

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Foundation Tier and Higher Tier  
June 2010

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

**CHY1BP**  
**F&H**

**Monday 28 June 2010 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 'Chemistry Unit 1b' 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.

1	2	3	4
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1	2	3	4
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**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 12 of this booklet.

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## FOUNDATION TIER

### Section One

Questions **ONE** to **FIVE**.

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 table shows some information about four of the gases, **A**, **B**, **C** and **D**, in the Earth's atmosphere.

	Gas	Percentage (%) in the atmosphere	Melting point in °C	Boiling point in °C	Density in g per litre
<b>A</b>	Nitrogen	78	-210	-196	1.25
<b>B</b>	Oxygen	20	-218	-183	1.43
<b>C</b>	Carbon dioxide	0.04	-57	-78	1.98
<b>D</b>	Argon	1	-189	-186	1.78

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

The gas with the highest density is . . . **1** . . . .

The gas that makes up the largest percentage of the atmosphere is . . . **2** . . . .

The gas with the lowest melting point is . . . **3** . . . .

The gas with the smallest difference between its melting point and its boiling point is . . . **4** . . . .

**QUESTION TWO**

This question is about the Earth and its structure.

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

**A** mantle

**B** core

**C** atmosphere

**D** crust

Since the Earth was formed, the percentages of the gases in the . . . **1** . . . have changed.

At the centre of the Earth is the . . . **2** . . . .

The middle layer of the Earth where convection currents form is the . . . **3** . . . .

It was once thought that mountain ranges formed because the . . . **4** . . . was shrinking.

**QUESTION THREE**

The following table lists some properties of four different polymers, **A**, **B**, **C** and **D**.

Polymer	Maximum working temperature in °C	Appearance	Flexibility	Breaking strength
<b>A</b>	250	Grey	Medium	High
<b>B</b>	80	White	High	High
<b>C</b>	70	Transparent	Low	High
<b>D</b>	110	Transparent	High	Low

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

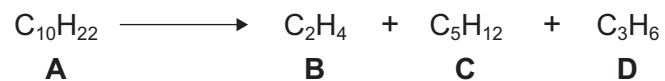
	Most suitable polymer for
<b>1</b>	non-stick coating for cooking pans
<b>2</b>	spectacle lenses
<b>3</b>	cling film (for covering food)
<b>4</b>	toothbrush bristles

Turn over ►

**QUESTION FOUR**

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.

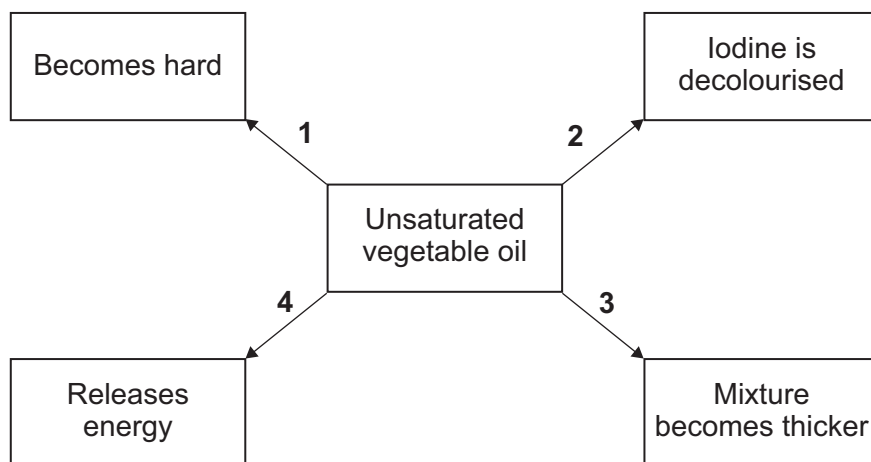


Match hydrocarbons, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

<b>1</b>	It has molecules with 17 atoms.
<b>2</b>	It is ethene.
<b>3</b>	It can be represented by $  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H} - \text{C} - \text{C} = \text{C} \\    \quad \quad   \\  \text{H} \quad \quad \text{H}  \end{array}  $
<b>4</b>	It is the alkane with the largest molecules.

**QUESTION FIVE**

The diagram shows what happens to an unsaturated vegetable oil when it is treated in different ways.



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

- A** Burn in oxygen
- B** Test for unsaturation
- C** Add water and shake vigorously
- D** React with hydrogen

**Turn over for the next question**

**Turn over ►**

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**Section Two**Questions **SIX** 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 SIX**

Scientists have tried to predict when and where earthquakes will happen, but they have had limited success. Although they know which regions will have earthquakes, they cannot be precise about the exact place and time.

To gain scientific information, scientists put measuring instruments deep into the Earth's crust where tectonic plates meet.

They have measured tremors which are small vibrations from deep underground. They have found that these tremors occur a short time before earthquakes.

- 6A** The link between tremors and an earthquake occurring is an example of a . . .
- 1 variable.
  - 2 measurement.
  - 3 calibration.
  - 4 relationship.
- 6B** Scientists could conclude that there is a link between tremors and earthquakes by . . .
- 1 looking on the internet for information on tremors and earthquakes.
  - 2 collecting more data on both tremors and earthquakes.
  - 3 counting the number of tremors in a year.
  - 4 measuring each earthquake on the Richter scale.
- 6C** The link between tremors and earthquakes is difficult to prove because . . .
- 1 it is impossible to control other variables.
  - 2 data is not available for tremors.
  - 3 tremors cannot be measured.
  - 4 earthquakes and tremors happen far too often.

**6D** It is difficult to predict the exact time and place of an earthquake.

This is because scientists do **not** know . . .

- 1 what causes tectonic plates to move.
- 2 where tectonic plates are touching.
- 3 how all the forces act on tectonic plates.
- 4 how far tectonic plates move per year.

**Turn over for the next question**

**Turn over ►**

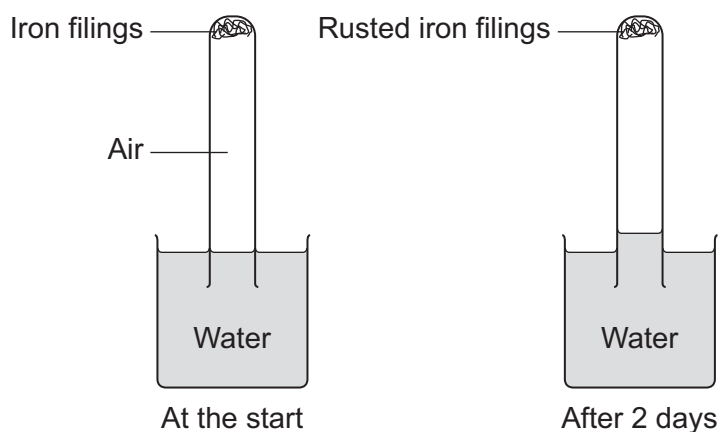
## QUESTION SEVEN

The experiment below can be used to estimate the percentage of oxygen in the air.

- Damp iron filings are placed into a 150 mm long test tube.
- The test tube is inverted and then placed in a beaker of water.
- The test tube is then left for one week.
- The height of the water in the test tube is measured every day.

Rusting is a reaction between iron, oxygen and water.

The water rises up the test tube to replace the oxygen that has reacted.



These are the results of the experiment.

Day	0	1	2	3	4	5	6	7
Height of the water in the test tube in mm	0	9	16	20	23	25	25	25

**7A** At what height will the water be after another seven days?

- 1 25 mm
- 2 50 mm
- 3 just below the iron filings
- 4 the top of the test tube



---

**7B** In this experiment, the height of the water in the test tube is the dependent variable.

This is because . . .

- 1 it is dependent on an accurate measurement being carried out.
- 2 it changes due to the changes in another variable.
- 3 it is the value that is measured first.
- 4 it is not dependent on any other variable.

**7C** A student used the experiment described to find the percentage of oxygen in the air. He was unsure about his result.

The student could check the reliability of the results by . . .

- 1 using fewer iron filings.
- 2 using colder water.
- 3 repeating the experiment.
- 4 using already rusted iron filings.

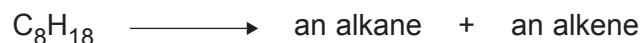
**7D** Another student did the experiment with more iron filings in the test tube.

One reason for doing this is because . . .

- 1 the reaction would be much slower.
- 2 the volume of oxygen reacting would be much greater.
- 3 there would be less air in the test tube.
- 4 it would confirm that all the oxygen had reacted.

**QUESTION EIGHT**

This equation shows the thermal decomposition of a hydrocarbon.



**8A** What is the name of this process?

- 1 polymerisation
- 2 cracking
- 3 combustion
- 4 hydrogenation

**8B** In this decomposition, . . .

- 1 the hydrocarbon vapour is heated with iodine.
- 2 the hydrocarbon is mixed with hydrogen and heated.
- 3 the hydrocarbon vapour is passed over a hot catalyst.
- 4 the hydrocarbon is liquefied, then passed over a catalyst.

**8C** The alkene produced . . .

- 1 is an unsaturated compound.
- 2 has molecules in which each carbon atom has two bonds.
- 3 is unreactive.
- 4 will burn to produce carbon dioxide and hydrogen.

**8D** Poly(ethene) is a polymer that is made from an alkene.

The polymer is . . .

- 1 produced by thermal decomposition.
- 2 a thermosoftening polymer.
- 3 produced by cracking.
- 4 biodegradable.

**QUESTION NINE**

Palm oil and sunflower oil are vegetable oils.

**9A** Sunflower oil is more unsaturated than palm oil.

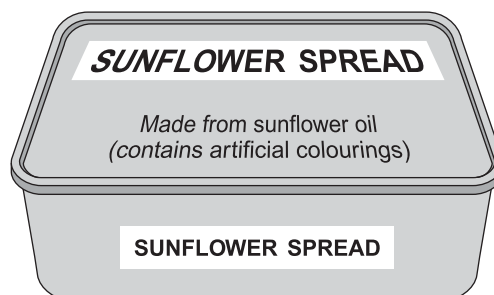
This means that . . .

- 1 sunflower oil is thicker than palm oil at the same temperature.
- 2 palm oil does not react with bromine or iodine.
- 3 sunflower oil is more useful as a fuel than palm oil.
- 4  $1\text{ cm}^3$  of sunflower oil will decolourise more bromine water than  $1\text{ cm}^3$  of palm oil.

**9B** Sunflower oil is liquid at  $20^\circ\text{C}$ . The sunflower spread made from the oil is solid at  $20^\circ\text{C}$ .

This is because the sunflower spread . . .

- 1 still contains sunflower seeds.
- 2 contains water between its molecules.
- 3 has a higher melting point than the oil.
- 4 forms a layer on top of the oil.



**9C** Additives in the sunflower spread . . .

- 1 are listed as ingredients only if they are artificial.
- 2 are added only to improve the colour of the sunflower spread.
- 3 are added to improve the appearance, taste and shelf-life of the sunflower spread.
- 4 are added so that they can be given E-numbers.

**9D** An artificial colour in the sunflower spread could be identified by . . .

- 1 distillation.
- 2 chromatography.
- 3 filtration.
- 4 decomposition.

**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**.

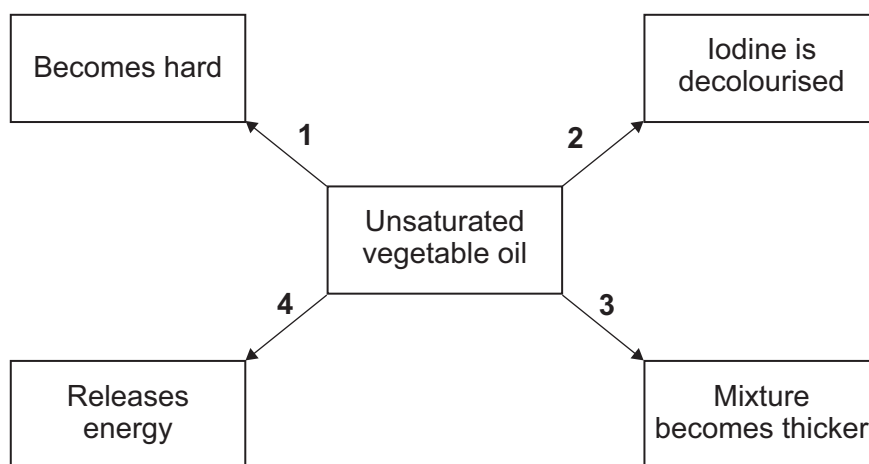
Use **each** answer only **once**.

Mark your choices on the answer sheet.

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### QUESTION ONE

The diagram shows what happens to an unsaturated vegetable oil when it is treated in different ways.

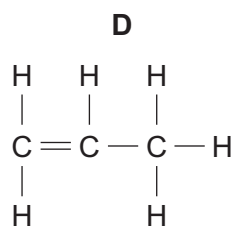
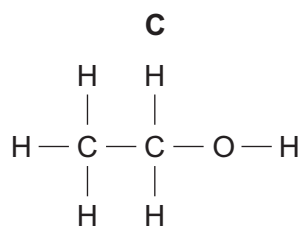
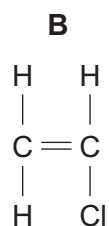
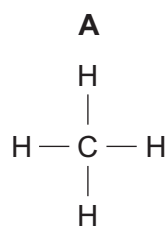


Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the diagram.

- A** Burn in oxygen
- B** Test for unsaturation
- C** Add water and shake vigorously
- D** React with hydrogen

**QUESTION TWO**

This question is about the formulae of four carbon compounds, **A**, **B**, **C** and **D**.



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

<b>1</b>	It is an unsaturated hydrocarbon.
<b>2</b>	It is the alkane that was present in Earth's early atmosphere.
<b>3</b>	It is made by reacting ethene with steam.
<b>4</b>	It is the monomer from which the polymer, poly(chloroethene) is made.

**Turn over for the next question**

**Turn over ►**

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**Section Two**Questions **THREE** to **NINE**.

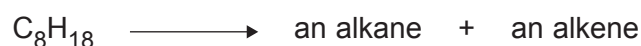
Each of these questions has four parts.

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

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**QUESTION THREE**

This equation shows the thermal decomposition of a hydrocarbon.

**3A** What is the name of this process?

- 1 polymerisation
- 2 cracking
- 3 combustion
- 4 hydrogenation

**3B** In this decomposition, . . .

- 1 the hydrocarbon vapour is heated with iodine.
- 2 the hydrocarbon is mixed with hydrogen and heated.
- 3 the hydrocarbon vapour is passed over a hot catalyst.
- 4 the hydrocarbon is liquefied, then passed over a catalyst.

**3C** The alkene produced . . .

- 1 is an unsaturated compound.
- 2 has molecules in which each carbon atom has two bonds.
- 3 is unreactive.
- 4 will burn to produce carbon dioxide and hydrogen.

**3D** Poly(ethene) is a polymer that is made from an alkene.

The polymer is . . .

- 1 produced by thermal decomposition.
- 2 a thermosoftening polymer.
- 3 produced by cracking.
- 4 biodegradable.

**Turn over for the next question**

**Turn over ►**

**QUESTION FOUR**

Palm oil and sunflower oil are vegetable oils.

**4A** Sunflower oil is more unsaturated than palm oil.

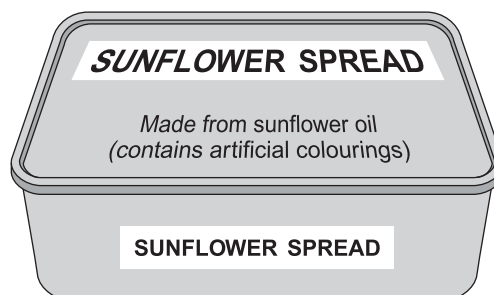
This means that . . .

- 1 sunflower oil is thicker than palm oil at the same temperature.
- 2 palm oil does not react with bromine or iodine.
- 3 sunflower oil is more useful as a fuel than palm oil.
- 4  $1\text{ cm}^3$  of sunflower oil will decolourise more bromine water than  $1\text{ cm}^3$  of palm oil.

**4B** Sunflower oil is liquid at  $20^\circ\text{C}$ . The sunflower spread made from the oil is solid at  $20^\circ\text{C}$ .

This is because the sunflower spread . . .

- 1 still contains sunflower seeds.
- 2 contains water between its molecules.
- 3 has a higher melting point than the oil.
- 4 forms a layer on top of the oil.



**4C** Additives in the sunflower spread . . .

- 1 are listed as ingredients only if they are artificial.
- 2 are added only to improve the colour of the sunflower spread.
- 3 are added to improve the appearance, taste and shelf-life of the sunflower spread.
- 4 are added so that they can be given E-numbers.

**4D** An artificial colour in the sunflower spread could be identified by . . .

- 1 distillation.
- 2 chromatography.
- 3 filtration.
- 4 decomposition.



**Turn over for the next question**

**Turn over ►**

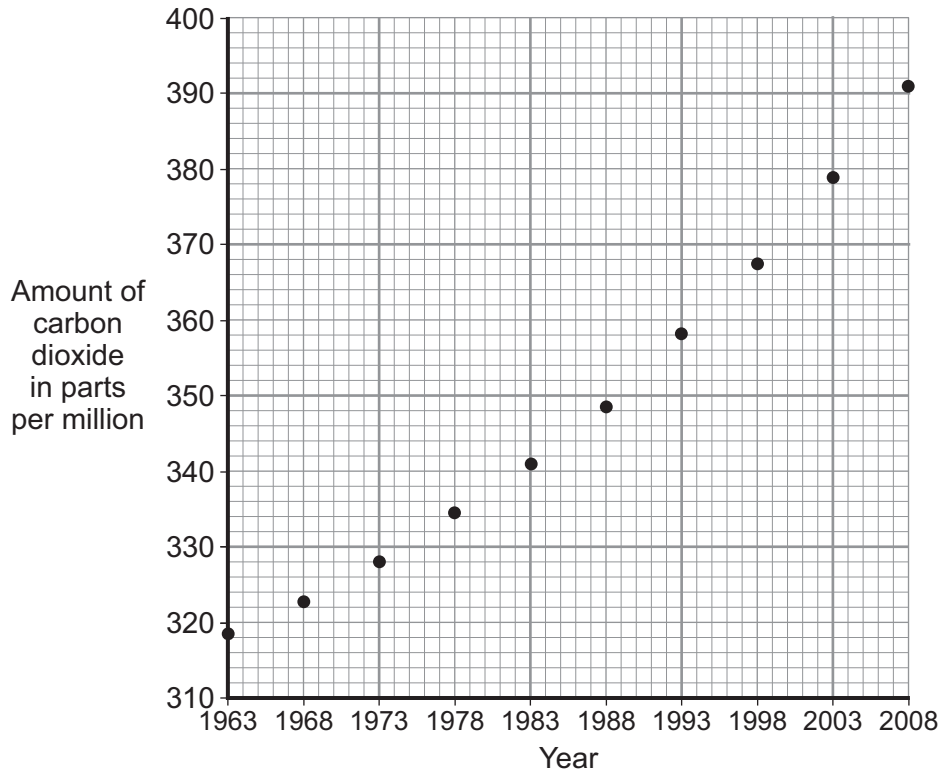
**QUESTION FIVE**

Scientists have been measuring the amount of carbon dioxide in the atmosphere high above a remote island in the Pacific Ocean.

The table shows some data that they collected over 45 years.

The data is plotted on the graph.

Year	1963	1968	1973	1978	1983	1988	1993	1998	2003	2008
<b>Amount of carbon dioxide in parts per million</b>	318.9	323.1	328.0	334.2	340.9	348.9	358.1	367.7	378.8	391.0



**5A** What is the best way of showing the trend in the amount of carbon dioxide on the graph?

- 1 Draw a series of straight lines linking one point to the next.
- 2 Add points between those already plotted to estimate the missing years.
- 3 Draw a bar chart.
- 4 Draw a smooth curve as close as possible to the points.

- 
- 5B** What does the data show about the amounts of carbon dioxide above the island?
- 1 The amount of carbon dioxide has increased at an increasing rate since 1963.
  - 2 Recent efforts to slow the increase in the amount of carbon dioxide have been successful.
  - 3 Amounts of carbon dioxide before 1963 were lower than 300 parts per million.
  - 4 The amount of carbon dioxide has increased because there are now more cars on the island.

- 5C** Is there enough data to support the theory that global carbon dioxide levels have increased over the period studied?
- 1 No, because the scientists would need to measure the amount of carbon dioxide every year to be certain.
  - 2 Yes, because it is obvious that the amount of carbon dioxide is the same all over the world.
  - 3 No, because data from many different sites worldwide would be needed to make sure.
  - 4 Yes, because the amount of carbon dioxide went up every time a measurement was made.

- 5D** Scientists have compared the amount of carbon dioxide in the atmosphere today with the amount they estimate there was during the first billion years of the Earth's existence.

They think that . . .

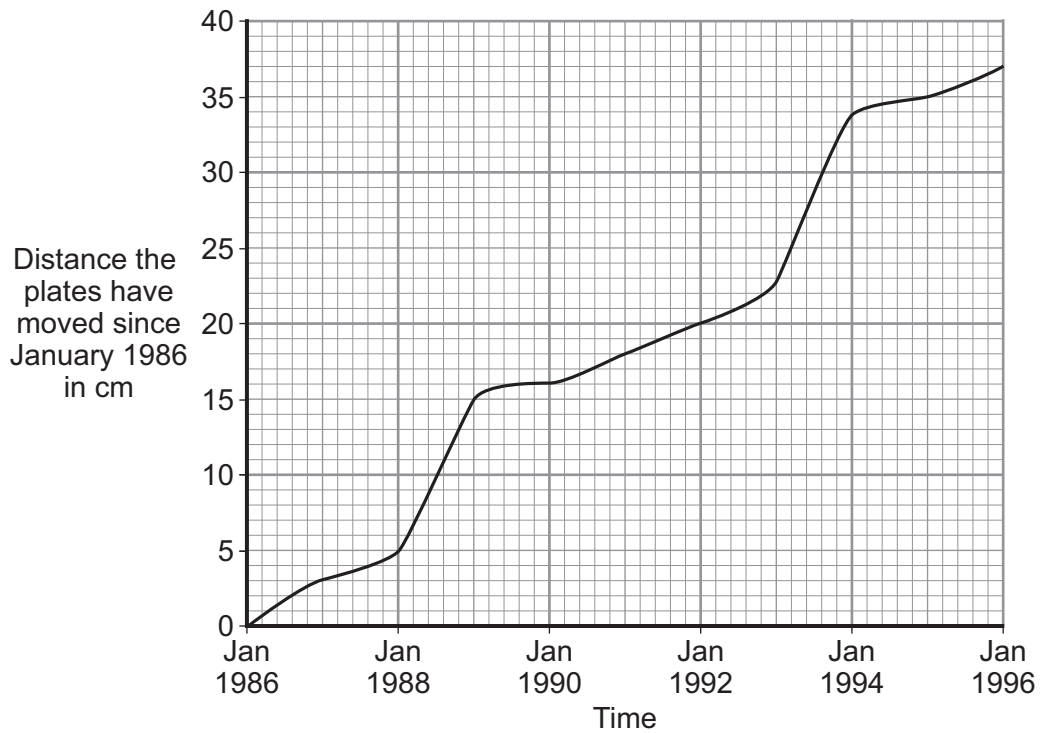
- 1 there is more carbon dioxide today because of the burning of fossil fuels.
- 2 there is less carbon dioxide today because a lot became trapped in carbonate rocks.
- 3 the amount of carbon dioxide has remained much the same until very recently.
- 4 there was no carbon dioxide to begin with because there were no humans to burn fuels.

**QUESTION SIX**

In California, the San Andreas Fault marks the boundary between two tectonic plates. The plates are sliding past each other.

Scientists can measure how far the land moves on one side of the fault relative to the other.

The graph shows the results of a 10-year study which the scientists began in January 1986.



**6A** Which row in the table below correctly describes the distance variable in this study?

1	Dependent	Continuous
2	Independent	Categoric
3	Dependent	Categoric
4	Independent	Continuous

**6B** In which two years is it likely that there were earthquakes along the fault?

- 1 in 1988 and in 1990
- 2 in 1988 and in 1993
- 3 in 1990 and in 1994
- 4 in 1990 and in 1995

**6C** The points on the graph do not lie on a straight line.

This is because . . .

- 1 the movement is impossible to measure accurately.
- 2 the movement of the tectonic plates occurs randomly.
- 3 the points have not been plotted accurately enough.
- 4 the measurements were made only once a year.

**6D** If a line of best fit had been extended into the future, would it have enabled scientists to predict earthquakes after 1996?

- 1 Yes, because lines of best fit are good at predicting values outside measured ranges.
- 2 No, because a line of best fit is difficult to draw with this data.
- 3 Yes, because earthquakes occur at regular intervals.
- 4 No, because a line of best fit shows only average movement, not specific events.

**Turn over for the next question**

**Turn over ►**

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**QUESTION SEVEN**

Biofuels are made from plants. Ethanol is an example of a biofuel. It can be made by fermentation of material from a variety of plants.

These claims were published on an ethanol producer's website:

- ethanol can be made from maize
- motorists who use ethanol instead of petrol will save money
- using ethanol helps to reduce greenhouse gas emissions
- making ethanol is not responsible for the increase in global food prices
- future biofuels will remove concern about effects on food production.

**7A** Why is the ethanol producer claiming that using ethanol helps to reduce greenhouse gas emissions?

It is because . . .

- 1 ethanol is not a fossil fuel.
- 2 crops take in carbon dioxide as they grow.
- 3 fermentation uses very little energy.
- 4 when ethanol burns it does not produce carbon dioxide.

**7B** There is a debate about whether land should be used for crops to produce food or crops to produce fuel.

Which of the following is a correct statement?

- 1 Crops used to produce food are different from those used to produce fuels.
- 2 Both food and fuel provide a lot of energy.
- 3 Demand for biofuels will increase if the price of fossil fuels falls.
- 4 The debate is only about economics.

**7C** The claims on the website could be criticised.

Which is a valid criticism?

- 1 The use of biofuels increases global warming.
- 2 There is a connection between biofuel production and food prices.
- 3 Ethanol can be made from maize.
- 4 Ethanol production can be from crops or from ethene.

**7D** Which row in the table correctly describes the nature of some of the information on the website?

	Information	Description
1	Ethanol can be made from maize	Political
2	Savings to consumer	Technological
3	Reduction in greenhouse gas emissions	Environmental
4	Not responsible for increase in food prices	Ethical

**Turn over for the next question**

**Turn over ►**

### QUESTION EIGHT

Four hydrocarbons, **K**, **L**, **M** and **N**, were each analysed to measure their carbon and hydrogen content.

The results are shown in the table.

	Hydrocarbon			
	<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>
<b>Number of hydrogen atoms in each molecule</b>	8	20	8	12
<b>Number of carbon atoms in each molecule</b>	4	10	16	5

**8A** From the table we can deduce that . . .

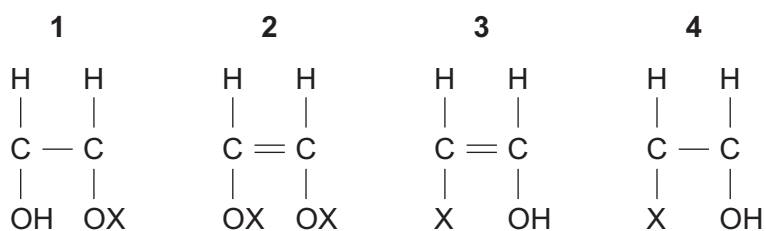
- 1 none of the four is an alkene.
- 2 **K** and **L** are alkenes.
- 3 only **M** is an alkene.
- 4 only **N** is an alkene.

**8B** Hydrocarbon **N** cannot be used to make a polymer because its molecules . . .

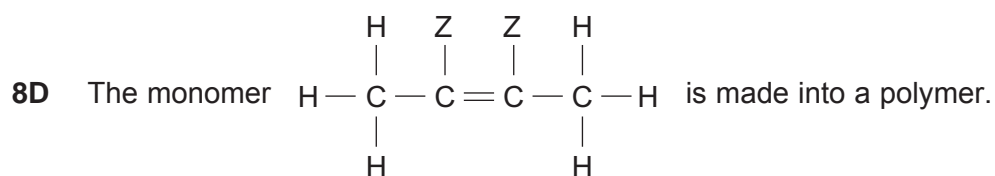
- 1 are too short.
- 2 have an odd number of carbon atoms.
- 3 have fewer carbon atoms than hydrogen atoms.
- 4 do not have a carbon carbon double bond.

**8C** The polymer with the formula  $\left( \begin{array}{cc} \text{H} & \text{H} \\ | & | \\ -\text{C} & - & \text{C}- \\ | & | \\ \text{X} & \text{OH} \end{array} \right)_n$  where 'n' is a large number, could be made

from the monomer . . .

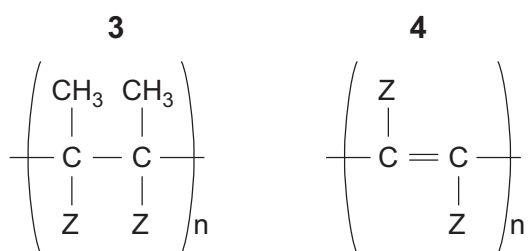
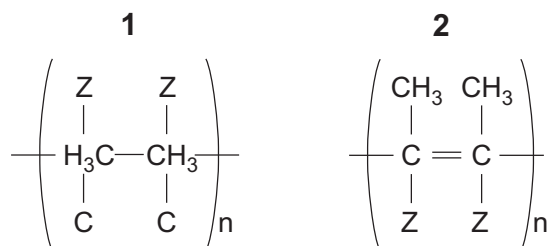






In the formulae below, 'n' is a large number.

The polymer may be represented as . . .



Turn over for the next question

Turn over ►

**QUESTION NINE**

'Food miles' is the distance that food is transported from the time of its production until it reaches the consumer.

Environmentalists are concerned that food miles are increasing and that this is causing increased carbon dioxide emissions.

The table shows some of the social costs of transporting food to and within the UK in 2002. At the time there were about 32 million vehicles on UK roads, 25 million of which were cars.

The values shown are an indication of the damage to the environment caused by the transport of food. The larger the number, the greater the environmental damage.

Type of transport	Carbon dioxide emissions	Reduction in air quality	Noise from transport	Congestion due to transport
Lorry	120	170	120	1400
Van	30	50	30	1100
Car	50	20	40	2600
Train	0	20	0	0

**9A** Which one of the following would explain the difference between the congestion values due to 'Vans' and 'Cars'?

- 1 A van will cover more distance than a car on a tank of fuel.
- 2 Cars will travel down more minor roads than vans.
- 3 Vans can carry larger loads than cars.
- 4 There are more cars than vans on UK roads.

**9B** The table shows that there is no damage caused by carbon dioxide emissions from trains. This is because the trains referred to in the table are electric trains.

This is misleading, mainly because . . .

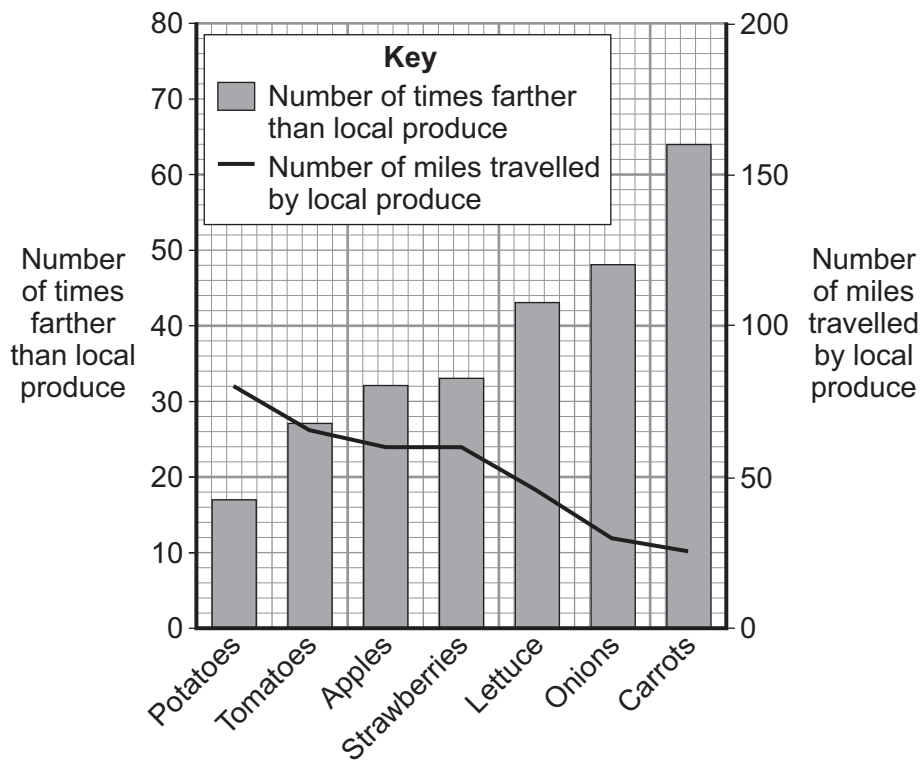
- 1 it does not take into account the lighting used at railway stations.
- 2 the carbon dioxide emissions given off by railway staff travelling to work should also be included.
- 3 carbon dioxide is given off when electricity is generated using fossil fuels.
- 4 the environmental effect of driving goods to railway stations should be included.

**9C** Haulage companies suggest that transporting goods by lorries is preferable to using vans.

If all environmental aspects are considered, how many vans cause as much environmental damage as one lorry?

- 1 less than one
- 2 between one and two
- 3 between two and three
- 4 between three and four

**9D** The graph shows the relative distances travelled when transporting food to the UK from a distant source compared with locally produced food.



Which food from a distant source travels the least food miles compared with when it is produced locally?

- 1 potatoes
- 2 strawberries
- 3 lettuce
- 4 carrots

**END OF TEST**

**There are no questions printed on this page**