

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2012

Science A

Unit Chemistry C1b (Oils, Earth and Atmosphere)

Chemistry

Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHY1BP
F&H

Tuesday 6 November 2012 Afternoon 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
○ ● ○ ○

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 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**.

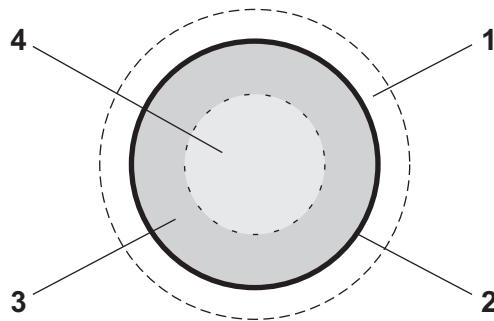
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows the layered structure of the Earth.

The outer dotted line marks a layer above the Earth's surface.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

- A** Atmosphere
- B** Core
- C** Crust
- D** Mantle

QUESTION TWO

This question is about four cooking oils.

	Type of cooking oil	Saturated fat %	Unsaturated fat %		Melting point in °C	Energy from 100 g of the oil in kJ
			mono	poly		
A	Corn	13	25	62	-15	3700
B	Olive	11	69	20	-12	3378
C	Rapeseed	12	24	64	5	3696
D	Sunflower	14	19	67	-18	3690

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

1	It has the highest percentage of saturated fat.
2	It has the highest percentage of unsaturated fat.
3	It releases the most energy from 100 g of the oil.
4	It would be the first to turn solid if the oils were cooled from 20 °C.

Turn over for the next question

Turn over ►

QUESTION THREE

This question is about hydrocarbons.

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

A alkanes

B fuels

C monomers

D polymers

Hydrocarbons are cracked to produce smaller molecules.

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

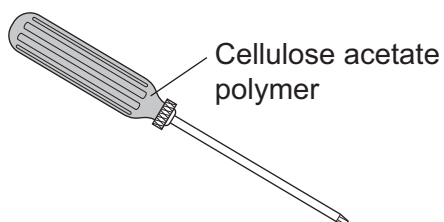
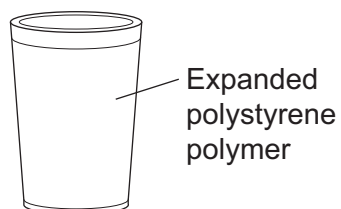
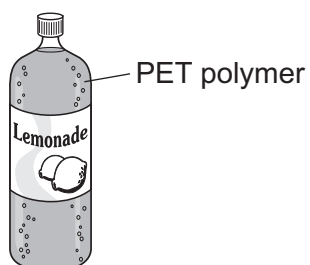
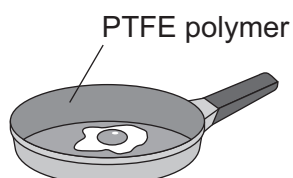
The products of cracking include alkenes and saturated hydrocarbons called . . . **2**

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

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

QUESTION FOUR

The drawings show four different objects. Each object 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, lightweight, transparent and can be recycled.
3	It is strong, rigid and a good electrical insulator.
4	It is a good heat insulator and has a very low density.

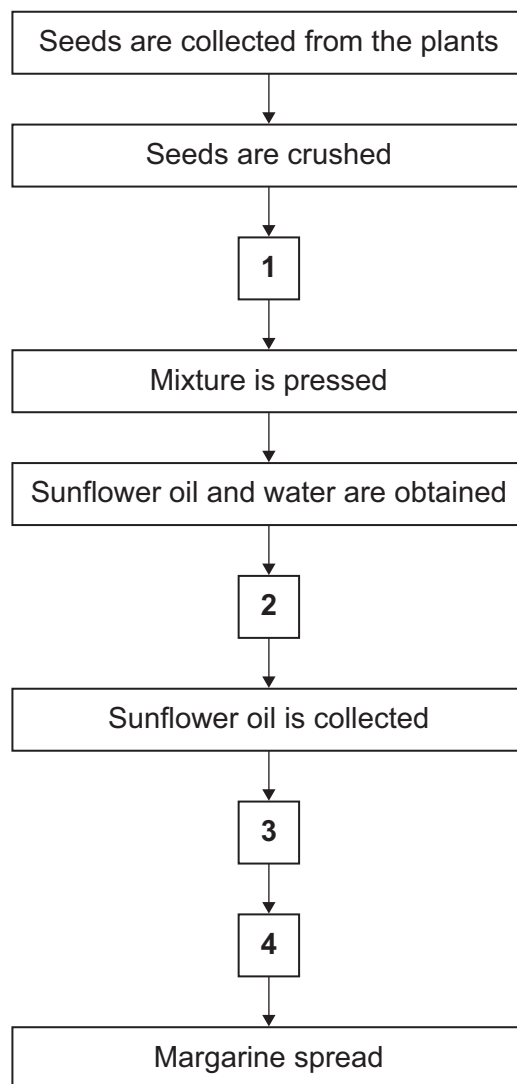
Turn over ►

QUESTION FIVE

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.



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.

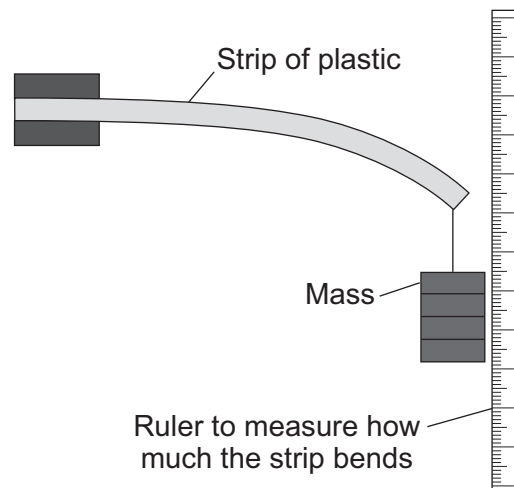
Mark your choices on the answer sheet.

QUESTION SIX

A student used the apparatus shown in the diagram to measure the flexibility of a strip of plastic. The strip of plastic was 5 mm thick.

The student did the test again using the same piece of plastic and recorded the results of both tests.

He did identical tests using three more strips of the same plastic but each with a different thickness. All four strips were the same length.



The results are shown in the table.

Thickness of the plastic strip in mm	How much the plastic strip bends downwards in mm	
	Test 1	Test 2
5	27	25
10	18	20
15	12	8
20	8	7

-
- 6A** The plastic strip giving the most unreliable results is the one with a thickness of . . .
- 1 5 mm.
 - 2 10 mm.
 - 3 15 mm.
 - 4 20 mm.
- 6B** Which one of the following is controlled to make sure the investigation is a fair test?
- 1 the mass added
 - 2 the thickness of the plastic strip
 - 3 the width of the ruler
 - 4 the distance the plastic strip bends
- 6C** To improve the reliability of the results, you can . . .
- 1 use different lengths of plastic strip.
 - 2 use plastic strips with a wider range of thicknesses.
 - 3 ask another student to repeat the tests.
 - 4 do the tests at a higher temperature.
- 6D** Which one of the following correctly describes the relationship in the results?
- 1 As the thickness increases, the flexibility decreases.
 - 2 The thickness does **not** affect the flexibility.
 - 3 The flexibility is proportional to the mass added.
 - 4 The longer the plastic strip, the less it bends.

Turn over for the next question

Turn over ►

QUESTION SEVEN

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

Type of fat	Butter	Activo
Total fat of which . . .	81.0g	80.0g
saturates	51.2g	26.3g
monounsaturates	27.5g	18.8g
polyunsaturates	2.3g	34.9g

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% is a result of 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.

7A The manufacturing company claims that Activo is healthier than butter.

This claim may not be valid 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 not sure which fats Activo contains.

7B From the information provided, it can be concluded that . . .

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

7C 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 fats.

7D Designing surveys to compare the effects of butter and Activo in causing heart disease is difficult because . . .

- 1 both butter and Activo 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

Turn over ►

QUESTION EIGHT

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

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

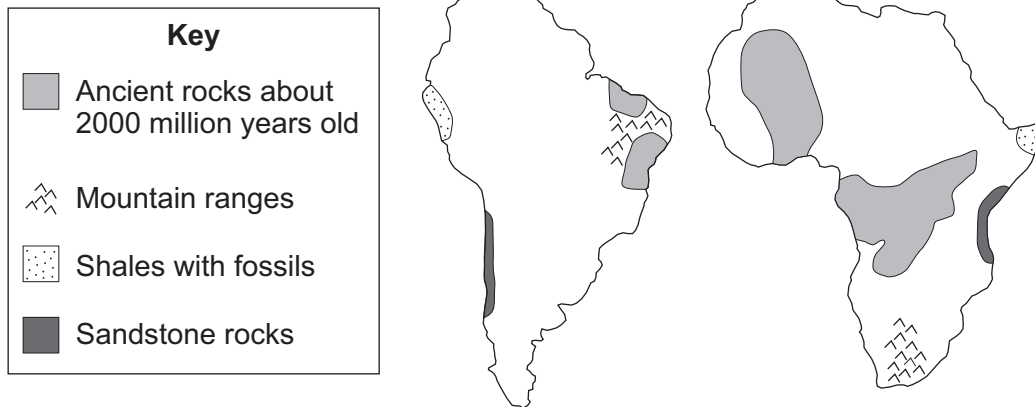
He suggested that the super continent split up and that the separate continents drifted away from each other.



8A One piece of evidence that Wegener used was that some continents . . .

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

- 8B** When Wegener studied the African and South American continents, he found other evidence that these continents had been joined in the past.



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

- 1 ancient rocks in matching positions.
 - 2 similar patterns of fossils.
 - 3 similar patterns of mountain ranges.
 - 4 similar sandstone rocks.
- 8C** In the early part of the 20th century, many scientists did not accept Wegener's theory because . . .
- 1 the continents did not have all the same animals.
 - 2 the continents did not have all the same plants.
 - 3 there was no explanation how continents could move.
 - 4 the Earth's crust stayed the same.
- 8D** About 50 years after Wegener put forward his theory, scientists began to accept his ideas.

This was because of evidence that . . .

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

Turn over ►

QUESTION NINE

In Britain, we drink about 2 billion litres of bottled water per year.

Use the following information to answer the questions.

Manufacturing the bottles

Many of the bottles are made from a plastic called PET. PET takes about 450 years to biodegrade. PET is made from substances obtained from crude oil.

Getting bottled water to our homes

About 25% of the bottled water is imported. Lorries that deliver bottled water travel up to 2000 km.

The used empty bottles

About 4.5% of household waste is plastic bottles, of which 10% is PET water bottles. The majority of this ends up in landfill sites or is burned.

9A One problem the information suggests is that the substances used to make PET . . .

- 1 are obtained from a non-renewable raw material.
- 2 are obtained from a renewable raw material.
- 3 are dangerous to use.
- 4 are too expensive.

9B What percentage of household waste is made up of PET water bottles?

- 1 0.045%
- 2 0.45%
- 3 14.5%
- 4 45.0%

9C An important reason for **not** putting PET bottles in landfill sites is that . . .

- 1 landfill sites are only used for glass bottles.
- 2 PET biodegrades very slowly.
- 3 PET has a low density and is blown over the countryside.
- 4 PET kills wildlife.

- 9D** An environmental problem with importing bottled water by road is that . . .
- 1** it increases the amount of carbon dioxide in the atmosphere.
 - 2** it increases the amount of oxygen in the atmosphere.
 - 3** it takes a long time for the water to get to British households.
 - 4** water from European countries is of poor quality.

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**.

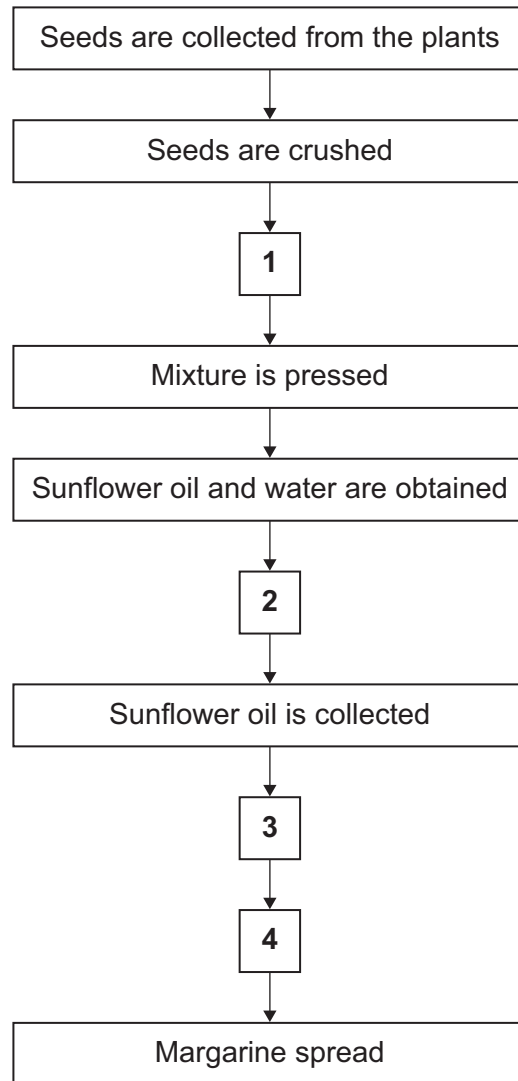
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QUESTION ONE

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.

- A** Oil hardens and additives are mixed in.
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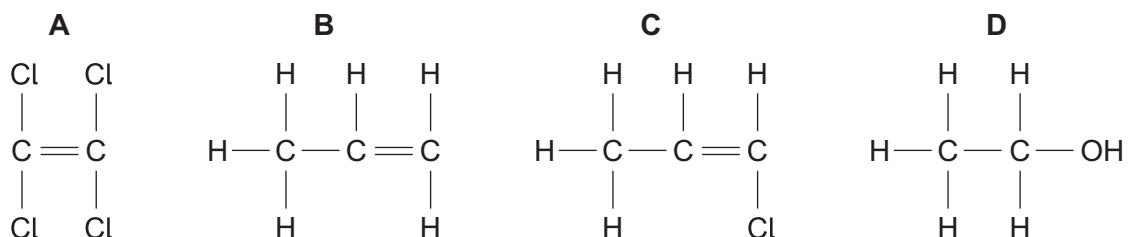
Turn over for the next question

Turn over ►

QUESTION TWO

Some plastic waste was taken to a recycling centre. At the recycling centre, the plastic was sorted and treated chemically. The chemical treatment broke down the plastic.

Breaking down the plastic produced new substances. The formulae for some of the substances produced are shown below.



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

1	It is a hydrocarbon.
2	It could be made from propene, C ₃ H ₆
3	It is made when ethene reacts with steam, H ₂ O
4	It would not produce water vapour if burnt in air.

Turn over for the next question

Turn over ►

Section TwoQuestions **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

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

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

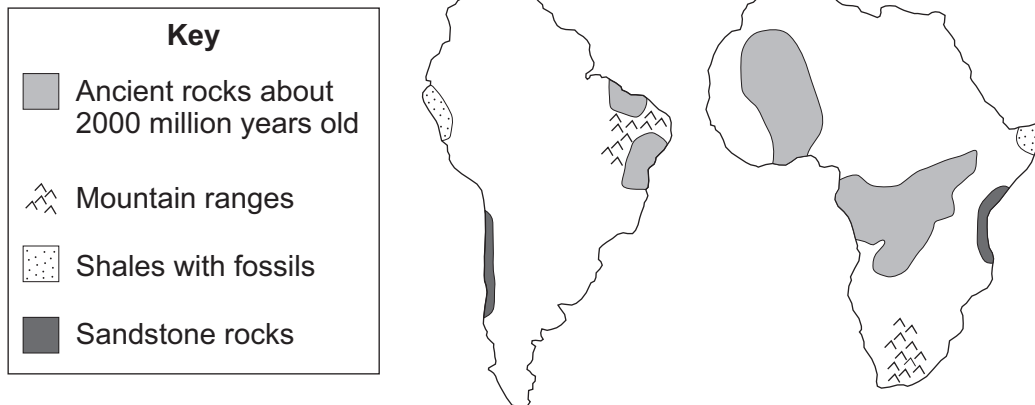
He suggested that the super continent split up and that the separate continents drifted away from each other.



3A One piece of evidence that Wegener used was that some continents . . .

- 1 have similar shapes.
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- 3 have coastlines that fit quite closely together.
- 4 have similar vegetation.

- 3B** When Wegener studied the African and South American continents, he found other evidence that these continents had been joined in the past.



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

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 - 2 similar patterns of fossils.
 - 3 similar patterns of mountain ranges.
 - 4 similar sandstone rocks.
- 3C** In the early part of the 20th century, many scientists did not accept Wegener's theory because . . .
- 1 the continents did not have all the same animals.
 - 2 the continents did not have all the same plants.
 - 3 there was no explanation how continents could move.
 - 4 the Earth's crust stayed the same.
- 3D** About 50 years after Wegener put forward his theory, scientists began to accept his ideas. This was because of evidence that . . .
- 1 the Earth's crust was shrinking.
 - 2 the Earth's crust was cooling.
 - 3 the Earth's crust was separated into tectonic plates.
 - 4 there was volcanic activity on most coastlines.

QUESTION FOUR

In Britain, we drink about 2 billion litres of bottled water per year.

Use the following information to answer the questions.

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The used empty bottles

About 4.5% of household waste is plastic bottles, of which 10% is PET water bottles. The majority of this ends up in landfill sites or is burned.

4A One problem the information suggests is that the substances used to make PET . . .

- 1 are obtained from a non-renewable raw material.
- 2 are obtained from a renewable raw material.
- 3 are dangerous to use.
- 4 are too expensive.

4B What percentage of household waste is made up of PET water bottles?

- 1 0.045%
- 2 0.45%
- 3 14.5%
- 4 45.0%

4C An important reason for **not** putting PET bottles in landfill sites is that . . .

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- 2 PET biodegrades very slowly.
- 3 PET has a low density and is blown over the countryside.
- 4 PET kills wildlife.

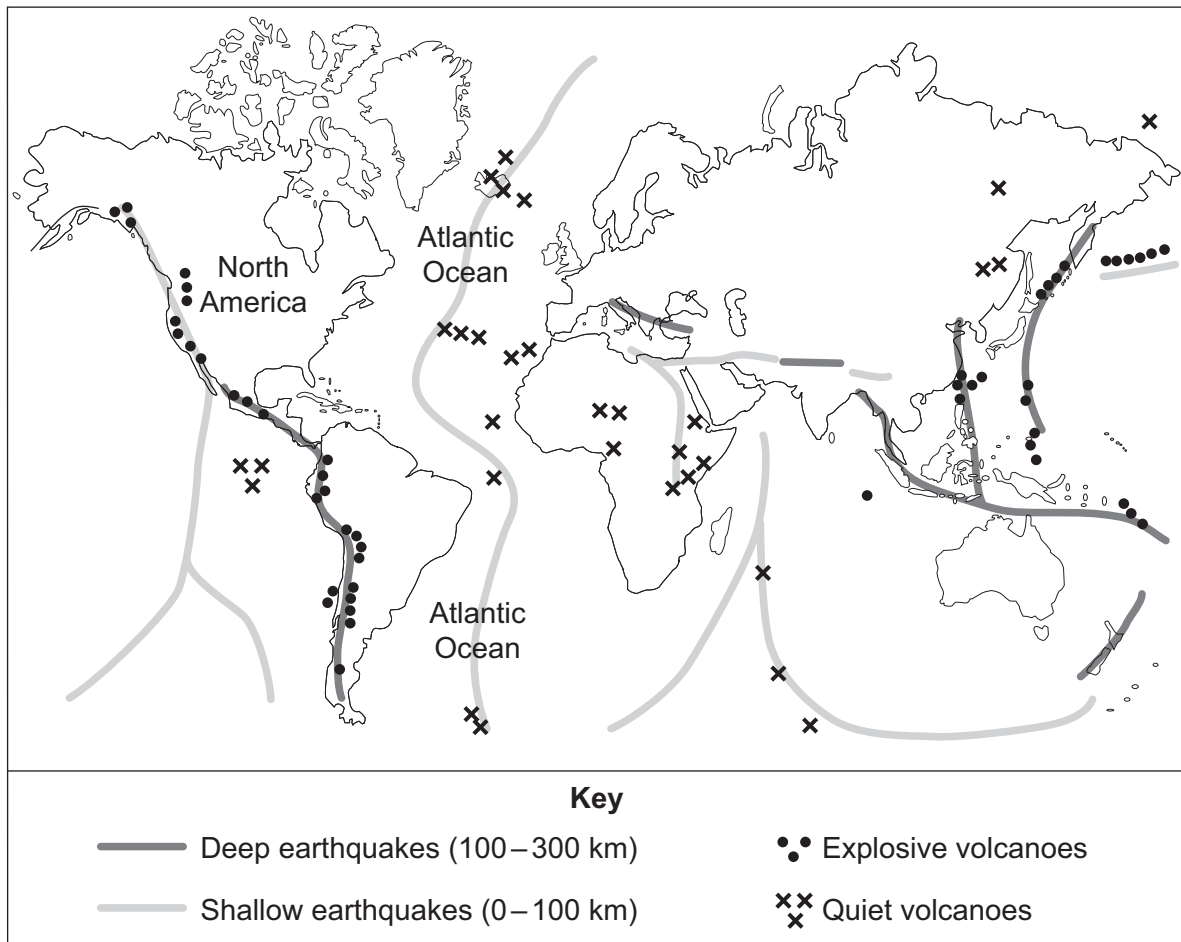
- 4D** An environmental problem with importing bottled water by road is that . . .
- 1 it increases the amount of carbon dioxide in the atmosphere.
 - 2 it increases the amount of oxygen in the atmosphere.
 - 3 it takes a long time for the water to get to British households.
 - 4 water from European countries is of poor quality.

Turn over for the next question

Turn over ►

QUESTION FIVE

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



5A 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.

5B 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.

5C 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.

5D Research has shown that magma underneath explosive volcanoes has a high water content. When this magma escapes from the Earth it explodes because all of the water turns to steam.

A high water content in magma indicates a potential explosion because when the magma escapes . . .

- 1 the temperature decreases.
- 2 the pressure decreases.
- 3 the magma is very fluid.
- 4 the magma is very dense.

Turn over for the next question

Turn over ►

QUESTION SIX

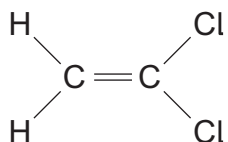
Worldwide, about 20 billion wine bottle stoppers are produced each year.

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

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

A screw-top stopper can be made of aluminium, with a polymer sealant inside. 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 needed. It is difficult to separate the polymer from the aluminium cap to allow aluminium to be recycled.

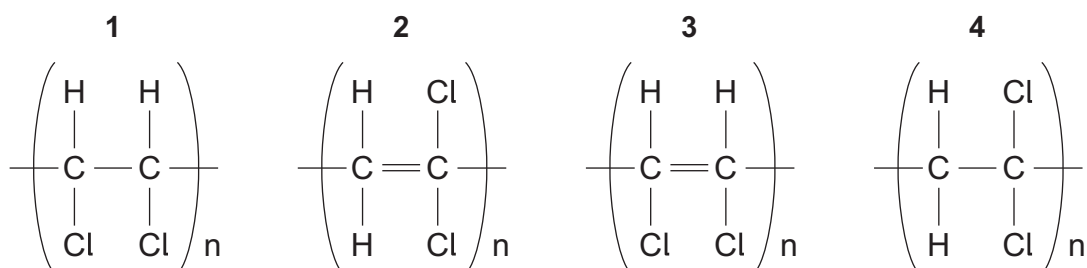
Vinylidene chloride has the structure:



6A 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.

6B The formula for poly(vinylidene chloride) is . . .



- 6C** 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?

1	increased use of crude oil	loss of jobs in Portugal
2	reduction in carbon dioxide emissions	loss of jobs in Portugal
3	reduction in carbon dioxide emissions	loss of important forest habitat
4	increased use of crude oil	reduced amount of material put in landfill

- 6D** 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?

	Issue	Impact
1	ethical	effect on the price of wine
2	social	effect on some communities
3	environmental	effect on the quality of wine
4	economic	effect on cork forest habitat

Turn over for the next question

Turn over ►

QUESTION SEVEN

Green plant cells contain many different coloured pigments.

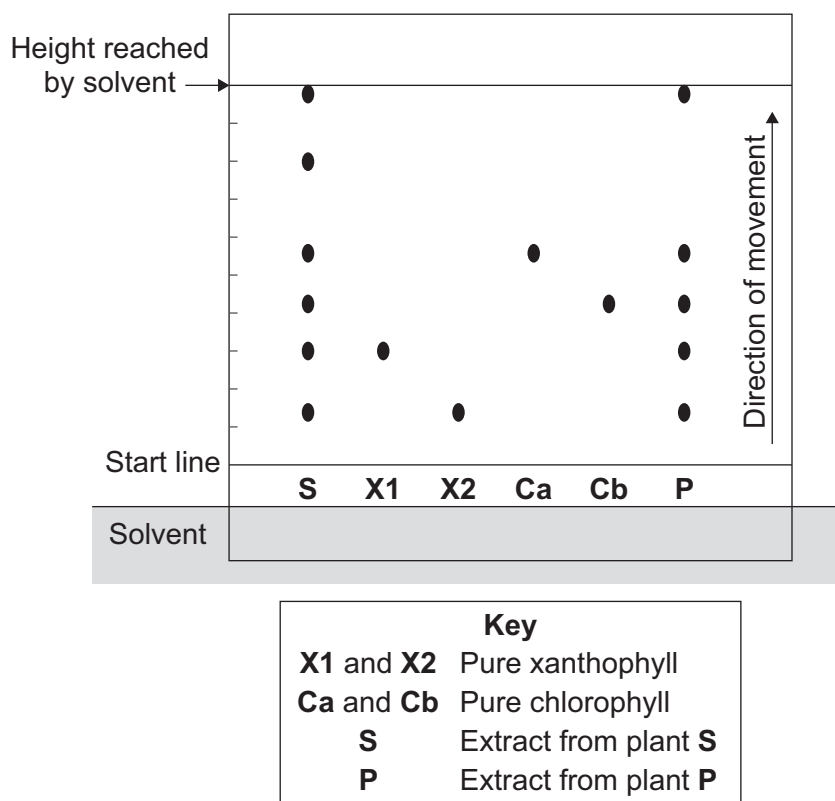
Examples are:

- two types of chlorophyll, **Ca** and **Cb**
- two types of xanthophyll, **X1** and **X2**.

The pigments can be separated by chromatography.

In an experiment, extracts from two plants, **P** and **S**, were compared with pure **Ca**, **Cb**, **X1** and **X2** using chromatography.

The diagram shows the results of the experiment.



7A From this experiment, it is possible to deduce that plant **S** contains . . .

- 1 coloured substances **not** identified by this experiment.
- 2 four coloured substances.
- 3 seven coloured substances.
- 4 the same mixture of coloured substances as plant **P**.

7B From this experiment, it is possible to deduce that plant **P** . . .

- 1 contains coloured substances that are soluble in the solvent.
- 2 contains substances that could be safely used for colouring food.
- 3 is unhealthy.
- 4 would look identical to plant **S**.

In chromatography, the R_f value = $\frac{\text{distance moved by the substance from the start line}}{\text{distance moved by the solvent from the start line}}$

7C What is the R_f value for **X1**?

- 1 0.03
- 2 0.16
- 3 0.30
- 4 3.33

7D Two other coloured substances found in plants are:

- carotene R_f value 0.98
- phaeophytin R_f value 0.80

From this information we can deduce that the leaves on plant **S** contain . . .

- 1 both carotene and phaeophytin.
- 2 carotene but **not** phaeophytin.
- 3 phaeophytin but **not** carotene.
- 4 neither carotene nor phaeophytin.

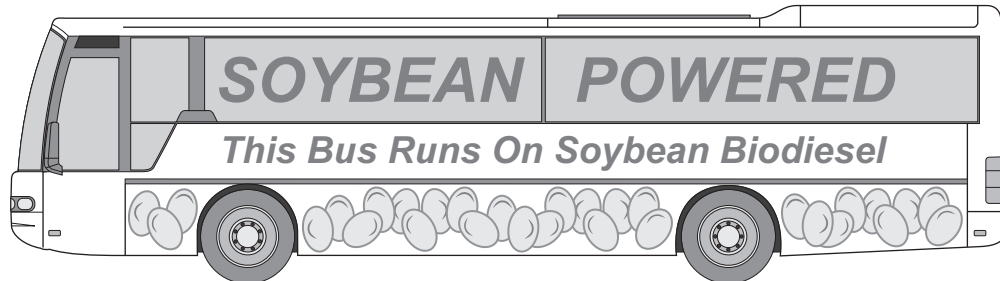
Turn over for the next question

Turn over ►

QUESTION EIGHT

Petroleum diesel fuel is made from crude oil.

Biodiesel fuel is made from vegetable oils. In America, soybean and rapeseed oils are used to make biodiesel.



Biodiesel biodegrades in about a quarter of the time needed for petroleum diesel to biodegrade. 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; 80% petroleum diesel)
- B2 (2% biodiesel; 98% petroleum diesel).

In a diesel engine, the fuel flows from the fuel tank, along fuel pipes, to the combustion chamber. In the combustion chamber, glow plugs ignite the fuel.

There are some problems using B100. Biodiesel is more viscous 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 needed.

8A The availability of B2 and B20 may persuade more motorists to use biodiesel.

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 burning biodiesel does not produce any waste gases.

- 8B** The biodiesel made from vegetable oil should have all the following properties **except** . . .
- 1 a low viscosity.
 - 2 a high melting point.
 - 3 a high cetane number.
 - 4 a good flow rate.
- 8C** 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 plants used to make biodiesel take in carbon dioxide for photosynthesis.
 - 4 The carbon dioxide produced by burning biodiesel is very soluble in water.
- 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 ►

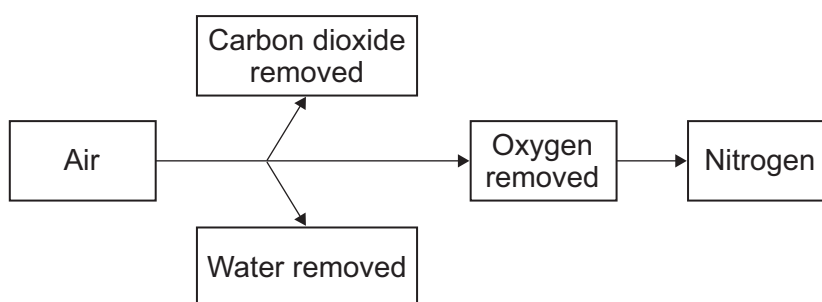
QUESTION NINE

The table below gives information about the gases in the air after the water vapour has been removed.

Gas	Melting point in °C	Boiling point in °C	Abundance in %
Nitrogen	-209	-196	78
Oxygen	-223	-183	21
Carbon dioxide	-57	-57	0.03
Helium	-272	-269	Less than 0.01
Neon	-248	-246	Less than 0.01
Argon	-189	-186	0.9
Krypton	-157	-153	Less than 0.01
Xenon	-112	-108	Less than 0.01

In 1892, scientists believed that the air consisted of three gases, nitrogen, oxygen and carbon dioxide.

Lord Rayleigh extracted nitrogen from the air.



He also collected very pure nitrogen by decomposing ammonium nitrate.

He found that there was a very small difference in the densities of the nitrogen samples from the two different sources.

- Density of nitrogen from the air = 1.2572 g per litre
- Density of nitrogen from ammonium nitrate (NH_4NO_3) = 1.2511 g per litre

- 9A** A correct conclusion from this information is that . . .
- 1 hydrogen, a gas with a very low density, is present in the nitrogen from ammonium nitrate.
 - 2 the nitrogen from the air contains a small amount of hydrogen.
 - 3 a gas that is denser than nitrogen is mixed with the nitrogen from the air.
 - 4 some carbon dioxide was given off when the ammonium nitrate was heated.

- 9B** It was several years after 1892 when the other gases in the table were identified.

This was because these other gases . . .

- 1 are colourless.
- 2 are unreactive.
- 3 have a very low density.
- 4 have very low boiling points.

The separation of gases in the air is done in several stages:

- carbon dioxide is first removed
- the air is then cooled to -200°C so it liquefies
- the liquefied air is allowed to warm up
- two main fractions, oxygen and nitrogen, are collected
- a third fraction that is mainly argon is also collected.

- 9C** The carbon dioxide is removed before the air is liquefied because . . .

- 1 it is present only in very small quantities.
- 2 it is a compound and the other gases are elements.
- 3 it would solidify during cooling and cause blockages in the pipes.
- 4 its density is very similar to the density of argon.

- 9D** What is the order in which these fractions boil off from the liquefied air?

- 1 argon, nitrogen, oxygen
- 2 oxygen, nitrogen, argon
- 3 argon, oxygen, nitrogen
- 4 nitrogen, argon, oxygen

END OF TEST

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