

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2007



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

CHY1B

CHEMISTRY
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Monday 25 June 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:
- 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
○ ● ○ ○

1 2 3 4
○ ✗ ○ ●

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.

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 oils and food additives.

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

A an additive

B a catalyst

C an emulsion

D a mixture

Crude oil is . . . **1**

Droplets of vegetable oil in a solution of vinegar with water form . . . **2** . . . that we call salad cream.

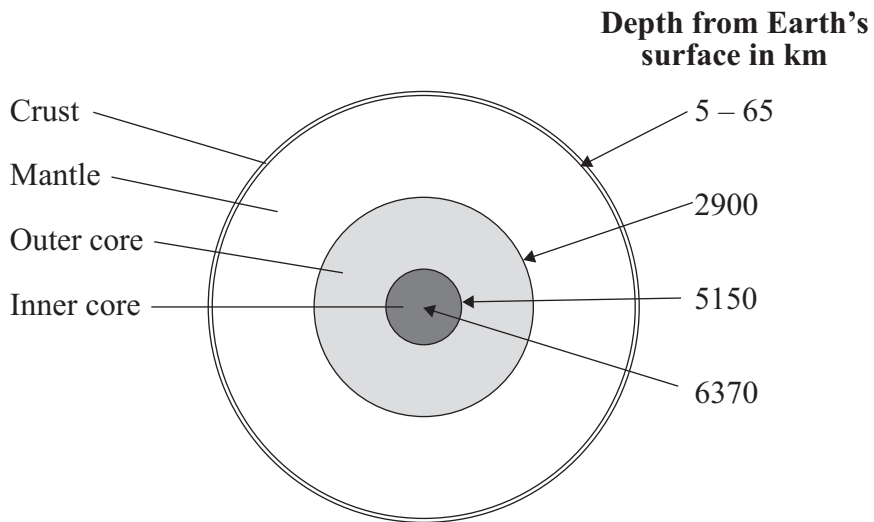
Monosodium glutamate is . . . **3** . . . used to add flavour to some foods.

Nickel is . . . **4** . . . used to speed up the reaction between vegetable oils and hydrogen.

QUESTION TWO

The table and the diagram give information about the Earth and its interior.

Layer	Name of layer	Volume (%)	Density in g per cm ³
A	Crust	1.5	2.7–3.0
B	Mantle	82.3	3.3–5.8
C	Outer core	15.4	9.4–12.3
D	Inner core	0.8	13.0–13.5



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

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

The layer with the largest volume is the ... **2**

The thinnest layer is the ... **3**

The layer with a thickness of 2250 km is the ... **4**

Turn over for the next question

Turn over ►

QUESTION THREE

This question is about vegetable oils.

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

A double

B harder

C higher

D lower

Vegetable oils have . . . **1** . . . melting points than fats.

Most vegetable oils are unsaturated because they contain molecules with . . . **2** . . . carbon carbon bonds.

When vegetable oils react with hydrogen, they become . . . **3** . . . because these hydrogenated oils have . . . **4** . . . melting points.

QUESTION FOUR

The list below shows the first five noble gases, in the order in which they appear in Group 0 of the periodic table, and their boiling points.

Noble gas	Boiling point in °C
Helium	-269
Neon	-246
Argon	-186
Krypton	-152
Xenon	-107

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

- A** boiling point
- B** colour
- C** density
- D** reactivity

Argon is used in filament lamps because of its low chemical . . . **1**

In electric discharge tubes, used for advertisement signs, each noble gas glows with a different . . . **2**

Helium is used in balloons because it has a low . . . **3**

Xenon is the noble gas in the list that has the highest . . . **4**

Turn over for the next question

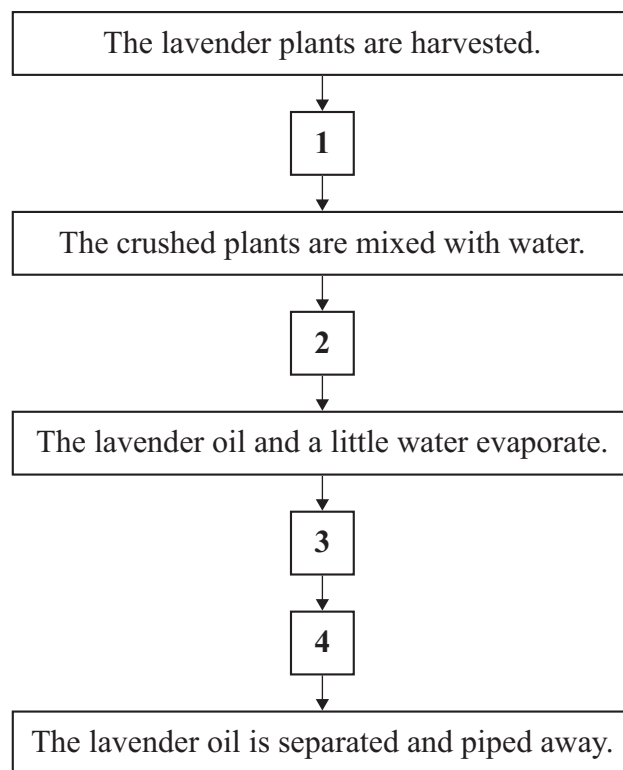
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QUESTION FIVE

This question is about collecting lavender oil from lavender plants.

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

- A** The vapours are cooled and condense.
- B** The mixture is heated in a distillation flask.
- C** The lavender oil floats on top of the water.
- D** The lavender plants are crushed.



QUESTION SIX

The table shows some information about four vegetable oils.

	Type of oil	Average mass of oil extracted from 100 kg of seeds in g	Energy provided by 100 g of the oil in kJ	Approximate melting point in °C	Smoke point in °C	Iodine number
A	Corn	6	3700	-15	229–268	120
B	Olive	40	3378	-12	204–210	60
C	Rapeseed	35	3696	5	230–240	100
D	Sunflower	32	3700	-18	229–252	130

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

The smoke point is the temperature at which an oil begins to give off smoke when heated.

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

What we can say about the oil	
1	It does not begin to give off smoke until heated to 265 °C.
2	It would be the first to solidify if the oils were cooled from 20 °C.
3	It would need the largest volume of bromine water to react completely.
4	It would provide the most energy from 100 kg of seeds.

Turn over for the next question

Turn over ►

SECTION TWO

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

Each of these questions has four parts.

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

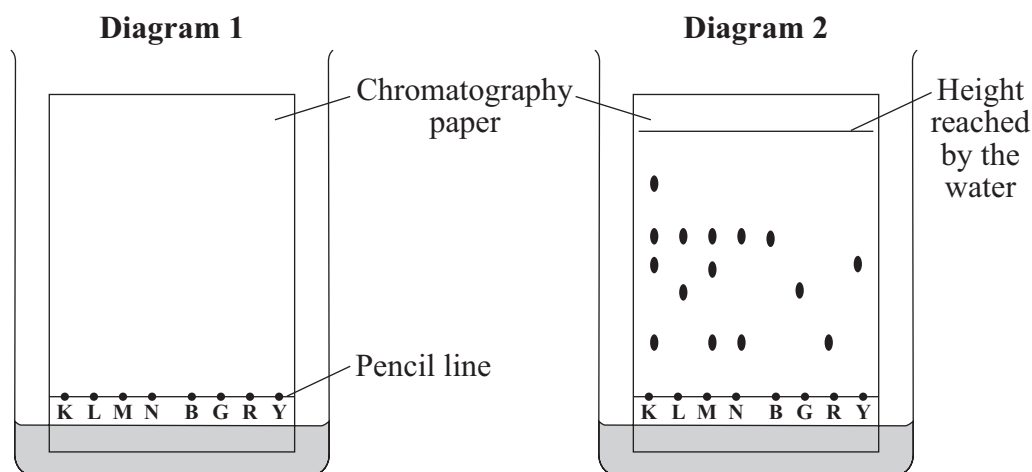
Mark your choices on the answer sheet.

QUESTION SEVEN

A student investigated the coloured substances used in making four different fruit drinks, **K**, **L**, **M** and **N**.

- A spot of each drink was placed on a pencil line on chromatography paper.
- Spots of four single known food colourings, **B**, **G**, **R** and **Y**, permitted in foods, were also placed on the pencil line.
- The paper was then left to stand in water in a beaker.

Diagram 1 shows how the apparatus was arranged. **Diagram 2** shows the result after a short time.



Key	
Known food colourings	
B Blue	R Red
G Green	Y Yellow

7A Which of the drinks contains the green colouring?

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

7B From the evidence on the chromatography paper, the student could conclude that . . .

- 1 red, blue, green and yellow are the only food colourings allowed in fruit drinks.
- 2 all four drinks contain the same number of food colourings.
- 3 red, blue, green and yellow food colourings are soluble in water.
- 4 fruit drink **L** is a lighter colour than the other drinks.

7C Why should the student make further checks on fruit drink **K**?

- 1 It is too dark in colour.
- 2 It contains too many food colourings.
- 3 Its colour may mean that consumers will not buy the drink.
- 4 It contains a colour that he has not identified.

7D A fruit drink that is on sale in the shops is found to contain a food colouring that may be harmful.

What immediate action should the manufacturers take?

- 1 stop production of all fruit drinks
- 2 stop production of this particular fruit drink
- 3 in future, make this fruit drink without the potentially harmful food colouring
- 4 withdraw the fruit drink from all shops and advise the public not to drink it

Turn over for the next question

Turn over ►

QUESTION EIGHT

The table shows the fats in 100 grams of butter and in 100 grams of a margarine spread called Activo.

	Butter	Activo
Total fat	81.0 g	80.0 g
of which saturates	51.2 g	26.3 g
monounsaturates	27.5 g	18.8 g
polyunsaturates	2.3 g	34.4 g
trans fats	0 g	0.5 g

Fats can:

- increase a person's weight and cause obesity
- raise cholesterol levels in the blood.

Most human cholesterol is manufactured in the body; only about 4% results from diet.

High cholesterol levels are linked to heart disease.

Saturated fats raise cholesterol levels.

The more unsaturated a fat, the better it is for lowering cholesterol levels.

8A The Activo company claims that Activo is healthier than butter.

This claim may not be reliable because . . .

- 1 the company's scientists are unqualified.
- 2 the company wants to increase sales of Activo.
- 3 Activo is cheaper than butter.
- 4 the company is unsure which fats Activo contains.

8B From the information provided, it is safe to conclude that . . .

- 1 butter is the main cause of heart disease.
- 2 heart disease will be reduced by eating Activo instead of butter.
- 3 trans fats are more harmful than saturated fats.
- 4 there is more unsaturated fat in Activo than in butter.

8C An overweight person ate his normal diet, except that he stopped eating foods containing saturated fats. He was surprised that he continued to gain weight.

This could be because . . .

- 1 his diet still contained a high level of unsaturated fats.
- 2 his cholesterol level was reduced.
- 3 his cholesterol level was unchanged.
- 4 he was no longer eating any trans fats.

8D Designing surveys to compare the effects of butter and Activo in causing heart disease is difficult because . . .

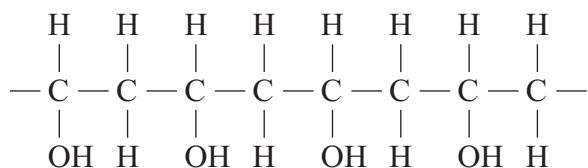
- 1 they both contain similar amounts of fat.
- 2 other factors can cause heart disease.
- 3 Activo contains more polyunsaturates than butter.
- 4 people with heart disease will not take part in the survey.

Turn over for the next question

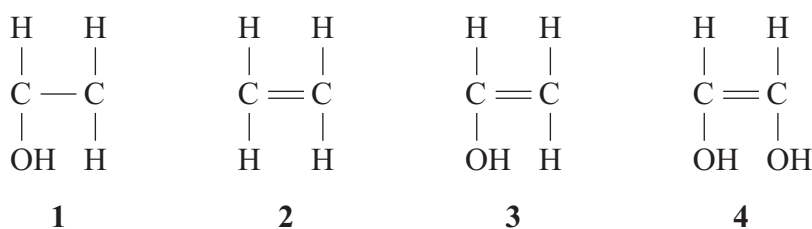
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QUESTION NINE

Poly(vinyl alcohol) has this structure:



9A The monomer from which poly(vinyl alcohol) is made can be represented by . . .



Poly(vinyl alcohol) reacts with a solution of sodium borate to form ‘slime’.
Slime can be fluid or, when almost solid, it can retain its shape.

A student measured the relationship between the spread of a lump of slime and the concentration of the sodium borate solution used to make it.
She called this ‘the slump test’.

The student followed this procedure:

- make a sample of slime using 50 cm³ of 4% poly(vinyl alcohol) solution and 5 cm³ of a 1% solution of sodium borate
- stir the mixture for 2 minutes
- measure out 50 cm³ of the slime produced and make this into a disc shape
- place this disc on paper and mark its outline with a pencil line
- leave for 5 minutes
- mark the new outline of the slime with a pencil
- calculate the increase in area of the disc
- repeat, using different concentrations of sodium borate to make the slime.

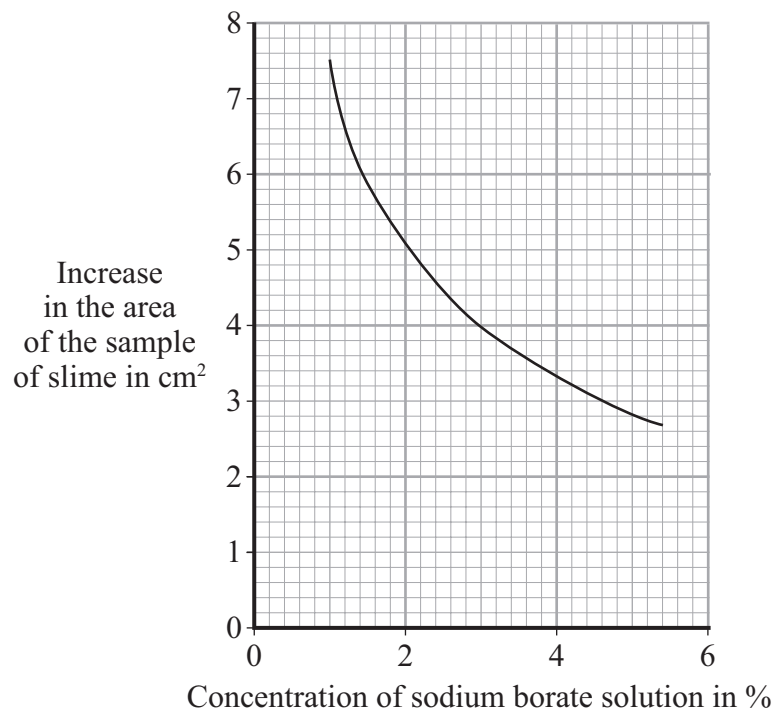
9B The student would have achieved greater accuracy in the test if she had . . .

- 1** used a smaller piece of slime.
- 2** stirred the reacting mixture for more than 2 minutes.
- 3** allowed the slime to spread for less than 5 minutes.
- 4** controlled the starting area of the slime discs.

9C One variable that she did not control was . . .

- 1 the concentration of the poly(vinyl alcohol).
- 2 the room temperature during the slump test.
- 3 the volume of the sodium borate solution.
- 4 the volume of the slime.

9D The student's results are shown on the graph.



The graph shows that . . .

- 1 the increase in area is directly proportional to the concentration of the sodium borate solution.
- 2 there is a linear relationship between the increase in area and the concentration of the sodium borate solution.
- 3 the increase in area is reduced as the sodium borate solution becomes more concentrated.
- 4 there is no relationship between the size of the disc and the concentration of the sodium borate solution.

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

The table shows some information about four vegetable oils.

	Type of oil	Average mass of oil extracted from 100 kg of seeds in g	Energy provided by 100 g of the oil in kJ	Approximate melting point in °C	Smoke point in °C	Iodine number
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A high iodine number indicates a large number of double bonds in a molecule of the oil.

The smoke point is the temperature at which the heated oil begins to give off smoke.

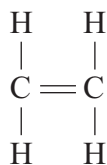
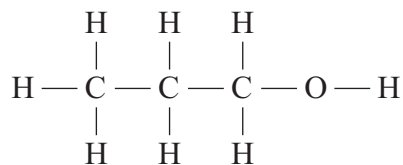
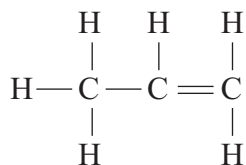
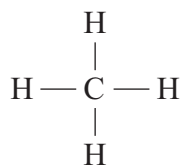
Match oils, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

What we can say about the oil	
1	It begins to smoke only when heated to 265 °C.
2	It would be the first to solidify if the oils were cooled from 20 °C.
3	It would need the largest volume of bromine water to react completely.
4	It would provide the most energy from 100 kg of seeds.

QUESTION TWO

This question is about the formulae for four compounds.

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

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

Description	
1	It is an unsaturated hydrocarbon with three carbon atoms in each molecule.
2	It is the monomer from which poly(ethene) is made.
3	It is the alkane that was present in Earth's early atmosphere.
4	It is not a hydrocarbon.

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 table shows the fats in 100 grams of butter and in 100 grams of a margarine spread called Activo.

	Butter	Activo
Total fat	81.0 g	80.0 g
of which saturates	51.2 g	26.3 g
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polyunsaturates	2.3 g	34.4 g
trans fats	0 g	0.5 g

Fats can:

- increase a person's weight and cause obesity
- raise cholesterol levels in the blood.

Most human cholesterol is manufactured in the body; only about 4% results from diet.

High cholesterol levels are linked to heart disease.

Saturated fats raise cholesterol levels.

The more unsaturated a fat, the better it is for lowering cholesterol levels.

3A The Activo company claims that Activo is healthier than butter.

This claim may not be reliable because . . .

- 1 the company's scientists are unqualified.
- 2 the company wants to increase sales of Activo.
- 3 Activo is cheaper than butter.
- 4 the company is unsure which fats Activo contains.

3B From the information provided, it is safe to conclude that . . .

- 1 butter is the main cause of heart disease.
- 2 heart disease will be reduced by eating Activo instead of butter.
- 3 trans fats are more harmful than saturated fats.
- 4 there is more unsaturated fat in Activo than in butter.

3C An overweight person ate his normal diet, except that he stopped eating foods containing saturated fats. He was surprised that he continued to gain weight.

This could be because . . .

- 1 his diet still contained a high level of unsaturated fats.
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- 3 his cholesterol level was unchanged.
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3D Designing surveys to compare the effects of butter and Activo in causing heart disease is difficult because . . .

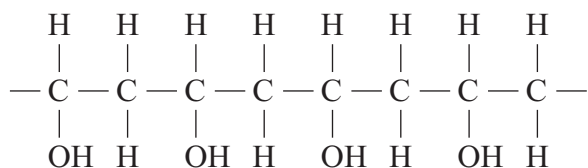
- 1 they both contain similar amounts of fat.
- 2 other factors can cause heart disease.
- 3 Activo contains more polyunsaturates than butter.
- 4 people with heart disease will not take part in the survey.

Turn over for the next question

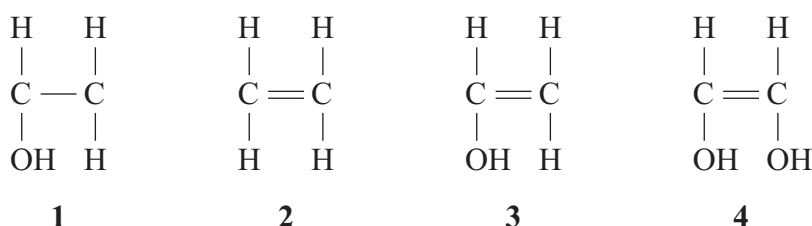
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QUESTION FOUR

Poly(vinyl alcohol) has this structure:



4A The monomer from which poly(vinyl alcohol) is made can be represented by . . .



Poly(vinyl alcohol) reacts with a solution of sodium borate to form ‘slime’.
Slime can be fluid or, when almost solid, it can retain its shape.

A student measured the relationship between the spread of a lump of slime and the concentration of the sodium borate solution used to make it.
She called this ‘the slump test’.

The student followed this procedure:

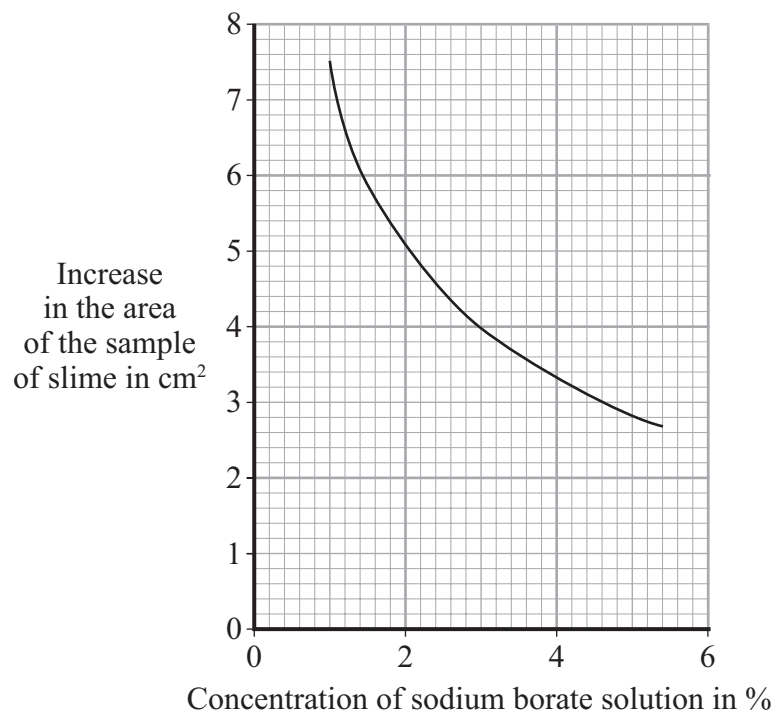
- make a sample of slime using 50 cm³ of 4% poly(vinyl alcohol) solution and 5 cm³ of a 1% solution of sodium borate
- stir the mixture for 2 minutes
- measure out 50 cm³ of the slime produced and make this into a disc shape
- place this disc on paper and mark its outline with a pencil line
- leave for 5 minutes
- mark the new outline of the slime with a pencil
- calculate the increase in area of the disc
- repeat, using different concentrations of sodium borate to make the slime.

4B The student would have achieved greater accuracy in the test if she had . . .

- 1** used a smaller piece of slime.
- 2** stirred the reacting mixture for more than 2 minutes.
- 3** allowed the slime to spread for less than 5 minutes.
- 4** controlled the starting area of the slime discs.

- 4C One variable that she did not control was . . .
- 1 the concentration of the poly(vinyl alcohol).
 - 2 the room temperature during the slump test.
 - 3 the volume of the sodium borate solution.
 - 4 the volume of the slime.

4D The student's results are shown on the graph.



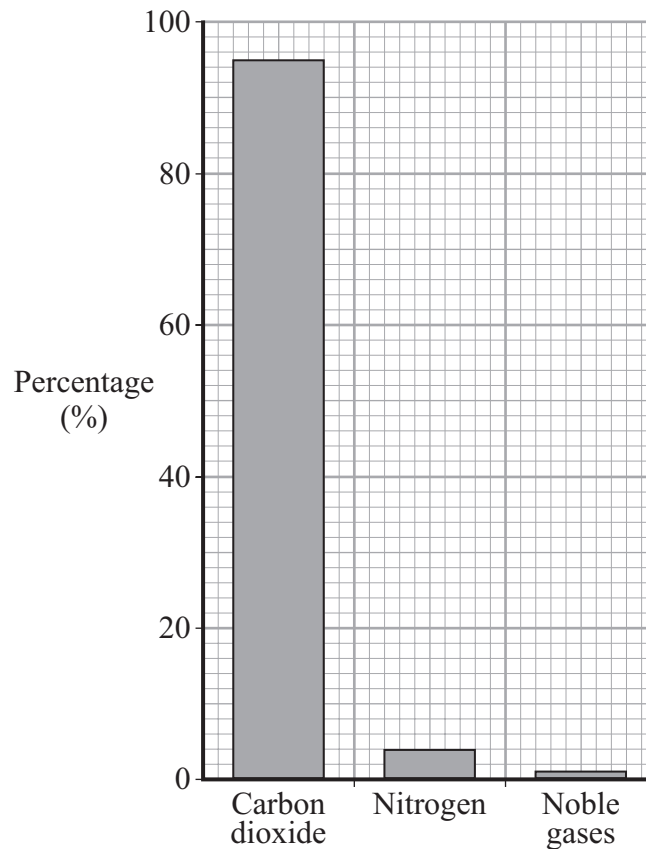
The graph shows that . . .

- 1 the increase in area is directly proportional to the concentration of the sodium borate solution.
- 2 there is a linear relationship between the increase in area and the concentration of the sodium borate solution.
- 3 the increase in area is reduced as the sodium borate solution becomes more concentrated.
- 4 there is no relationship between the size of the disc and the concentration of the sodium borate solution.

Turn over ►

QUESTION FIVE

The bar chart shows the composition of a sample of the atmosphere on Mars.



5A Earth's early atmosphere also contained a high percentage of carbon dioxide.

Scientists think that most of the carbon dioxide . . .

- 1 came out of solution from the oceans.
- 2 was released from volcanoes.
- 3 was given off as carbonate rocks decomposed.
- 4 was released as fossil fuels formed.

5B One way in which Earth's atmosphere today is different from that on Mars is that the Earth's atmosphere. . .

- 1 contains less nitrogen.
- 2 contains more carbon dioxide.
- 3 does not contain noble gases.
- 4 contains more water vapour.

5C The first plants are thought to have appeared on Earth about 2 billion years ago.

What effect did the plants have on the Earth's atmosphere?

- 1 They increased the percentage of carbon dioxide.
- 2 They decreased the percentage of nitrogen.
- 3 They increased the percentage of oxygen.
- 4 They increased the percentage of ammonia.

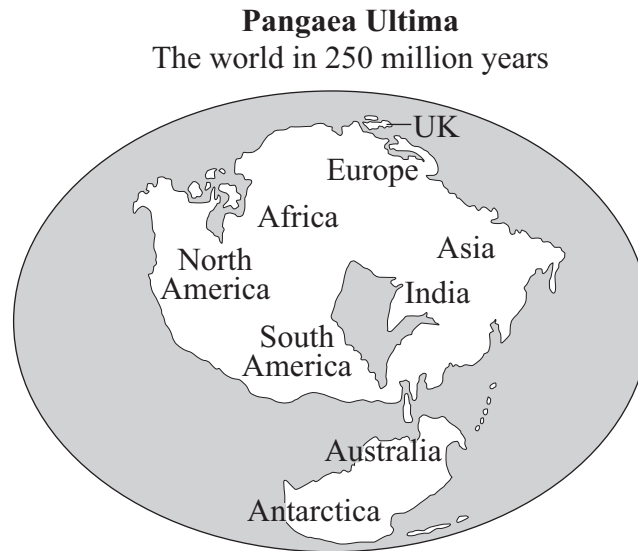
5D Filament lamps are normally filled with a noble gas.

The metal filament in a lamp would quickly burn away if the bulb was filled with air because air contains . . .

- 1 carbon dioxide.
- 2 nitrogen.
- 3 oxygen.
- 4 ammonia.

Turn over for the next question

Turn over ►

QUESTION SIX**Continental shifts will push Britain into the Arctic**

Dr Christopher Scotese, of the University of Texas, has predicted that in about 250 million years all the land masses on the Earth will come together to form a new mega-continent which he has called 'Pangaea Ultima'.

He claims that large tectonic plates, creeping more slowly than a fingernail grows, will bring the land masses together.

Africa would collide with Europe, erasing the Mediterranean and driving up a Himalayan-scale mountain range. Meanwhile, the Atlantic would first widen and then later disappear.

6A What name do we give to this movement of plates?

- 1 earthquakes
- 2 continental drift
- 3 convection
- 4 mountain building

6B Evidence suggests that in ‘creeping more slowly than a fingernail grows’, Dr Scotese means that the plates move . . .

- 1 a few millimetres a year.
- 2 a few centimetres a year.
- 3 a few metres a year.
- 4 a few kilometres a year.

6C The theory that continents move was first put forward in 1915 by a German scientist called Alfred Wegener.

Why did many scientists reject his theory?

- 1 They believed that the Earth’s crust was shrinking.
- 2 They had no way of explaining how the continents could move.
- 3 Alfred Wegener was not English.
- 4 They thought that tectonic plates only moved away from each other.

6D What discovery, made some years later, brought a greater acceptance of Wegener’s theory?

- 1 that the Earth’s crust is cooling down
- 2 the existence of tectonic plates
- 3 that global warming is occurring on the Earth
- 4 the effects of gravitational attraction

Turn over for the next question

Turn over ►

QUESTION SEVEN

A compound, C_4H_{10} , was decomposed by passing it over a hot catalyst.

Analysis showed the product to be a mixture of two different hydrocarbons, hydrocarbon **A** (an alkane) and hydrocarbon **B**.

Both hydrocarbon **A** and hydrocarbon **B** had two carbon atoms in each molecule.

7A Which row in the table shows the correct formulae for these two hydrocarbons?

	Hydrocarbon A	Hydrocarbon B
1	C_2H_6	C_2H_4
2	C_2H_2	C_2H_8
3	C_2H_4	C_2H_6
4	C_2H_5	C_2H_5

7B The boiling point of hydrocarbon **A** is $-89\text{ }^\circ\text{C}$ and that of hydrocarbon **B** is $-104\text{ }^\circ\text{C}$.

They could probably be separated and collected by . . .

- 1** thermal decomposition.
- 2** cracking.
- 3** condensation.
- 4** polymerisation.

7C Each of the two hydrocarbons was tested with bromine water.

Which row in the table correctly shows what happens to the bromine water?

	With hydrocarbon A	With hydrocarbon B
1	turns green	turns colourless
2	turns colourless	stays yellow-brown
3	stays yellow-brown	turns colourless
4	stays yellow-brown	turns green

7D Of these two hydrocarbons, only hydrocarbon **B** can form polymers.

This is because . . .

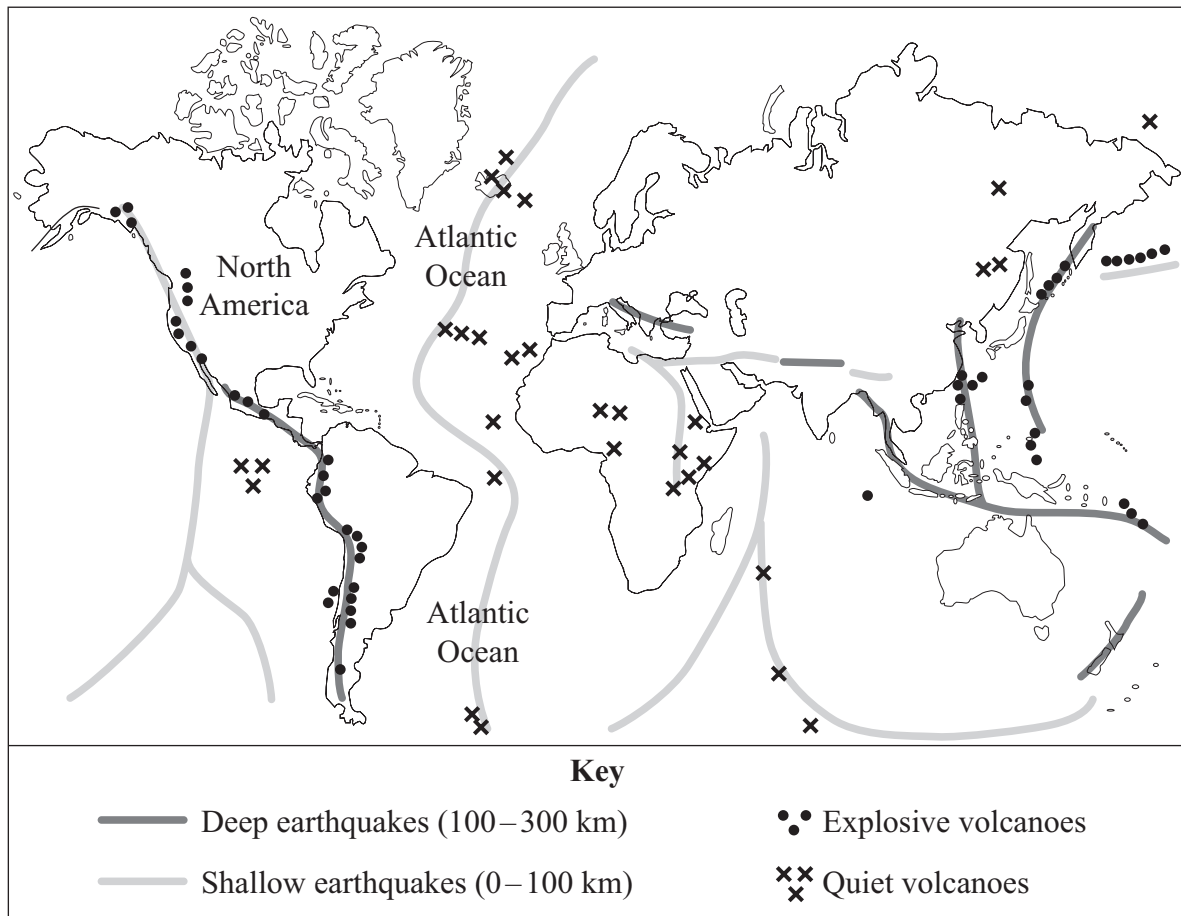
- 1 it has a higher boiling point.
- 2 its molecule has a double carbon carbon bond.
- 3 its molecule is saturated.
- 4 it has smaller molecules.

Turn over for the next question

Turn over ►

QUESTION EIGHT

The map shows the main areas on Earth where earthquakes and volcanoes occur.



8A What pattern is most clear?

- 1 Earthquakes and volcanoes always occur in the same areas.
- 2 Earthquakes and volcanoes always occur at the same time.
- 3 Explosive volcanoes often occur in the same areas as deep earthquakes.
- 4 Quiet volcanoes occur only on land masses.

8B There is considerable earthquake activity in the middle of the Atlantic Ocean because . . .

- 1 there are very deep ocean trenches in this area.
- 2 it is the boundary between two tectonic plates.
- 3 it is a zone of explosive volcanic activity.
- 4 the Earth's crust is very thick under the oceans.

8C In the past, there have been earthquakes associated with the San Andreas fault in North America. Scientists would like to be able to predict when another earthquake will affect this heavily populated area.

They cannot do this accurately because . . .

- 1 all the evidence has been destroyed.
- 2 it is too dangerous to work in the earthquake zone.
- 3 there are too few scientists to cover the length of the fault.
- 4 movements along the fault occur at random intervals.

8D Explosive volcanoes can be more dangerous than quiet ones. Recent research has shown that magma underneath these volcanoes contains droplets of water waiting to be released as vapour. Water escapes as the magma escapes from the Earth and the pressure on it decreases. Scientists believe that they can test lumps of ejected lava to calculate how much water the magma contains.

A high water content indicates a potential explosion because . . .

- 1 the magma is at a high temperature.
- 2 the magma is under high pressure.
- 3 the magma is very fluid.
- 4 the magma is cooling very quickly.

Turn over for the next question

Turn over ►

QUESTION NINE

This passage is about biodiesel.

- Petroleum diesel is made from crude oil.
- Biodiesel is made from a variety of vegetable oils, eg soybean, palm and rapeseed.
- Biodiesel can be used in diesel cars without modification to the engine.

The use of biodiesel will reduce a country's dependency on crude oil, particularly if the technology involved in the production of biodiesel is improved.

However, large areas of agricultural land will be needed to grow the crops from which to extract the vegetable oils.

Palm oil produces better yields of fuel per hectare of land than other crops. Indonesia plans to increase the amount of land used to produce palm oil by 50%. 1.8 million hectares of rainforest in Borneo would be cut down to produce the world's largest palm oil plantation.

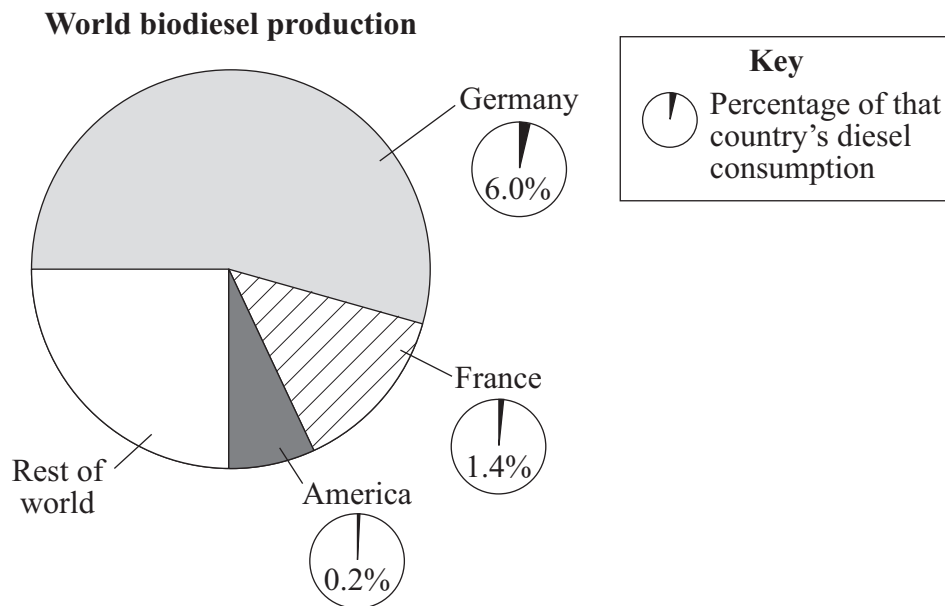
9A One reason why there is research and development into the use of biodiesel is that . . .

- 1 biodiesel does not produce any harmful waste gases when it burns.
- 2 there are large areas of unused agricultural land.
- 3 in some countries, manufacturers do not know how to make petroleum diesel.
- 4 crude oil is non-renewable.

9B On what basis can those who support the increased use of biodiesel claim that, when compared with petroleum diesel, it reduces the **net** greenhouse gas emissions?

- 1 Plants used to make biodiesel take up carbon dioxide for photosynthesis.
- 2 Biodiesel does not produce greenhouse gases when it burns.
- 3 Biodiesel produces more carbon dioxide when it burns.
- 4 Biodiesel does not produce water vapour when it burns.

- 9C The pie chart shows information on the world biodiesel production and percentage of diesel consumption in 2005.



The pie chart shows that in 2005, . . .

- 1 France used seven times more biodiesel than America.
 - 2 America produced less biodiesel than any other country in the world.
 - 3 three countries produced about 75 % of the world's biodiesel.
 - 4 Germany was the largest user of biodiesel.
- 9D Some pressure groups argue against the increased use of biodiesel.

Which of the following is **not** an argument that they could reasonably use?

- 1 It could result in the loss of some animal and plant species.
- 2 It could create food shortages in some parts of the world.
- 3 It could cause water shortages in some countries.
- 4 It could cause petroleum diesel prices to rise sharply.

END OF TEST

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