daily amount of salt for an adult is 6.0 g

Using your knowledge of a healthy diet and this information, it is fair to deduce that . . .

- 1 more salt should be added to each packet of crisps.
- 2 adults should eat at least one packet of crisps each day.
- 3 adults should not eat crisps.
- 4 it is unnecessary to add salt to crisps.

**END OF TEST**

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Foundation Tier is earlier in this booklet.

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## 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.

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#### QUESTION ONE

The flow chart shows the stages in the breakdown of large hydrocarbon molecules.

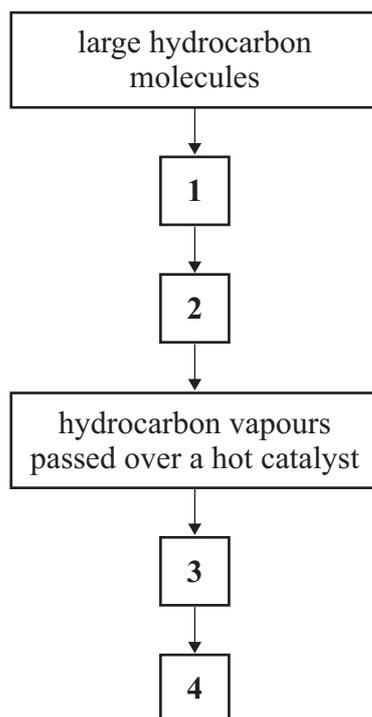
Match phrases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

**A** hydrocarbons undergo thermal decomposition

**B** hydrocarbons are heated

**C** hydrocarbons vaporise

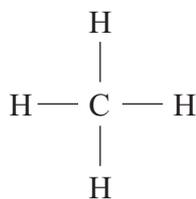
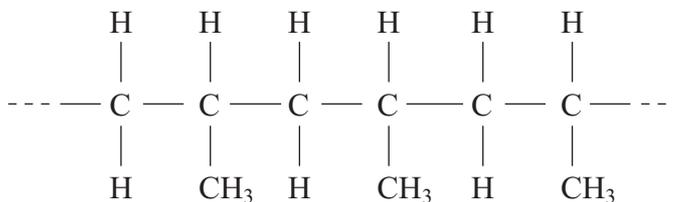
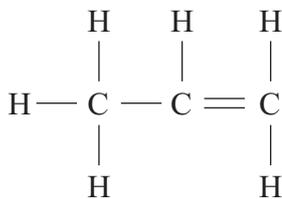
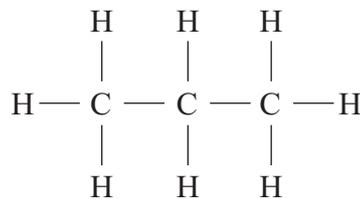
**D** small hydrocarbon molecules



**QUESTION TWO**

This question is about the formulae for four hydrocarbon compounds.

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

**A****B****C****D**

Hydrocarbon compound	Description
<b>1</b>	It has the molecular formula C <sub>3</sub> H <sub>8</sub>
<b>2</b>	It is the hydrocarbon with the smallest molecules.
<b>3</b>	It is an unsaturated hydrocarbon.
<b>4</b>	It is part of a polymer.

**Turn over for the next question**

**Turn over ►**

## 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.

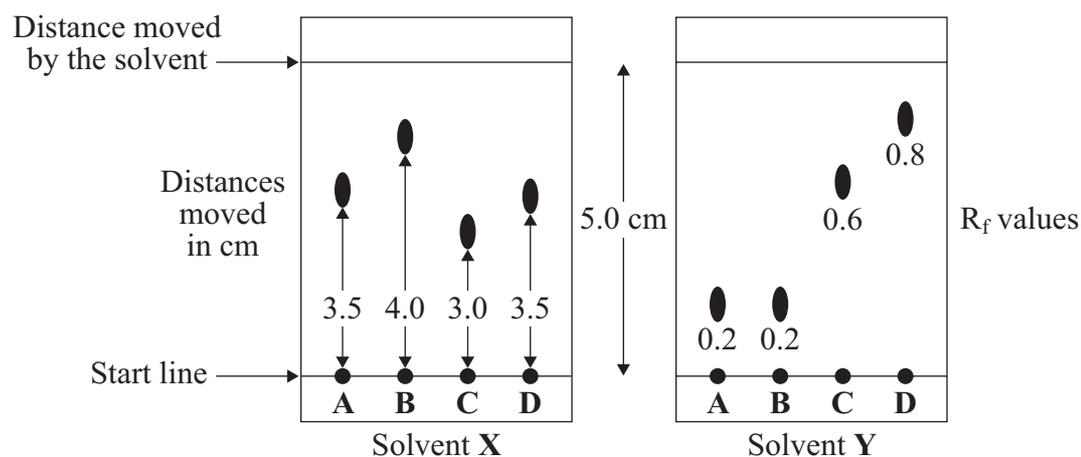
### QUESTION THREE

In chromatography, substances can be identified by their  $R_f$  value.

The  $R_f$  value can be calculated using the formula:

$$R_f = \frac{\text{distance moved by the substance}}{\text{distance moved by the solvent}}$$

The  $R_f$  value for a substance is different in different solvents.



Four red substances, **A**, **B**, **C** and **D**, were tested. The test was done using two different solvents, **X** and **Y**.

For solvent **X**, the distances the substances moved and the distance the solvent moved are shown (in cm). For solvent **Y**, the  $R_f$  values are shown.

**3A** What is the  $R_f$  value of substance **B** in solvent **X**?

- 1 0.6
- 2 0.7
- 3 0.8
- 4 1.25

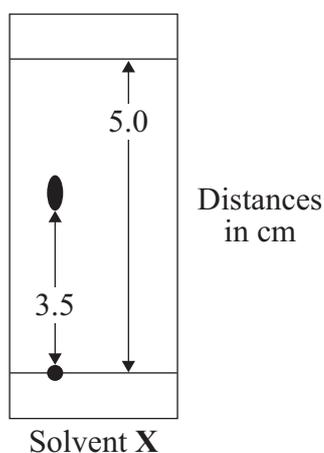
**3B** Which statement is true?

- 1 Substances **A** and **B** are the same.
- 2 Substances **A** and **D** are the same.
- 3 Substances **B** and **D** are the same.
- 4 The four substances are different.

**3C** Which statement about chromatography is true?

- 1 Chromatography works only on added artificial colouring.
- 2 Chromatography works only on added natural colouring.
- 3 Chromatography works only on natural colouring already in the food.
- 4 Chromatography works on any soluble colouring.

**3D** A red substance was tested. The chromatography strip using solvent **X** is shown.



The  $R_f$  value in solvent **Y** is 0.2.

Which statement is true?

- 1 The red substance could be **A**.
- 2 The red substance could be **B**.
- 3 The red substance could be **C**.
- 4 The red substance could be **D**.

**Turn over ►**

**QUESTION FOUR**

This information is on a packet of crisps.

Typical nutritional values per 34.5 gram packet of crisps	
Energy	183 kJ
Carbohydrate	17.1 grams
Fat – saturates	0.9 grams
monounsaturates	9.3 grams
polyunsaturates	1.0 grams
Salt	0.5 grams

**4A** What is the total amount of unsaturated fat in a packet of these crisps?

- 1 9.3 g
- 2 10.3 g
- 3 11.2 g
- 4 11.7 g

**4B** Unsaturated fats are different from saturated fats because unsaturated fats . . .

- 1 contain less iodine.
- 2 contain double carbon carbon bonds.
- 3 have higher melting points.
- 4 dissolve in water.

**4C** Approximately how much energy would be provided by 100 grams of these crisps?

- 1 400 kJ
- 2 530 kJ
- 3 720 kJ
- 4 1830 kJ

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**4D**

- a packet of crisps contains 0.5 g of salt
- a slice of bread contains about 0.5 g of salt
- many processed foods contain salt
- the guideline daily amount of salt for an adult is 6.0 g

Using your knowledge of a healthy diet and this information, it is fair to deduce that . . .

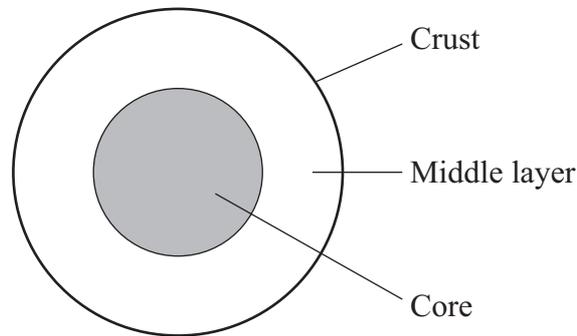
- 1 more salt should be added to each packet of crisps.
- 2 adults should eat at least one packet of crisps each day.
- 3 adults should not eat crisps.
- 4 it is unnecessary to add salt to crisps.

**Turn over for the next question**

**Turn over ►**

**QUESTION FIVE**

The diagram shows the layered structure of the Earth.



**5A** The middle layer is called the . . .

- 1 atmosphere.
- 2 lava.
- 3 magma.
- 4 mantle.

**5B** The material in the middle layer is moving slowly.

The movement is caused by . . .

- 1 the rotation of the Earth.
- 2 the drifting tectonic plates.
- 3 the cooling of the Earth.
- 4 heat from natural radioactive processes.

**5C** Mountains on the Earth's surface are caused by large-scale movements of the Earth's crust but scientists used to believe that they were caused by . . .

- 1 the movement of low density rocks above those that were more dense.
- 2 the activity of volcanoes.
- 3 shrinking of the crust after it was formed.
- 4 weathering and erosion.

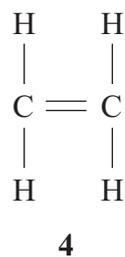
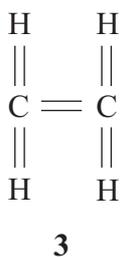
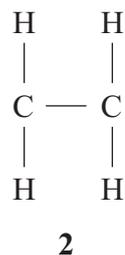
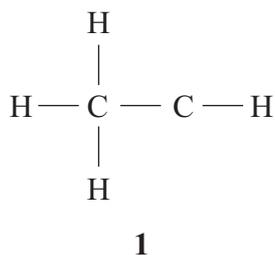
- 5D** Much of the carbon dioxide that was present in Earth's early atmosphere is now locked up in . . .
- 1** fossil fuels and sedimentary carbonate rocks.
  - 2** volcanic rocks and fossil fuels.
  - 3** metal ores and sedimentary carbonate rocks.
  - 4** landfill sites and volcanic rocks.

**Turn over for the next question**

**Turn over ►**



6C The hydrocarbon  $C_2H_4$  can be represented as . . .



6D The general formula for the alkenes is . . .

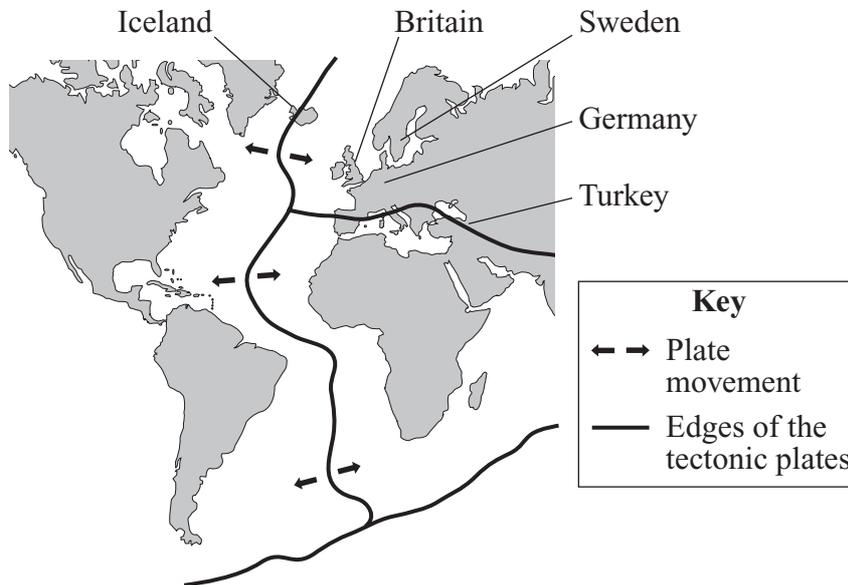
- 1  $C_nH_n$
- 2  $C_nH_{2n}$
- 3  $C_nH_{2n+2}$
- 4  $C_{2n}H_n$

**Turn over for the next question**

**Turn over ►**

## QUESTION SEVEN

The map gives some information about tectonic plates.



**7A** Why do we have only a few earthquakes in Britain?

- 1 Britain lies on the Eurasian plate.
- 2 Britain is not close to a plate boundary.
- 3 The Earth's crust around Britain is very thick.
- 4 The Earth's crust around Britain is not shrinking.

**7B** Turkey has a lot of earthquakes.

People are not sure when the next one will happen because . . .

- 1 earthquakes occur in five or ten year cycles.
- 2 earthquakes occur only in mining areas.
- 3 scientists cannot accurately predict when an earthquake will occur.
- 4 earthquakes occur only when there is oil exploration.

**7C** Approximately how far will the tectonic plates move in 1000 years?

- 1 a few centimetres
- 2 50 centimetres
- 3 50 metres
- 4 50 kilometres

**7D** In which of these countries would you most expect volcanic eruptions?

- 1 Britain
- 2 Iceland
- 3 Sweden
- 4 Germany

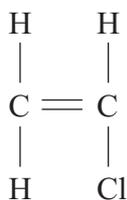
**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

Window frames for double glazing can be made from the plastic PVC, poly(vinyl chloride).

Poly(vinyl chloride) is made from the polymerisation of vinyl chloride molecules which have the structure:



**8A** Vinyl chloride molecules can be described as . . .

- 1 alkenes.
- 2 polymers.
- 3 saturated.
- 4 unsaturated.

**8B** Vinyl chloride belongs to a family of chemicals that have the general formula . . .

- 1  $\text{C}_n\text{HCl}$
- 2  $\text{C}_n\text{H}_{n-1}\text{Cl}$
- 3  $\text{C}_n\text{H}_{n+1}\text{Cl}$
- 4  $\text{C}_n\text{H}_{2n-1}\text{Cl}$

**8C** In the polymerisation process, vinyl chloride molecules are . . .

- 1 catalysts.
- 2 monomers.
- 3 additives.
- 4 emulsifiers.

**8D** PVC window frames do not need much maintenance because they are . . .

- 1 cheap to replace.
- 2 easily painted.
- 3 non-biodegradable.
- 4 rigid.

**Turn over for the next question**

**Turn over ►**

**QUESTION NINE**

Read this extract from a magazine article.

**BIODIESEL**

Biodiesel is a fuel made by the chemical reaction of alcohol with vegetable oils such as soya bean oil. This process also produces glycerine which is used in soap making.

Biodiesel can be used in engines which normally run on petroleum diesel. Biodiesel can be mixed with petroleum diesel in any proportions.

Biodiesel is biodegradable and contains very little sulfur. The complete combustion of biodiesel forms more carbon dioxide, less carbon monoxide and much less particulate, smoke-type emissions than petroleum diesel.

Some of the disadvantages of biodiesel include attacking engine hoses that were intended for a different fuel and loosening deposits within the engine left from previous fuels which can cause blockages.

- 9A** The main advantage of using biodiesel instead of petroleum diesel is that . . .
- 1 it does not cause any damage to engines.
  - 2 it guarantees the soap industry a plentiful supply of glycerine.
  - 3 it increases the amount of carbon dioxide released into the atmosphere.
  - 4 it is a renewable fuel.
- 9B** From the information given, it is possible to conclude that biodiesel will contribute to . . .
- 1 a decrease in acid rain formation.
  - 2 an increase in fog formation.
  - 3 a decrease in soap production.
  - 4 a reduction in global warming.

**9C** Which one of the following is a correct statement?

- 1 Biodiesel production will eventually make the distillation of crude oil unnecessary.
- 2 During combustion, fewer toxic emissions are produced by petroleum diesel than by biodiesel.
- 3 Plants used to make biodiesel use up carbon dioxide as they grow, so offsetting the carbon dioxide produced when the fuel burns.
- 4 There is nothing to limit the amount of crops a country can grow economically each year to produce biodiesel.

**9D** Which of the following statements about biodiesel compared with petroleum diesel is **not** based on scientific measurements?

- 1 Both the fuel and its combustion products are less carcinogenic than ordinary diesel.
- 2 For transportation, biodiesel is classed as less flammable than petroleum diesel.
- 3 The exhaust gases from a biodiesel-fuelled engine contain less unburnt hydrocarbons.
- 4 Biodiesel has a much more pleasant odour than petroleum diesel.

**END OF TEST**

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