Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
November 2007

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

CHEMISTRY
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Thursday 22 November 2007 Morning Session

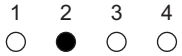
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

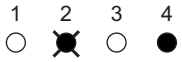
Time allowed: 30 minutes

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.

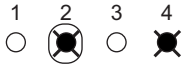
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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:



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 substances that can be found in some processed foods.

They are called food additives and each one is added to the food for a different reason.

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

A colouring

B emulsifier

C preservative

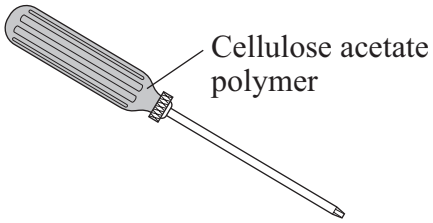
D sweetener

	Reason for using the additive in the food
1	to make water and oil stay mixed together in salad cream
2	to make soft drinks orange, red or purple
3	to stop harmful microorganisms from growing
4	to replace sugar in diet drinks

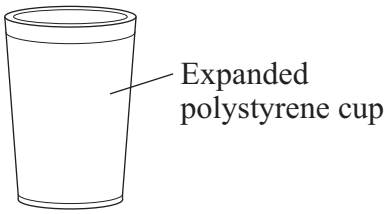
QUESTION TWO

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

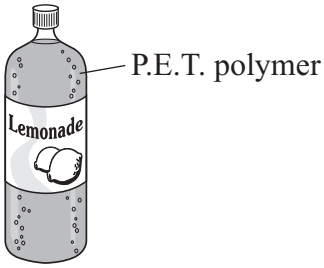
The drawings show four different objects. Each is made using a different polymer.



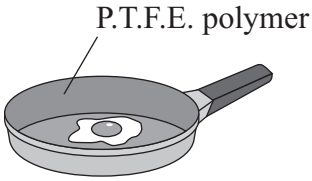
A Screwdriver



B Disposable coffee cup



C Bottle for soft drinks



D Frying pan

The table below shows some properties of four different polymers.

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

	Properties of the polymer
1	It forms a non-stick surface that can be strongly heated.
2	It is strong but light, transparent and can be recycled.
3	It is strong, rigid and a good electrical insulator.
4	It is a good heat insulator, very light and cheap to make.

QUESTION THREE

This question is about four vegetable oils.

The table shows the fat content, melting point and cetane number of each oil.
A high cetane number indicates that the oil is easily set alight.

Vegetable oil		Fat content %			
		Saturated fat	**Unsaturated fat**	**Melting point (°C)**	**Cetane number**
A	Olive	11	89	–12	52
B	Palm	52	48	35	65
C	Rapeseed	12	88	5	45
D	Sunflower	14	86	–18	60

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

	What we can say about the vegetable oil
1	It has the lowest melting point.
2	It is the most difficult to set alight.
3	It contains the highest percentage of unsaturated fat.
4	It is solid at room temperature (20 °C).

QUESTION FOUR

This question is about gases in the Earth's atmosphere.

In the Earth's early atmosphere	In the Earth's atmosphere today
Carbon dioxide	Nitrogen
Small amounts of: ammonia, NH_3 methane, CH_4	Oxygen
	Small amounts of: carbon dioxide noble gases
Water vapour	Water vapour

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

A ammonia

B helium

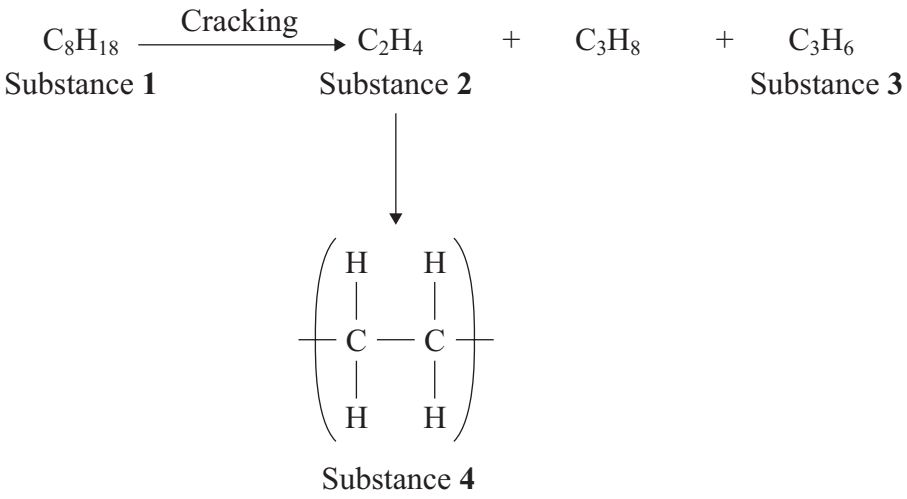
C methane

D oxygen

	What we can say about the gas
1	It is a hydrocarbon.
2	It is a noble gas.
3	It is a compound of nitrogen and hydrogen.
4	It is produced in the atmosphere by the activity of plants.

QUESTION FIVE

The flow diagram shows an example of cracking and how one of the products is used.



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

A alkene with the smallest molecules

B alkene with the largest molecules

C alkane

D polymer

QUESTION SIX

This question is about the manufacture of margarine spreads from sunflower oil.

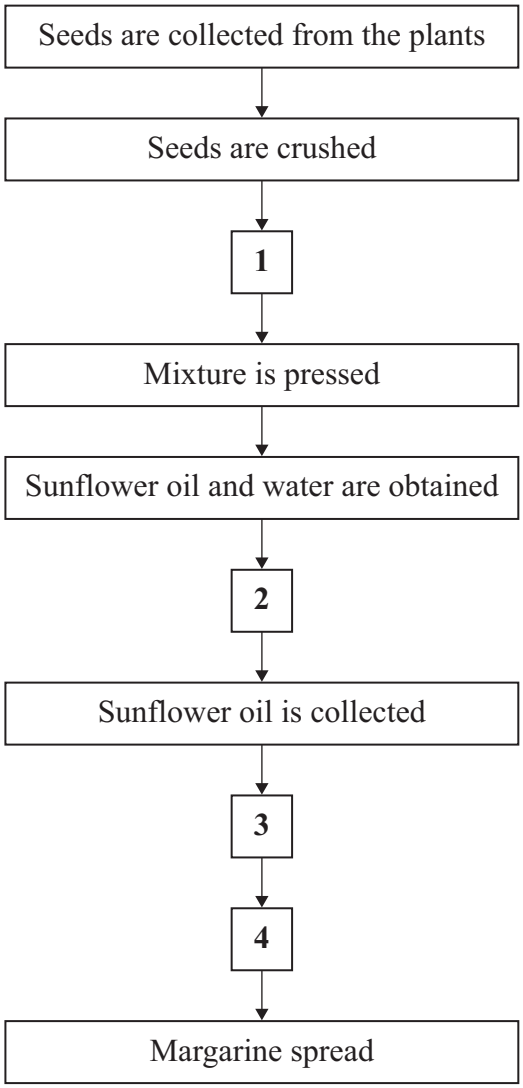
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Oil hardens and additives are mixed in.

B Sunflower oil separates from the water.

C Water is added and the mixture is stirred.

D Sunflower oil is reacted with hydrogen.



SECTION TWO

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

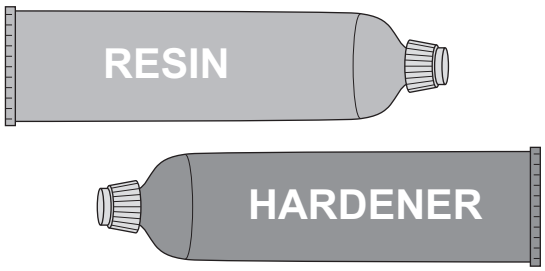
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

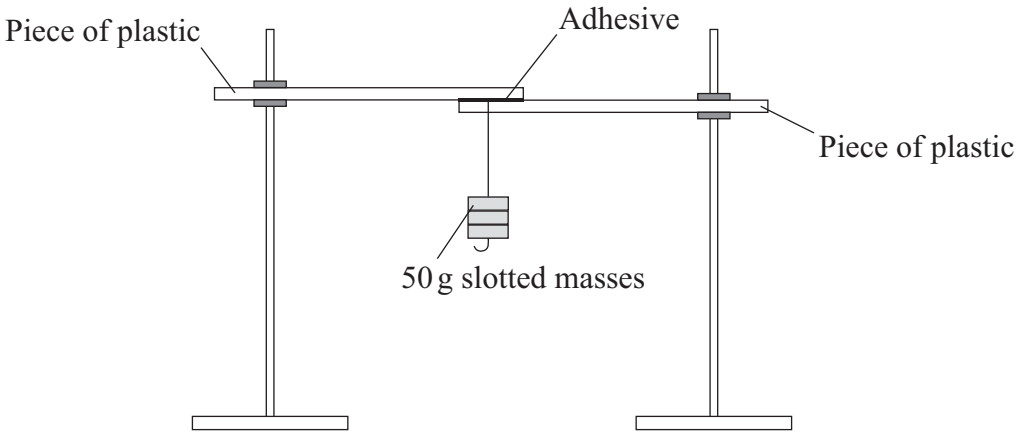
QUESTION SEVEN

Epoxy adhesives come in two separate tubes.



When the resin and hardener are mixed, a chemical reaction occurs and molecules of the resin join up to form a plastic. This plastic, when hard, glues the two surfaces together.

- A student designed an experiment to investigate the strength of an epoxy adhesive by gluing two pieces of plastic together.
- The student followed the instructions for use of the adhesive carefully, then clamped the pieces of plastic together with the same force but for different lengths of time.
- The student added 50 g masses, one after another, until the joint broke.



Time for which the plastic pieces were clamped, in minutes	1	2	3	4	5	6	7	8	9	10
Mass added when the joint broke, in grams	50	50	50	50	100	150	200	200	200	200

7A In this experiment, the student is trying to find out how the strength of the adhesive is affected by . . .

1 the amounts of resin and hardener used in the mixture.

2 the temperature of the mixture.

3 the size of the plastic pieces used.

4 the time the adhesive is left to harden.

7B Which row in the table shows the independent and dependent variables in this experiment?

	Independent variable	**Dependent variable**
1	the temperature of the room	the size of the plastic pieces used
2	the time for which the plastic pieces were clamped	the mass added when the joint broke
3	the force with which the plastic pieces were clamped	the size of the plastic pieces used
4	the time taken for the joint to break	the mass of the plastic pieces

7C After how long does the adhesive reach maximum strength?

1 4 minutes

2 6 minutes

3 7 minutes

4 10 minutes

7D One way in which the student could get more precise results would be to . . .

1 use more adhesive.

2 use masses smaller than 50 grams.

3 use a stronger clamp.

4 use pieces of wood instead of plastic.

QUESTION EIGHT

Plastic waste in the United Kingdom has reached 3 million tonnes per year.
About 56% of this waste is from packaging.
60% of the litter on United Kingdom beaches is plastic.
Under European law, at least 55% of packaging must be recycled by 2008.

Most plastic waste does not break down at all.
Three improved types of plastic used for bags and packaging are:

- degradable – breaks down over a long period of time, but only into smaller pieces
- biodegradable – undergoes decomposition by microorganisms; produces some solid waste which may be toxic
- compostable – biodegrades and disintegrates in a compost-making system at home; produces no toxic waste

8A One reason that plastics are often used for bags and packaging is that they are cheap to produce.

Which of these properties of plastics is the **least** important when they are used for making waste-bin liners?

1 lightweight

2 resist wear and tear

3 resist chemicals and water

4 transparent

8B Which of these is **not** an advantage of recycling plastics?

1 conservation of non-renewable fuels

2 reduced energy consumption

3 less waste to landfill

4 reduced use of plastic bags

8C A supermarket chain has introduced compostable food containers. Which of the following may **not** happen because of the increased use of compost-making systems at home?

1 It will save council transport and labour costs.

2 It will save space in landfill sites.

3 It will reduce costs to supermarkets.

4 It will help to conserve non-renewable fuels.

8D Some supermarkets are using more environmentally-friendly packaging.

The most likely commercial reason for this is that the supermarkets are concerned about . . .

1 decreasing the amount of litter.

2 the damaging effects of acid rain.

3 the increasing cost of plastics.

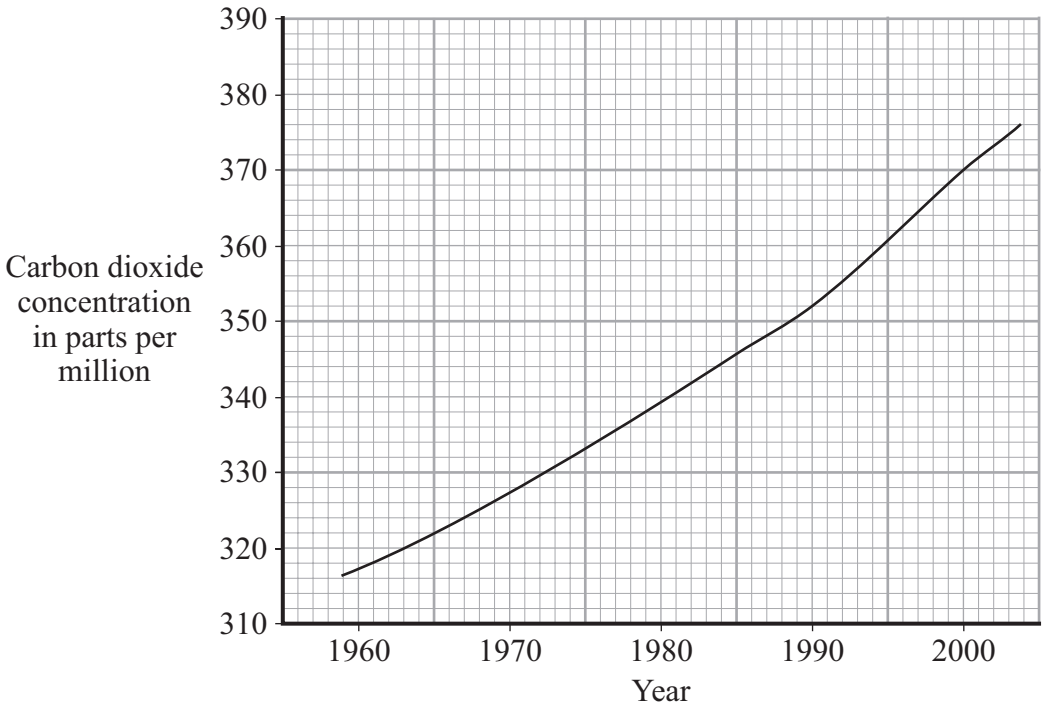
4 attracting more customers.

Turn over for the next question

QUESTION NINE

Measurements of carbon dioxide in the atmosphere have been made continuously for almost 50 years at the Mauna Loa Observatory, 4000 metres up a mountain in Hawaii.
This site is far enough away from any large carbon dioxide source to be a reliable measuring point.

Atmospheric carbon dioxide levels measured at Mauna Loa, Hawaii



9A What is the mean (average) rate of increase per year of carbon dioxide (in parts per million) in the atmosphere at Mauna Loa between 1990 and 2000?

1 1.8

2 18.0

3 352.0

4 370.0

9B The change in carbon dioxide concentration over the past 50 years is thought to be a result of . . .

1 increased volcanic activity.

2 an increase in the use of fossil fuels.

3 variations in the Sun's energy output.

4 an increase in ocean temperatures.

9C Many scientists think that there is a close link between atmospheric carbon dioxide levels and global warming.
Some political leaders have taken no action to reduce carbon dioxide emissions.

One possible reason is that . . .

1 restrictions on industrial development might result.

2 their countries have few oil reserves.

3 they do not think that scientists are qualified to make important judgements.

4 they do not think that global warming will affect their country.

9D Concerns about carbon dioxide levels and global warming have increased research and technical development in some areas.

Which of these has **not** been part of this development?

1 the use of ethanol as a fuel in cars

2 the use of diesel oil instead of petrol in cars

3 the use of vegetable oils as a fuel in cars

4 the development of electric cars

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 manufacture of margarine spreads from sunflower oil.

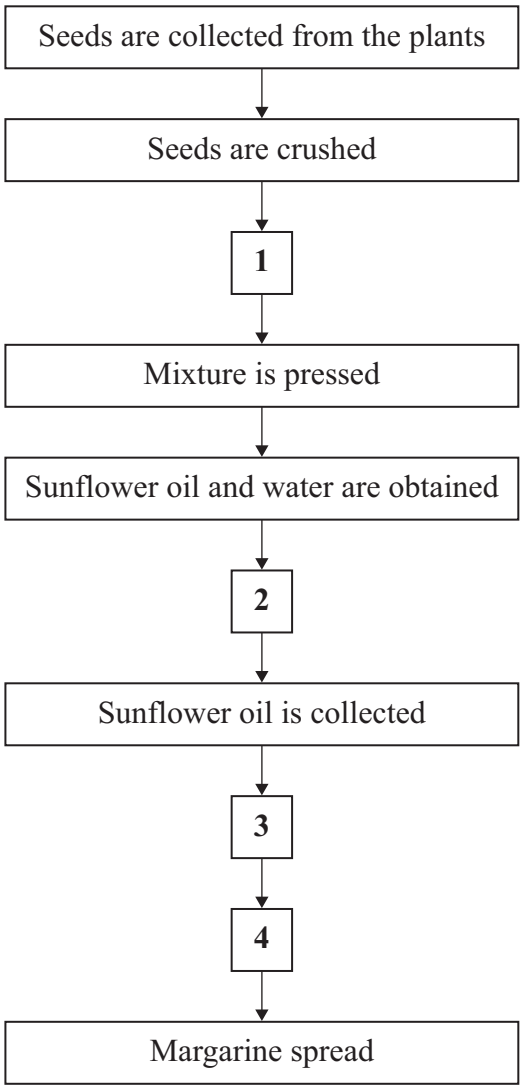
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart on the opposite page.

A Oil hardens and additives are mixed in.

B Sunflower oil separates from the water.

C Water is added and the mixture is stirred.

D Sunflower oil is reacted with hydrogen.

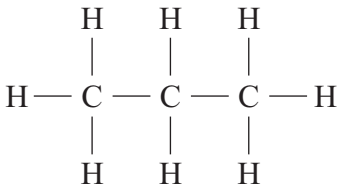


Turn over for the next question

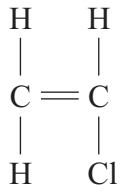
QUESTION TWO

This question is about the formulae of four organic compounds.

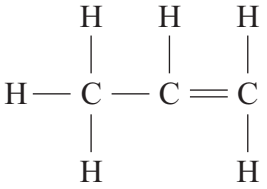
Match the formulae, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.



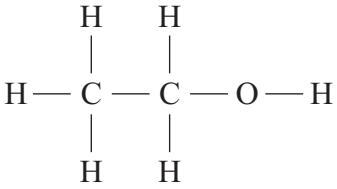
A



B



C



D

	What we can say about the organic compound
1	It is a saturated hydrocarbon useful as a fuel.
2	It is a monomer from which the polymer, polyvinylchloride, can be made.
3	It is the formula for ethanol.
4	It belongs to a group of hydrocarbons with the general formula C_nH_{2n}

Turn over for the next question

SECTION TWO

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

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

Plastic waste in the United Kingdom has reached 3 million tonnes per year.
About 56% of this waste is from packaging.
60% of the litter on United Kingdom beaches is plastic.
Under European law, at least 55% of packaging must be recycled by 2008.

Most plastic waste does not break down at all.
Three improved types of plastic used for bags and packaging are:

- degradable – breaks down over a long period of time, but only into smaller pieces
- biodegradable – undergoes decomposition by microorganisms; produces some solid waste which may be toxic
- compostable – biodegrades and disintegrates in a compost-making system at home; produces no toxic waste

3A One reason that plastics are often used for bags and packaging is that they are cheap to produce.

Which of these properties of plastics is the **least** important when they are used for making waste-bin liners?

1 lightweight

2 resist wear and tear

3 resist chemicals and water

4 transparent

3B Which of these is **not** an advantage of recycling plastics?

1 conservation of non-renewable fuels

2 reduced energy consumption

3 less waste to landfill

4 reduced use of plastic bags

3C A supermarket chain has introduced compostable food containers. Which of the following may **not** happen because of the increased use of compost-making systems at home?

1 It will save council transport and labour costs.

2 It will save space in landfill sites.

3 It will reduce costs to supermarkets.

4 It will help to conserve non-renewable fuels.

3D Some supermarkets are using more environmentally-friendly packaging.

The most likely commercial reason for this is that the supermarkets are concerned about . . .

1 decreasing the amount of litter.

2 the damaging effects of acid rain.

3 the increasing cost of plastics.

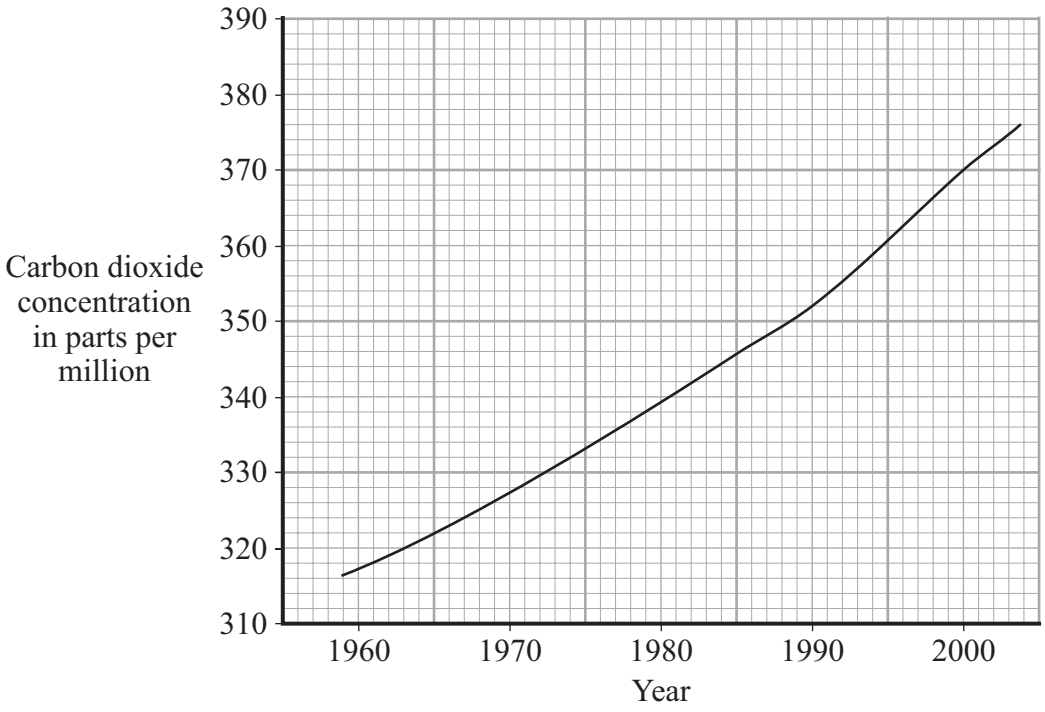
4 attracting more customers.

Turn over for the next question

QUESTION FOUR

Measurements of carbon dioxide in the atmosphere have been made continuously for almost 50 years at the Mauna Loa Observatory, 4000 metres up a mountain in Hawaii.
This site is far enough away from any large carbon dioxide source to be a reliable measuring point.

Atmospheric carbon dioxide levels measured at Mauna Loa, Hawaii



4A What is the mean (average) rate of increase per year of carbon dioxide (in parts per million) in the atmosphere at Mauna Loa between 1990 and 2000?

1 1.8

2 18.0

3 352.0

4 370.0

4B The change in carbon dioxide concentration over the past 50 years is thought to be a result of . . .

1 increased volcanic activity.

2 an increase in the use of fossil fuels.

3 variations in the Sun's energy output.

4 an increase in ocean temperatures.

4C Many scientists think that there is a close link between atmospheric carbon dioxide levels and global warming.
Some political leaders have taken no action to reduce carbon dioxide emissions.

One possible reason is that . . .

1 restrictions on industrial development might result.

2 their countries have few oil reserves.

3 they do not think that scientists are qualified to make important judgements.

4 they do not think that global warming will affect their country.

4D Concerns about carbon dioxide levels and global warming have increased research and technical development in some areas.

Which of these has **not** been part of this development?

1 the use of ethanol as a fuel in cars

2 the use of diesel oil instead of petrol in cars

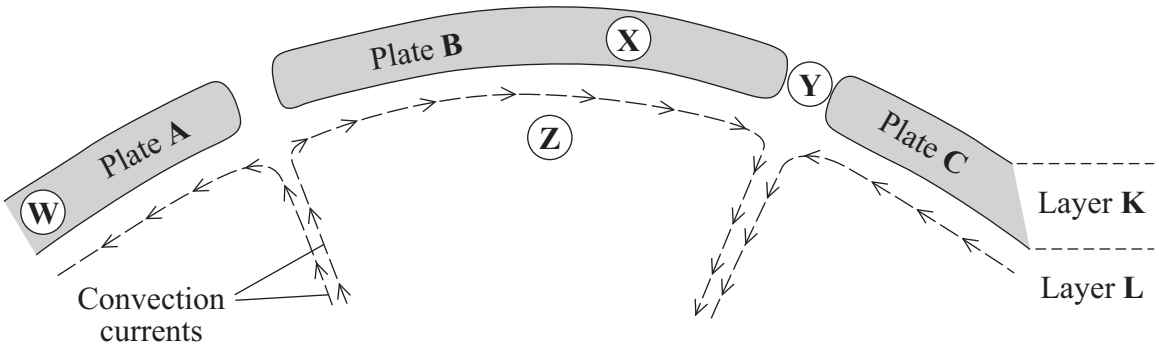
3 the use of vegetable oils as a fuel in cars

4 the development of electric cars

Turn over for the next question

QUESTION FIVE

The diagram represents the area near to the Earth's surface.



5A Which row in the table correctly names the layers **K** and **L**?

	K	**L**
1	crust	middle mantle
2	crust and upper mantle	core
3	crust	core
4	crust and upper mantle	middle mantle

5B Which plates are moving towards each other?

1 plates **A** and **B**

2 plates **B** and **C**

3 plates **A** and **C**

4 all the plates are separating

5C In which area, **W**, **X**, **Y** or **Z**, in the diagram would you expect earthquakes to occur?

1 area **W**

2 area **X**

3 area **Y**

4 area **Z**

5D There are volcanic islands in several parts of the mid-Atlantic Ocean.

They have probably formed here because . . .

1 this is a boundary between tectonic plates.

2 the ocean is shallow.

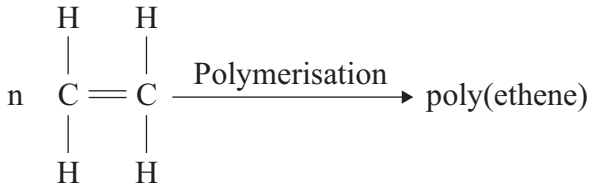
3 the Earth's crust is thin.

4 drilling for oil is taking place in this region.

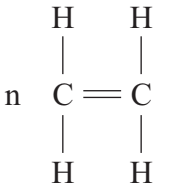
Turn over for the next question

QUESTION SIX

The equation shows how poly(ethene) is made.



6A



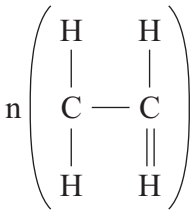
1 one molecule of poly(ethene).

2 one molecule of ethene.

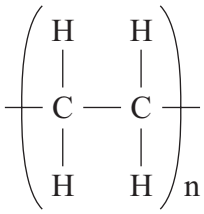
3 two molecules of ethene.

4 many molecules of ethene.

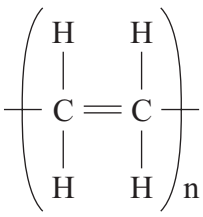
6B The formula for poly(ethene) is . . .



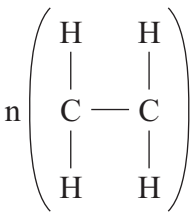
1



2



3



4

6C Which row in the table correctly shows the differences between the monomer molecules and the polymer molecule formed from them in this reaction?

	Monomer molecule	**Polymer molecule**
1	small, saturated	large, unsaturated
2	large, saturated	small, saturated
3	small, unsaturated	large, saturated
4	large, unsaturated	small, unsaturated

6D Poly(ethene) is not used to make plastic kettles because . . .

1 it is a thermosetting polymer.

2 it is too heavy.

3 it is opaque.

4 it is a thermosoftening polymer.

Turn over for the next question

QUESTION SEVEN

Palm oil and sunflower oil are vegetable oils.

The iodine number of an oil indicates its level of unsaturation.
The higher the iodine number, the more unsaturated the oil.

	Iodine number
Palm oil	54
Sunflower oil	125

7A Sunflower oil is more unsaturated than palm oil. This results in . . .

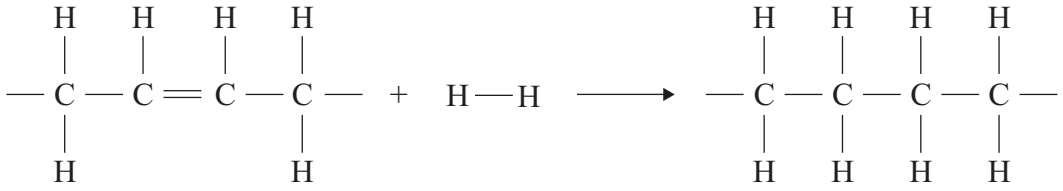
1 sunflower oil being thicker than palm oil at the same temperature.

2 palm oil not reacting with bromine water.

3 1 cm^3 of sunflower oil decolourising a larger volume of bromine water than 1 cm^3 of palm oil.

4 1 cm^3 of palm oil decolourising a larger volume of bromine water than 1 cm^3 of sunflower oil.

Sunflower oil reacts with hydrogen in the following way.



Part of the sunflower oil molecule

7B What is the process shown in this reaction?

1 cracking

2 hydrogenation

3 polymerisation

4 saturation

7C This reaction is usually carried out . . .

1 at high temperature and pressure.

2 with a nickel catalyst at about 60 °C.

3 by mixing with an emulsifier.

4 by cooling the oil to –5 °C.

7D When compared with the sunflower oil, the product of this reaction . . .

1 is harder.

2 has a lower melting point.

3 is softer.

4 is more unsaturated.

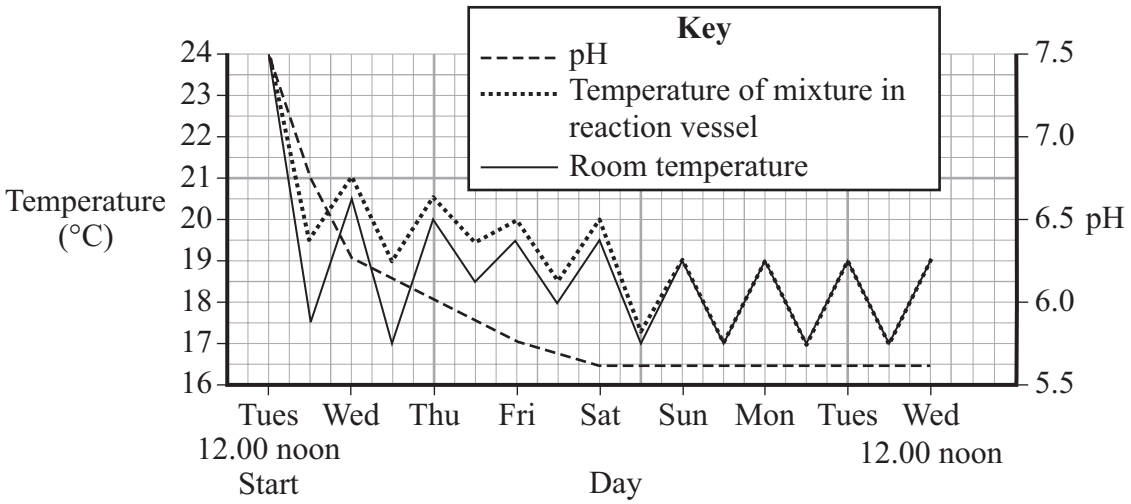
Turn over for the next question

QUESTION EIGHT

Ethanol can be made by the action of yeast on a solution of sugar. This is called fermentation. The sugar is converted to ethanol and carbon dioxide. Carbon dioxide is a slightly acid gas. During fermentation, some of the energy is transferred as thermal energy.

A sugar solution and yeast were put into a reaction vessel.
The temperature of the mixture, the pH of the mixture and the room temperature were recorded over an eight-day period.

The results are shown on the graph.



8A There is a larger difference between the temperature of the mixture and the room temperature during the first few days than there is later.

The probable reason is that . . .

1 fermentation is quicker at the start.

2 the room temperature is steadily decreasing.

3 the pH value of the mixture is decreasing.

4 the room temperature fluctuates.

8B From the information on the graph, . . .

1 fermentation is completed after 4 days.

2 fermentation is completed after 5 days.

3 fermentation is completed after 6 days.

4 fermentation continues after 8 days.

8C A general conclusion from the graph is that . . .

1 the yeast cannot survive for more than 8 days.

2 the acidity of the mixture increases in the first 4 days.

3 the acidity of the mixture is greater at the start than when fermentation is completed.

4 the temperature of the mixture does not fall below 18.0 °C.

8D One advantage of producing ethanol by fermentation rather than from ethene is that . . .

1 less carbon dioxide is produced in fermentation.

2 there are no waste products.

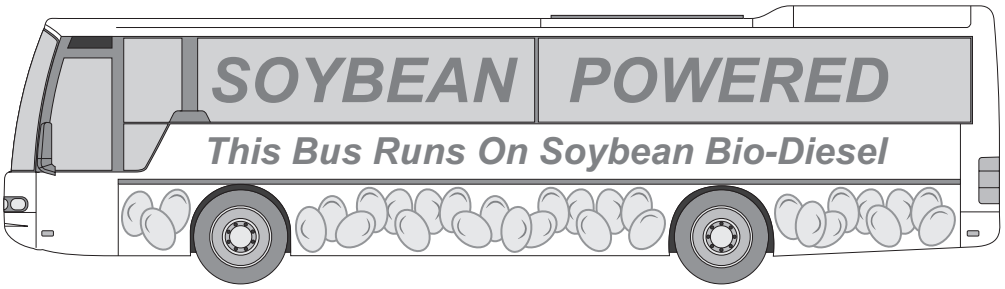
3 the raw materials are renewable.

4 the ethanol does not need further processing.

Turn over for the next question

QUESTION NINE

Petroleum diesel fuel is made from crude oil.
Biodiesel fuel is made from vegetable oils. In America, soybean and rapeseed oil are used.



Biodiesel biodegrades in about a quarter of the time required for petroleum diesel to do so.
Biodiesel, when burned, emits more acidic nitrogen oxides but fewer particulates than petroleum diesel.

Three types of fuel containing biodiesel are available in America:

- B100 (100% biodiesel)
- B20 (20% biodiesel)
- B2 (2% biodiesel).

In a diesel engine, the fuel flows from the fuel tank, along fuel pipes, to the combustion chamber where it is ignited by glow plugs.
There are some operating problems with B100. Biodiesel is much thicker than petroleum diesel and is more difficult to ignite (has a lower cetane number than petroleum diesel). In most engines, the biodiesel needs to be pre-heated.
Biodiesel also has a higher melting point than petroleum diesel and so, in winter, can solidify in pipes and filters.
Using B20 gives few problems, and little or no modification to engines is required.

9A The availability of B2 and B20 may persuade motorists to use biodiesel instead of petroleum diesel.

This could be important because . . .

1 crude oil is non-renewable.

2 biodiesel emissions are less likely to cause acid rain.

3 B100 does not ignite as easily as petroleum diesel.

4 biodiesel does not produce any waste gases when it burns.

9B Ideally, the vegetable oil used for biodiesel should have all these properties **except** . . .

1 a low viscosity.

2 a high melting point.

3 a high cetane number.

4 a good flow rate.

9C Why are **net** carbon dioxide emissions lower for biodiesel than for petroleum diesel?

1 The carbon dioxide is reused to make fossil fuels.

2 Some vegetable oils produce very little carbon dioxide when they burn.

3 The carbon dioxide is recycled as it is used by plants for photosynthesis.

4 The carbon dioxide formed from burning biodiesel is very soluble in water.

9D Spills of fuels from oil tankers cause considerable damage to the marine environment. Spills of biodiesel could be less harmful than those of petroleum diesel.

This is because biodiesel . . .

1 will float more easily on the water.

2 could be burned more easily on the surface of the water.

3 would not spread over the water as easily.

4 would break down into less harmful substances more quickly.

END OF TEST

There are no questions printed on this page