

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Foundation Tier and Higher Tier  
March 2011

## Science A

Unit Chemistry C1b (Oils, Earth and Atmosphere)

## Chemistry

Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHY1BP  
**F&H**

Wednesday 2 March 2011 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
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

**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 16 of this booklet.

---

## 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.

---

### QUESTION ONE

The Earth's atmosphere is made up of 78 % nitrogen.

The table shows the next four most abundant gases, two of which are noble gases.

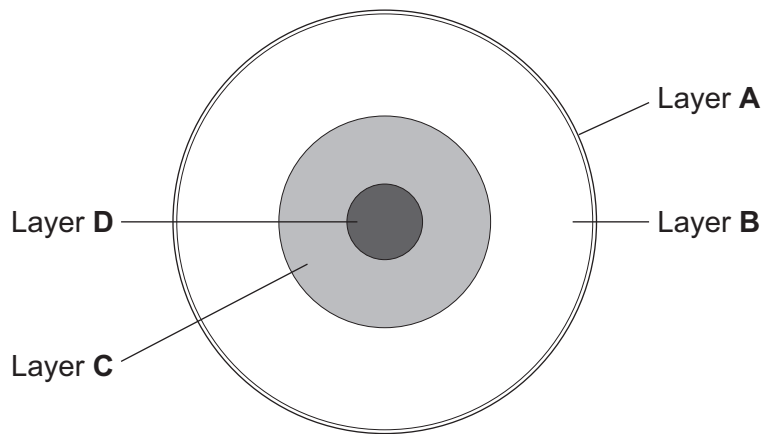
	Gas	Percentage (%) in the atmosphere by volume	Boiling point in °C
<b>A</b>	Oxygen	21.0	–183
<b>B</b>	Argon	0.930	–185
<b>C</b>	Carbon dioxide	0.030	–78
<b>D</b>	Neon	0.005	–246

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

<b>1</b>	It is the gas that is a compound.
<b>2</b>	It is the most abundant noble gas.
<b>3</b>	It is the gas with the lowest boiling point.
<b>4</b>	It is the gas needed for fuels to burn.

**QUESTION TWO**

The diagram and table give information about layers of the Earth.



Layer	Volume (%)	Density in g per cm <sup>3</sup>
<b>A</b>	1.5	2.7–3.0
<b>B</b>	82.3	3.3–5.8
<b>C</b>	15.4	9.4–12.3
<b>D</b>	0.8	13.0–13.5

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

<b>1</b>	It is the outermost layer of the Earth.
<b>2</b>	It is the layer with the smallest volume.
<b>3</b>	It is the layer called the mantle.
<b>4</b>	It is the layer with the greatest range of density.

Turn over ►

**QUESTION THREE**

The table shows some information about four vegetable oils, **A**, **B**, **C** and **D**.

Vegetable oil	Fat content		Energy from 100 g of the oil in kJ	Iodine number
	Percentage (%) of saturated fat	Percentage (%) of unsaturated fat		
<b>A</b>	11	89	3696	100
<b>B</b>	12	88	3378	60
<b>C</b>	13	87	3710	120
<b>D</b>	14	86	3700	130

A high iodine number indicates a large number of double bonds in a molecule of the oil.

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

<b>1</b>	It contains the highest percentage of unsaturated fat.
<b>2</b>	It releases the most energy from 100 g of oil.
<b>3</b>	It is the oil with the smallest number of double bonds in each molecule.
<b>4</b>	It is the oil that would react completely with the largest volume of iodine solution.

---

**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

An emulsion forms when oil is shaken with . . . **1** . . . .

Unsaturated oils can be detected because they decolourise . . . **2** . . . .

Unsaturated oils harden when they react with . . . **3** . . . .

This hardening of unsaturated oils needs a temperature of 60 °C and a . . . **4** . . . catalyst.

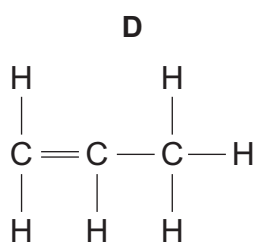
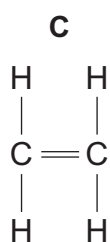
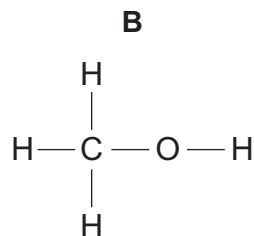
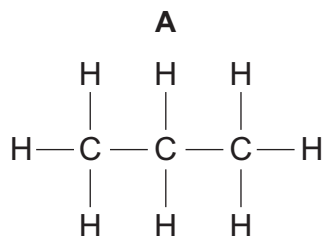
**Turn over for the next question**

**Turn over ►**

### QUESTION FIVE

This question is about the formulae of four compounds.

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



<b>1</b>	It is the alkene used to make ethanol.
<b>2</b>	It is a saturated hydrocarbon useful as a fuel.
<b>3</b>	It is not a hydrocarbon but burns to produce carbon dioxide and water vapour.
<b>4</b>	It belongs to the group with the general formula $C_nH_{2n}$ where $n=3$ .

**Turn over for the next question**

**Turn over ►**

**Section Two**Questions **SIX** to **NINE**.

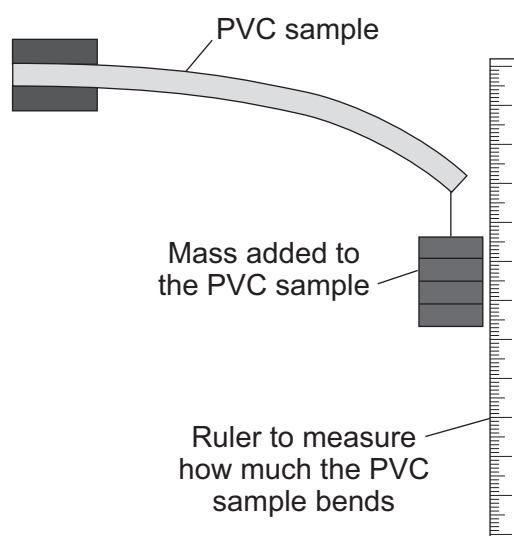
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

**QUESTION SIX**

A scientist investigated how much the plastic polyvinyl chloride (PVC) bends when a mass is added. He used the apparatus shown in the diagram.



He measured the bending of PVC samples containing different percentages of an added chemical called a plasticiser. The PVC samples were all the same size.

The results are shown in the table.

Percentage (%) of plasticiser added to PVC	Bending of PVC sample in mm				
	Test 1	Test 2	Test 3	Test 4	Mean
0	17	18	16	8	17
5	23	22	24	23	23
10	29	27	29	27	28



- 
- 6A** As the plasticiser percentage increases, the bending of the PVC samples . . .
- 1 remains the same.
  - 2 increases.
  - 3 decreases.
  - 4 increases and then decreases.
- 6B** The scientist did the test four times for each percentage of plasticiser added, . . .
- 1 to control all of the variables.
  - 2 to decrease the time needed.
  - 3 to improve reliability.
  - 4 to increase the precision.
- 6C** The mean bending value for 0 % plasticiser is shown in the table as 17 mm.  
The reason is that . . .
- 1 17 mm was the first reading taken.
  - 2 17 mm was the most common reading.
  - 3 when all values are added together and divided by 4, 17 mm is obtained.
  - 4 the reading for Test 4 is an anomalous value and is ignored.
- 6D** Plasticiser is **not** added to the PVC used to make doors because . . .
- 1 too much would be needed.
  - 2 it would be too toxic.
  - 3 the doors would be biodegradable.
  - 4 the doors need to be rigid.

**QUESTION SEVEN**

The table below shows some data on fats, **K**, **L**, **M** and **N**.

<b>Fats</b>	<b>Type</b>	<b>Melting point in °C</b>
<b>K</b>	Saturated	+63
<b>L</b>	Monounsaturated	+4
<b>M</b>	Polyunsaturated	-5
<b>N</b>	Polyunsaturated	-11

**7A** Which of the fats has the lowest melting point?

- 1 **K**
- 2 **L**
- 3 **M**
- 4 **N**

**7B** Which of the fats will not react with iodine?

- 1 **K**
- 2 **L**
- 3 **M**
- 4 **N**

**7C** Unsaturated fats and oils are healthier than saturated fats and oils.

Which of the following statements is **not** true?

- 1 Scientists can find out if an oil is unsaturated.
- 2 Scientists can show that unsaturated oils are healthier.
- 3 Scientists can prevent people from eating unhealthy foods.
- 4 Scientists can change unsaturated oils to saturated oils.

**7D** It is thought that eating too much saturated fat can cause health problems.

Some people say that saturated fats and oils are unhealthy.

Who is likely to give the most reliable advice?

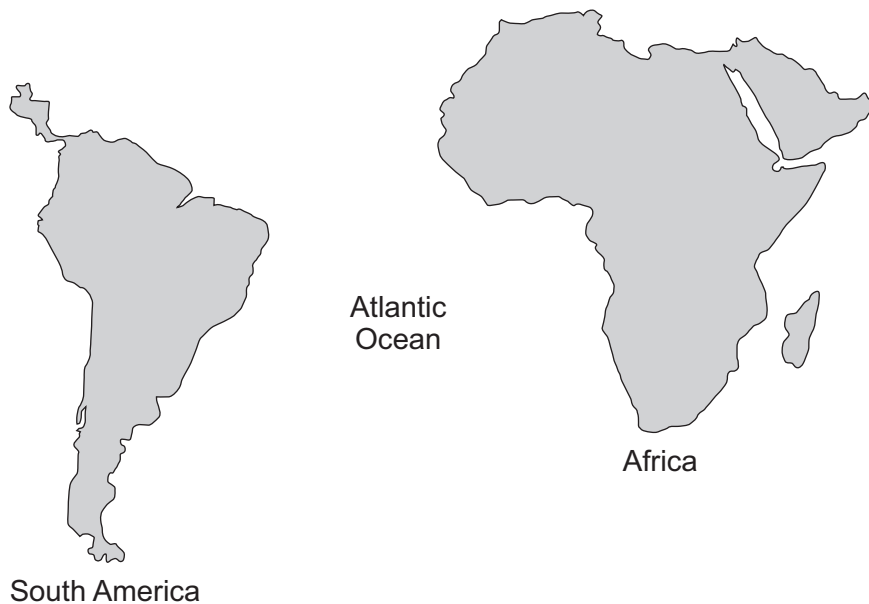
- 1 a Year 11 student at school
- 2 a farmer
- 3 a supermarket manager
- 4 a research scientist

**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

The diagram shows the positions of South America and Africa.



Early in the 20th century, a scientist called Alfred Wegener put forward a theory that South America and Africa had once been joined together, but had since moved apart.

**8A** Many scientists at the time did not accept Wegener's theory because . . .

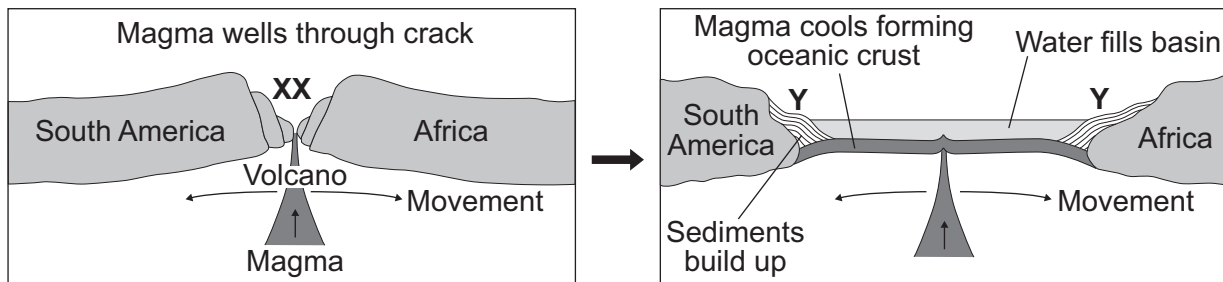
- 1 some of the rocks on the two continents were different.
- 2 they thought that the two continents were moving towards each other.
- 3 they were unable to explain how the continents could move.
- 4 they thought that the Earth's crust was expanding.

**8B** About 50 years later, more scientists began to accept Wegener's theory.

This was because of evidence that . . .

- 1 the continents have similar shapes.
- 2 the continents have different rocks and fossils.
- 3 the Earth's crust is made up of tectonic plates.
- 4 the Earth's crust is cracking as it expands.

The diagrams below show how the two continents were originally arranged and how they moved apart.



**8C** What do we now believe causes the continents to move apart?

- 1 volcanic activity
- 2 earthquakes
- 3 ocean currents
- 4 convection currents

**8D** One result of the movement of the continents from **XX** to **YY**, as shown in the diagrams is . . .

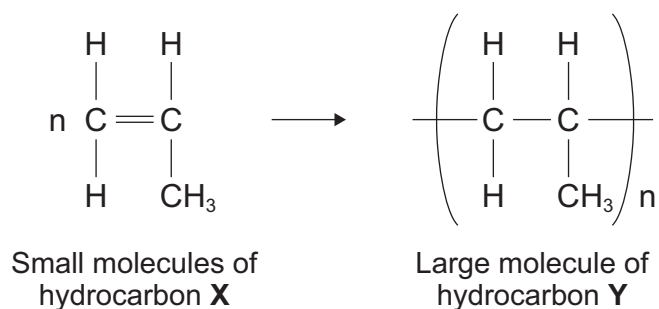
- 1 mountain building.
- 2 sea-floor spreading.
- 3 crustal shrinking.
- 4 subduction.

**Turn over for the next question**

**Turn over ►**

## QUESTION NINE

The equation shows a chemical reaction.



**9A** Hydrocarbon **X** is . . .

- 1 an alkane.
- 2 a polymer.
- 3 an alkene.
- 4 a catalyst.

**9B** Hydrocarbon **Y** is . . .

- 1 an unsaturated compound.
- 2 a polymer.
- 3 an alkene.
- 4 a monomer.

**9C** Poly(propene) is a thermosoftening polymer so it **cannot** be used to make . . .

- 1 buckets.
- 2 food containers.
- 3 non-stick coating for frying pans.
- 4 washing-up bowls.

**9D** Putting poly(propene) and other polymer waste into landfill creates a problem because this type of waste . . .

- 1 is very lightweight and blows about.
- 2 is not biodegradable.
- 3 does not dissolve in water.
- 4 is very dense and sinks deep underground.

**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**.

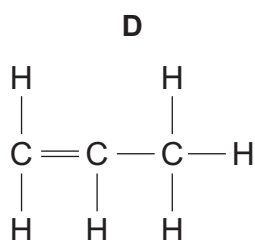
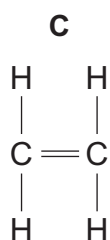
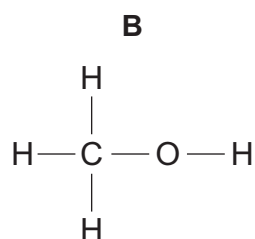
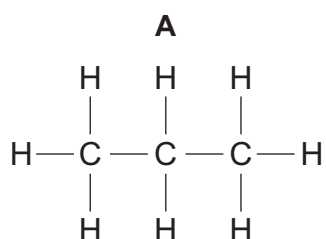
Use **each** answer only **once**.

Mark your choices on the answer sheet.

### QUESTION ONE

This question is about the formulae of four compounds.

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

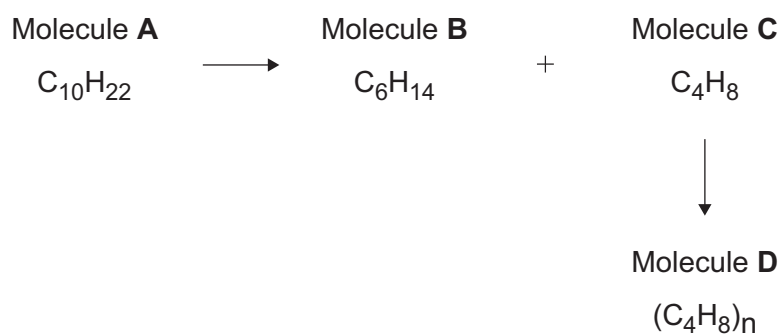


<b>1</b>	It is the alkene used to make ethanol.
<b>2</b>	It is a saturated hydrocarbon useful as a fuel.
<b>3</b>	It is not a hydrocarbon but burns to produce carbon dioxide and water vapour.
<b>4</b>	It belongs to the group with the general formula $\text{C}_n\text{H}_{2n}$ where $n=3$ .



**QUESTION TWO**

This question is about hydrocarbons.



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

Molecule . . . **1** . . . has been cracked.

Molecule . . . **2** . . . is an alkene.

Molecule . . . **3** . . . is a polymer.

Molecule . . . **4** . . . is the alkane in the reactions with the smallest molecules.

**Turn over for the next question**

**Turn over ►**

---

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

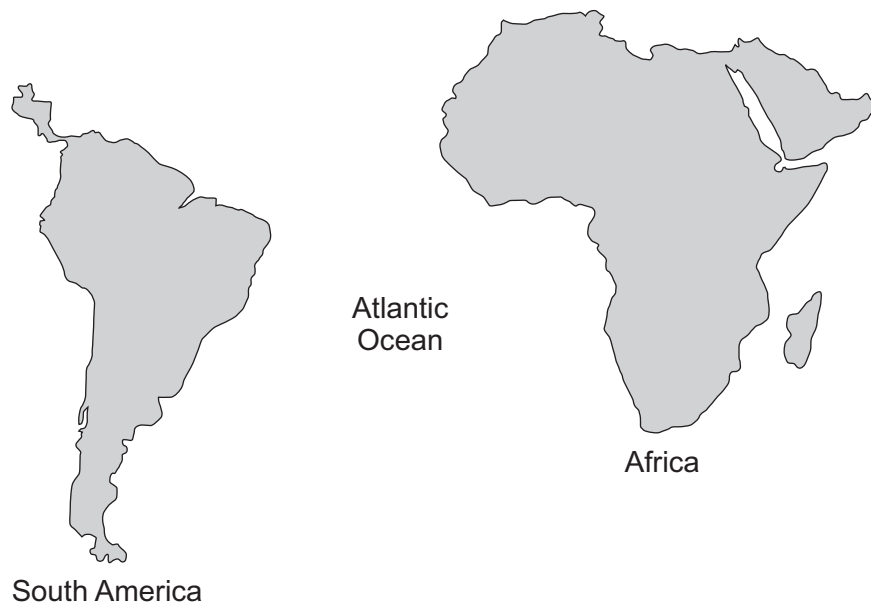
Each of these questions has four parts.

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

---

**QUESTION THREE**

The diagram shows the positions of South America and Africa.



Early in the 20th century, a scientist called Alfred Wegener put forward a theory that South America and Africa had once been joined together, but had since moved apart.

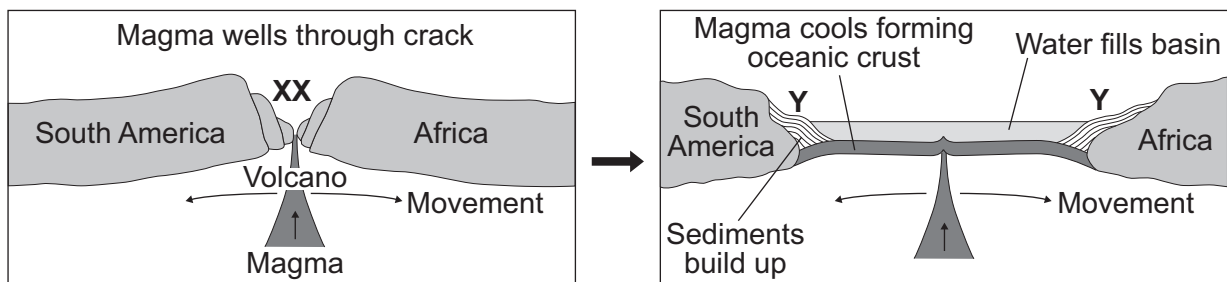
- 3A** Many scientists at the time did not accept Wegener's theory because . . .
- 1 some of the rocks on the two continents were different.
  - 2 they thought that the two continents were moving towards each other.
  - 3 they were unable to explain how the continents could move.
  - 4 they thought that the Earth's crust was expanding.

**3B** About 50 years later, more scientists began to accept Wegener's theory.

This was because of evidence that . . .

- 1 the continents have similar shapes.
- 2 the continents have different rocks and fossils.
- 3 the Earth's crust is made up of tectonic plates.
- 4 the Earth's crust is cracking as it expands.

The diagrams below show how the two continents were originally arranged and how they moved apart.



**3C** What do we now believe causes the continents to move apart?

- 1 volcanic activity
- 2 earthquakes
- 3 ocean currents
- 4 convection currents

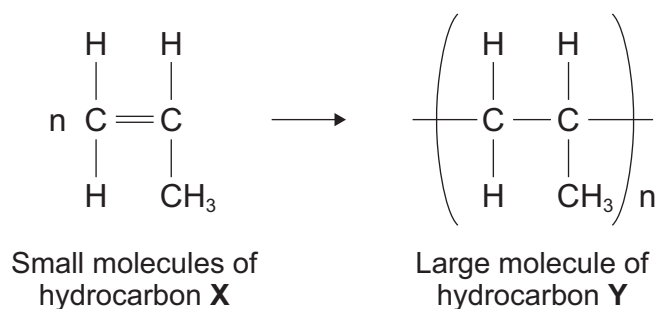
**3D** One result of the movement of the continents from **XX** to **YY**, as shown in the diagrams is . . .

- 1 mountain building.
- 2 sea-floor spreading.
- 3 crustal shrinking.
- 4 subduction.

Turn over ►

## QUESTION FOUR

The equation shows a chemical reaction.



**4A** Hydrocarbon **X** is . . .

- 1 an alkane.
- 2 a polymer.
- 3 an alkene.
- 4 a catalyst.

**4B** Hydrocarbon **Y** is . . .

- 1 an unsaturated compound.
- 2 a polymer.
- 3 an alkene.
- 4 a monomer.

**4C** Poly(propene) is a thermosoftening polymer so it **cannot** be used to make . . .

- 1 buckets.
- 2 food containers.
- 3 non-stick coating for frying pans.
- 4 washing-up bowls.

**4D** Putting poly(propene) and other polymer waste into landfill creates a problem because this type of waste . . .

- 1 is very lightweight and blows about.
- 2 is not biodegradable.
- 3 does not dissolve in water.
- 4 is very dense and sinks deep underground.

**Turn over for the next question**

**Turn over ►**

**QUESTION FIVE**

The table gives information about some of the gases in air.

Name	Formula	Melting point in °C	Boiling point in °C
Helium	He	-272.2	-269.0
Oxygen	O <sub>2</sub>	-219.0	-183.0
Nitrogen	N <sub>2</sub>	-210.0	-195.9
Argon	Ar	-189.0	-185.9
Carbon dioxide	CO <sub>2</sub>	-78.5	-78.5
Water vapour	H <sub>2</sub> O	0.0	100.0

To separate these gases, they are compressed and cooled.

- Water is first removed.
- Carbon dioxide is then removed by absorption.
- The gases remaining are cooled to -200 °C.

**5A** Why are water vapour and carbon dioxide first removed?

- 1 They are both compounds and the rest are elements.
- 2 They both contribute to global warming.
- 3 They would both solidify and block the pipes.
- 4 The carbon dioxide would dissolve in the water.

**5B** After the removal of water and carbon dioxide, which row in the table below shows the physical states of the remaining elements at -200 °C?

	Helium	Oxygen	Nitrogen	Argon
1	gas	liquid	liquid	solid
2	liquid	gas	solid	liquid
3	gas	liquid	solid	solid
4	solid	gas	liquid	gas

- 
- 5C** After the removal of water and carbon dioxide, which of the gases remaining would stay liquid over the greatest temperature range?
- 1 helium
  - 2 oxygen
  - 3 nitrogen
  - 4 argon
- 5D** After the gases are cooled to  $-200^{\circ}\text{C}$  and then allowed to warm up, which of the following gives the order in which they would vaporise?
- 1 oxygen, nitrogen, argon
  - 2 nitrogen, argon, oxygen
  - 3 argon, nitrogen, oxygen
  - 4 oxygen, argon, nitrogen

**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

Plant oils can be hardened for use in making margarine. A company selected five plant oils to test for their amount of unsaturation.

The company scientists added iodine solution to the oils to obtain iodine numbers. Iodine numbers show how many grams of iodine react with 100 g of the oil.

Plant oils with lower iodine numbers are:

- harder
- less unsaturated.

The company's results are shown in the table.

Plant oil	Melting point in °C	Iodine number
Palm	+35	54
Peanut	+3	93
Cotton seed	-1	105
Soybean	-16	130
Linseed	-24	178

**6A** The company concluded that for all plant oils, as the melting point decreases, the amount of unsaturation increases.

This conclusion is **not** valid because . . .

- 1 some of the oils are solid at room temperature (20 °C).
- 2 the company tested only a limited number of plant oils.
- 3 the results indicate that as the melting point decreases, the amount of unsaturation decreases.
- 4 some of the oils are from seeds and others are from nuts.



**6B** The results may have been affected by the brown colour of some of the oils.

This is because the brown colour could have . . .

- 1 reacted with the iodine.
- 2 changed the iodine colour produced.
- 3 made the loss of colour of the iodine difficult to see.
- 4 reacted with the double bonds in the oil.

**6C** The best way for the results to be reliable **and** unbiased would have been for . . .

- 1 the company scientists to use more modern equipment.
- 2 the company scientists to repeat the experiments with more sensitive equipment.
- 3 independent scientists to repeat the experiment with more modern equipment.
- 4 independent scientists to repeat the company's tests.

**6D** Which row in the table below correctly describes the conditions that the company would use to make sunflower oil suitable for use in margarine?

	Condition 1	Condition 2	Condition 3
1	Add emulsifiers	Do not let the temperature rise above 60 °C	Use a nickel catalyst
2	Add hydrogen	Warm the mixture above 37 °C	Add compounds with E-numbers
3	Add oxygen	Do not let the temperature rise above 37 °C	Use a nickel catalyst
4	Add hydrogen	Warm the mixture above 60 °C	Use a nickel catalyst

**Turn over for the next question**

**Turn over ►**

**QUESTION SEVEN**

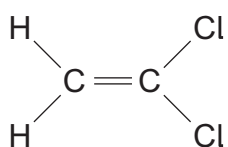
Worldwide, about 20 billion wine bottle stoppers are produced each year.

In recent years, the traditional cork stoppers have been gradually replaced by screw-top stoppers.

Cork is the bark from the cork-oak tree, which is cut off about every ten years. Tens of thousands of people in rural Portugal depend on cork for their livelihoods. Used cork can be recycled.

A screw-top stopper can be made of aluminium, inside which is a polymer sealant. The sealant is usually made of poly(ethene) or poly(vinylidene chloride). Extraction of aluminium from its ores is expensive and a lot of energy is required. It is difficult to separate the polymer from the aluminium cap to allow aluminium to be recycled.

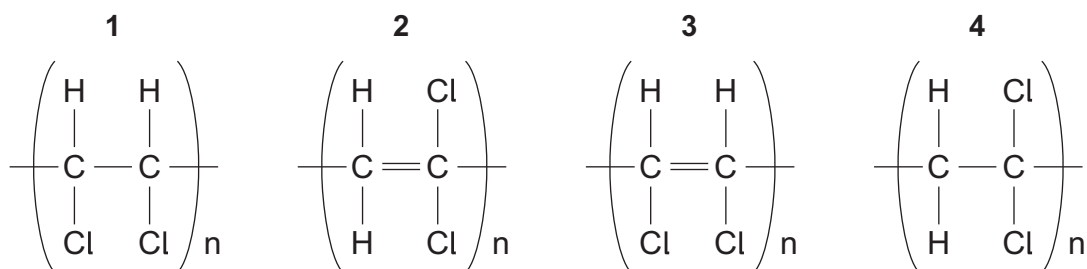
Vinylidene chloride has the structure:



**7A** One difference between ethene and vinylidene chloride is that . . .

- 1 only ethene is an unsaturated compound.
- 2 only vinylidene chloride will react with iodine.
- 3 only vinylidene chloride is obtained from crude oil.
- 4 only ethene is a hydrocarbon.

**7B** The formula for poly(vinylidene chloride) is . . .



- 7C** There are two likely consequences of wine companies using metal screw-top stoppers with polymer sealants instead of cork.

Which row in the table correctly shows the two likely consequences?

<b>1</b>	increased use of crude oil	loss of employment in rural Portugal
<b>2</b>	reduction in carbon dioxide emissions	loss of employment in rural Portugal
<b>3</b>	reduction in carbon dioxide emissions	loss of important forest habitat
<b>4</b>	increased use of crude oil	reduced amount of material to landfill

- 7D** Scientists are researching the consequences of using screw-top stoppers with polymer sealants instead of cork.

Which row in the table below gives the correct description of an issue and its impact?

	<b>Issue</b>	<b>Impact</b>
<b>1</b>	ethical	effect on the price of wine
<b>2</b>	social	effect on the rural communities
<b>3</b>	environmental	effect on the quality of wine
<b>4</b>	economic	effect on cork forest habitat

**Turn over for the next question**

**Turn over ►**

## QUESTION EIGHT

Some vehicles which normally use petroleum diesel fuel can also use a mixture of biodiesel and petroleum diesel.

Petroleum diesel is made from crude oil.

Biodiesel is made from a variety of vegetable oils: for example, soybean, palm and rapeseed.

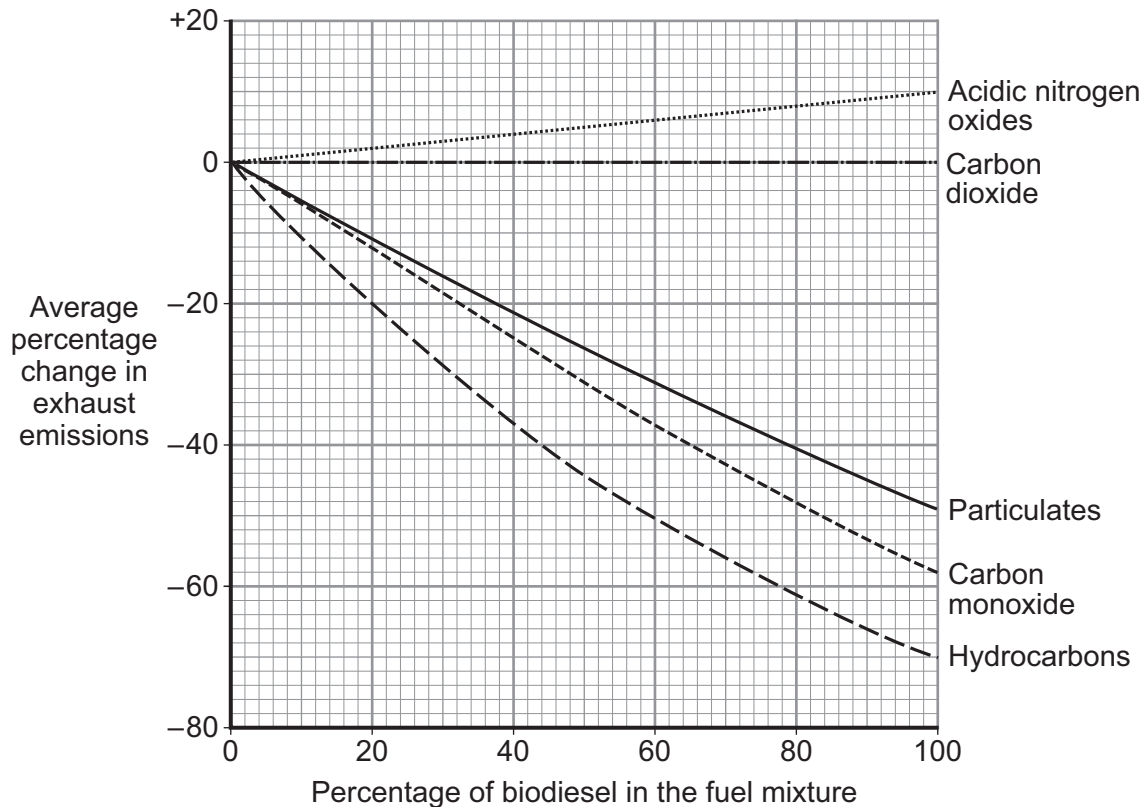
This means that large areas of land are needed to grow crops from which to extract the vegetable oils for the production of biodiesel.

**8A** Research into the production and use of biodiesel continues.

The main reason for this is that . . .

- 1 unused food crops are being wasted in some developing countries.
- 2 large, new oilfields have been discovered in Europe.
- 3 crude oil is a non-renewable energy source.
- 4 car manufacturers are making cars that run only on biodiesel.

The graph shows the average percentage change in exhaust emissions from vehicles using different mixtures of petroleum diesel and biodiesel.



---

**8B** Some scientists claim that net carbon dioxide emissions are lower for biodiesel than for petroleum diesel.

What is the basis for this argument?

- 1 Biodiesel produces less carbon dioxide when it burns.
- 2 Plants take up carbon dioxide as they grow.
- 3 Biodiesel is not a carbon compound.
- 4 Plants release carbon dioxide in respiration.

**8C** The graph indicates that when compared with 100 % petroleum diesel, a fuel mixture of equal volumes of petroleum diesel and biodiesel will . . .

- 1 reduce nitrogen oxides by about 5 %.
- 2 increase both particulates and carbon monoxide by about 25 %.
- 3 reduce hydrocarbons by about 45 %.
- 4 reduce carbon dioxide by about 5 %.

**8D** One possible disadvantage of using fuel with a high percentage of biodiesel is that . . .

- 1 it is non-biodegradable.
- 2 it could increase the amount of acid rain.
- 3 it is non-renewable.
- 4 it could increase global dimming.

**Turn over for the next question**

**Turn over ►**

## QUESTION NINE

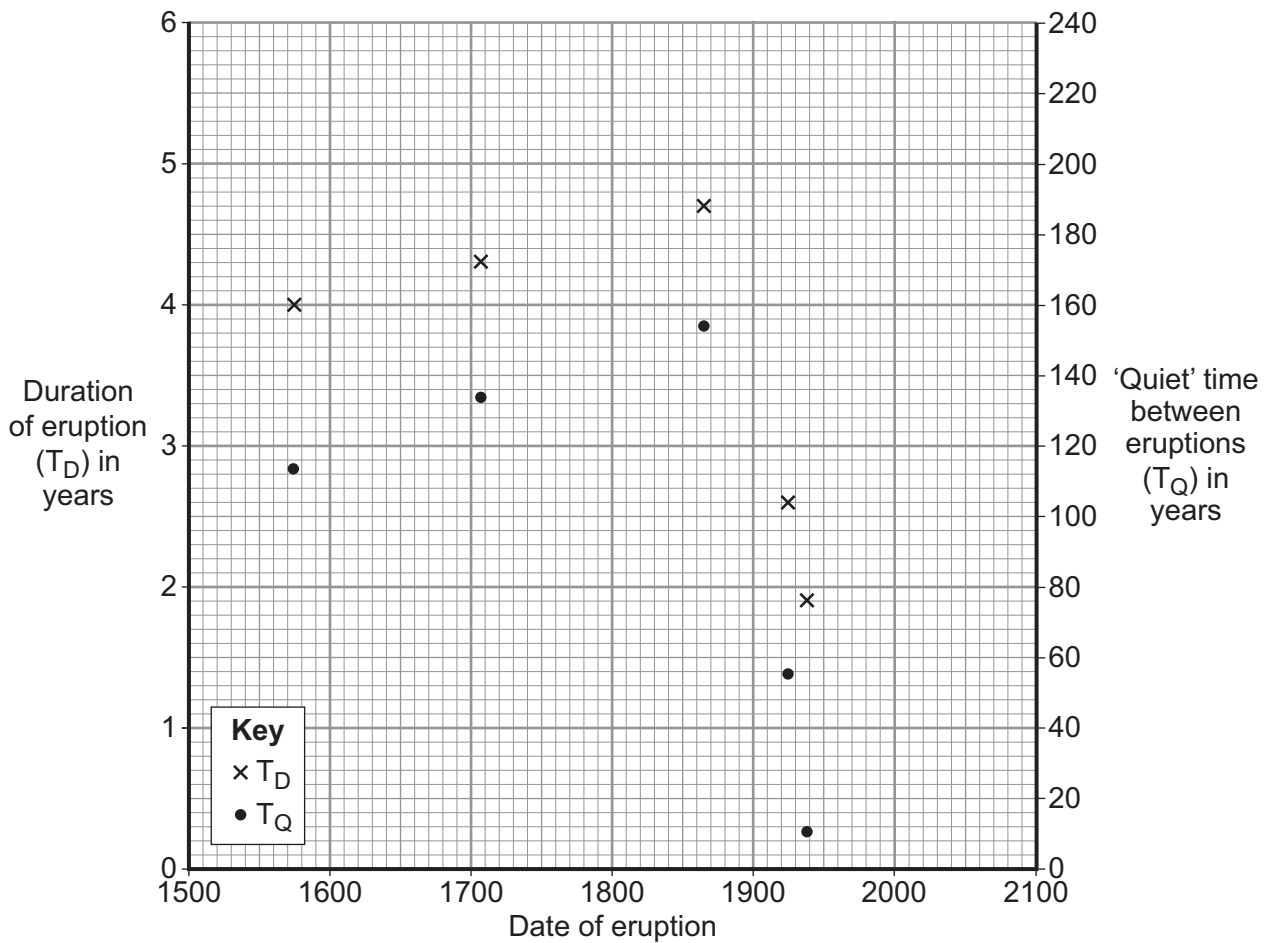
Use the information given to answer this question.

Santorini is a Greek island. Many volcanic eruptions have occurred there over thousands of years.

The graph refers to the major eruptions which have occurred there during the past 500 years.

$T_D$  is the duration time for each major eruption (the time for which it lasts).

$T_Q$  is the quiet time between the end of each major eruption and the start of the next one.



**9A** It is probable that the island of Santorini . . .

- 1 lies at the centre of a large tectonic plate.
- 2 will be unaffected by earthquakes.
- 3 is close to a boundary between tectonic plates.
- 4 will reduce in size as the Earth shrinks.

**9B** The graph indicates that . . .

- 1 another eruption should have occurred around 1950.
- 2 major eruptions occur at regular intervals of time.
- 3 the longer the quiet time ( $T_Q$ ), the longer the eruption is likely to be.
- 4 the volcano is gradually becoming extinct so it is unlikely to erupt again.

**9C** The mean quiet time ( $T_Q$ ) for the volcano is 93.4 years.

With this information available, scientists . . .

- 1 can predict when the next major eruption will occur and how long it is likely to last.
- 2 can predict when the next major eruption will occur but not how long it is likely to last.
- 3 cannot predict when the next major eruption will occur but can say how long it is likely to last.
- 4 cannot predict when the next major eruption will occur or how long it is likely to last.

**9D** The last major eruption occurred in 1939.

Suppose that the next eruption occurs in 2060, it would be most likely to last for . . .

- 1 6 months.
- 2 1 year.
- 3 4 years.
- 4 6 years.

**END OF TEST**

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