Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

Science A

Unit Chemistry C1b (Oils, Earth and Atmosphere)

Chemistry

Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHY1BP

F&H

Tuesday 28 June 2011 Morning Session

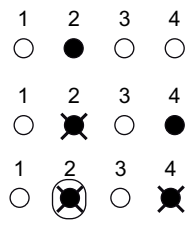
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.



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**.

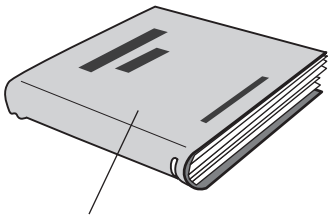
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

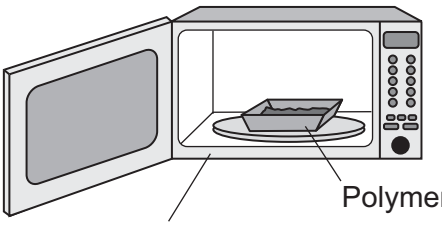
The drawings show four different ways in which polymers are used.

A



Polymer (dust cover)

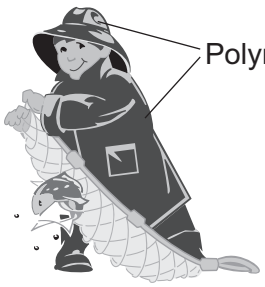
B



Polymer (tray)

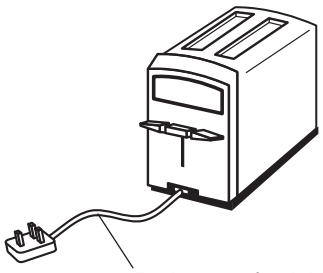
Microwave oven

C



Polymer (coat and hat)

D



Polymer (cable cover)

For each of the uses shown, the polymer must have particular properties.

The table shows the properties of four different polymers.

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

	Properties of the polymer
1	flexible, and must be a good electrical insulator
2	heat resistant and resistant to chemical attack
3	transparent, hard wearing and flexible
4	waterproof, breathable, flexible and can be coloured

Turn over for the next question

QUESTION TWO

This question is about four vegetable oils, **A**, **B**, **C** and **D**.

	Vegetable oil	Mass of the oil that can be extracted from 100 kg of seeds of the plant	Saturated fat %	Unsaturated fat %	
				mono	poly
A	Corn	6 kg	13	25	62
B	Olive	40 kg	11	69	20
C	Rapeseed	35 kg	12	24	64
D	Sunflower	32 kg	14	19	67

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

1	It contains the most saturated fat.
2	It contains 88 % unsaturated fat.
3	It contains the largest percentage of unsaturated fat.
4	Its seeds produce the least oil.

QUESTION THREE

This question is about the Earth's tectonic plates.

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

A volcanic eruptions

B convection currents

C continental drift

D radioactive processes

Millions of years ago, there was just one large land mass on Earth. The land mass split up into smaller land masses and these moved apart.

The movement of the smaller land masses is called . . . **1** . . . .

The land masses are on tectonic plates. The tectonic plates change position because in the Earth's mantle there are . . . **2** . . . .

The movement of the tectonic plates is caused by heat released from natural . . . **3** . . . .

At the boundary between tectonic plates, there are sometimes . . . **4** . . . .

Turn over for the next question

QUESTION FOUR

This question is about hydrocarbons.

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

A alkenes

B polymers

C monomers

D alkanes

Hydrocarbons are cracked to produce both saturated and unsaturated hydrocarbons.

The saturated hydrocarbons that are used as fuels are called . . . **1** . . . .

The unsaturated hydrocarbons are called . . . **2** . . . .

Compounds, such as poly(ethene) and poly(propene), that have very long chain molecules are called . . . **3** . . . .

Long chain molecules are made when many small molecules join together. These small molecules are called . . . **4** . . . .

QUESTION FIVE

This question is about sunflower oil.

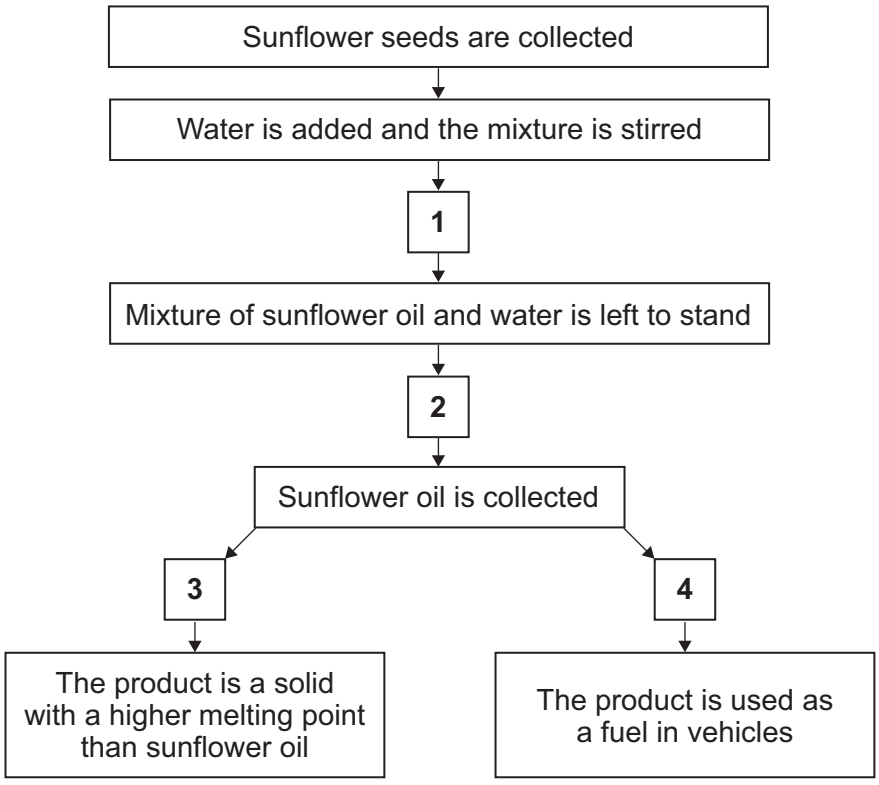
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Sunflower oil separates as a layer above the water.

B Sunflower oil is reacted with hydrogen at 60 °C.

C Sunflower oil is mixed with petroleum diesel.

D Mixture of sunflower seeds and water is pressed.



Turn over for the next question

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

This question is about unsaturated oils.

A student tested four oils, **K**, **L**, **M** and **N**, to find out which was the most unsaturated.

The student:

- used the same volume of each of the oils for all the tests.
- added bromine water from a burette to oil **K** and shook the mixture.
- continued until the bromine water was no longer decolourised.
- recorded the volume of bromine water added.
- repeated this two more times for oil **K**.

He then repeated the same procedure for oils **L**, **M** and **N**.

His results are given in the table.

Oil tested	Volume of bromine water added in cm^3		
	Test 1	**Test 2**	**Test 3**
K	20.1	20.2	20.2
L	42.2	44.2	46.2
M	25.6	26.3	27.0
N	15.8	16.5	14.3

6A The student used the burette to measure the volume of bromine water to the nearest . . .

1 0.1 cm^3

2 0.2 cm^3

3 1.0 cm^3

4 2.0 cm^3

6B The student obtained the largest range of burette readings for oil . . .

1 **K**

2 **L**

3 **M**

4 **N**

6C The student obtained the most precise results for oil . . .

1 **K**

2 **L**

3 **M**

4 **N**

6D A valid conclusion from his experiment is that . . .

1 four oils were tested.

2 oil **N** was the most unsaturated.

3 all four of the oils were unsaturated.

4 all oils react with bromine.

Turn over for the next question

QUESTION SEVEN

Biodiesel can be used as a fuel for vehicles. Biodiesel is made from vegetable oils. It can be used instead of diesel oil that is obtained from petroleum (crude oil).

Here is some more information about biodiesel.

- It contains much less sulfur than petroleum diesel.
- It is not hazardous to store.
- It is about the same price as petroleum diesel.
- It does not flow easily at low temperatures.
- It releases less energy than petroleum diesel when used as a fuel.
- It is difficult to ignite.

7A Biodiesel is a fuel because it . . .

1 is cheap.

2 is not hazardous when handled.

3 causes no pollution when burnt.

4 releases energy when burnt.

7B Tax is charged on petroleum diesel, but not on biodiesel.

The decision not to have tax charged on biodiesel is made by . . .

1 engine manufacturers to sell more of their engines.

2 politicians to encourage people to buy it.

3 scientists to help protect crude oil reserves.

4 petrol companies to increase sales of fuel.

7C The use of biodiesel is continuing to increase.

One reason is because . . .

1 it is easy to store.

2 it can be used at all temperatures.

3 less agricultural land is required to grow plants for food.

4 it is a sustainable fuel.

7D At present, there is more petroleum diesel used than biodiesel.

This is because petroleum diesel . . .

1 can be obtained from only a few places in the world.

2 contains more sulfur.

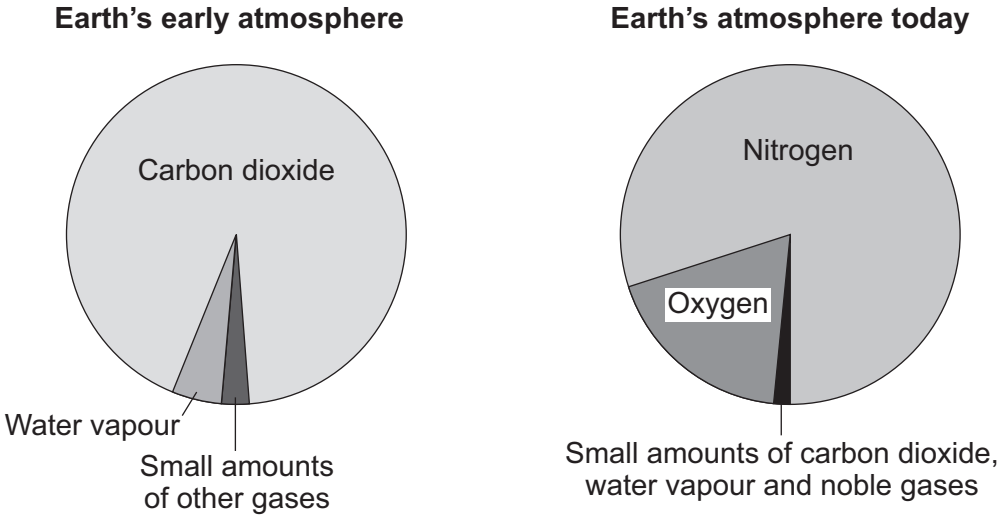
3 is more readily available.

4 is more expensive.

Turn over for the next question

QUESTION EIGHT

The pie charts show the amounts of gases in the Earth's early atmosphere and in the Earth's atmosphere today.



8A Very small amounts of a hydrocarbon gas are thought to have been in the Earth's early atmosphere.

This gas is . . .

1 ammonia, NH_3

2 helium, He

3 methane, CH_4

4 oxygen, O_2

8B As the Earth's early atmosphere was forming, it contained water vapour.

Which row in the table shows where the water vapour came from **and** why the quantity in the atmosphere reduced?

	Water vapour came from	**Water vapour reduced because**
1	evaporation from the ground.	it condensed to form the oceans.
2	evaporation from the ground.	there was less rainfall.
3	volcanic activity.	it condensed to form the oceans.
4	volcanic activity.	there was less rainfall.

8C Why was there no oxygen in the Earth's early atmosphere?

1 There was no carbon dioxide for the plants to use to make oxygen.

2 Living organisms had used up the oxygen.

3 There were no plants on Earth.

4 Oxygen is a very reactive gas.

8D The quantity of carbon dioxide in the Earth's atmosphere today is very different from the quantity that was in the Earth's early atmosphere.

One of the reasons why it is very different is that . . .

1 there are a lot of cars on our roads today.

2 it is locked up as carbon in fossil fuels.

3 most homes use fossil fuels for central heating.

4 plants produce carbon dioxide by photosynthesis.

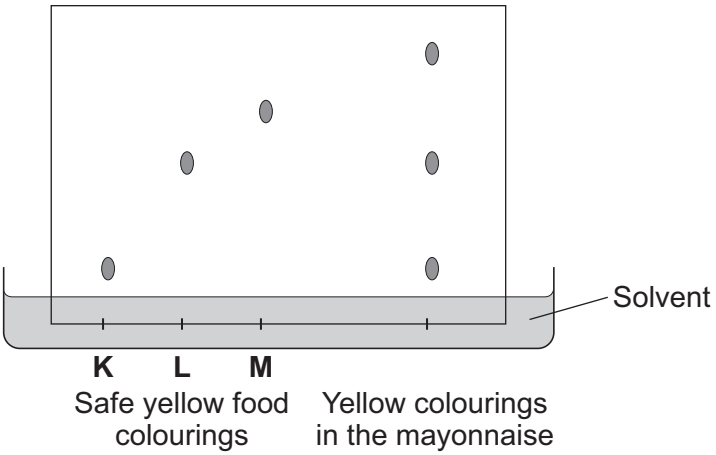
Turn over for the next question

QUESTION NINE

This ingredients list was on a jar of mayonnaise.

Ingredients
Water
Rapeseed oil
Sugar
Egg yolk
Cornflower
Vinegar
Colourings
Preservative E202

A test was used to find out if the yellow colourings in the mayonnaise were safe to eat.
The result of the test is shown below.



9A The test to detect and identify the colours is called . . .

1 distillation.

2 extraction.

3 vaporisation.

4 chromatography.

9B The test results show that in the mayonnaise . . .

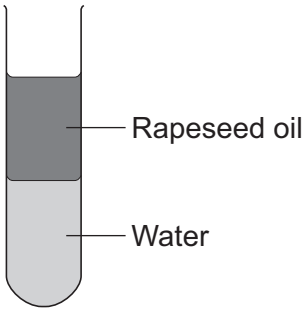
1 none of the colourings is safe.

2 only one of the colourings is safe.

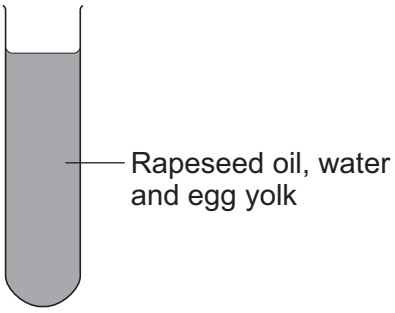
3 two of the colourings are safe.

4 all of the colourings are safe.

9C The diagrams show an experiment using some of the ingredients in the mayonnaise.



Mixture of rapeseed oil and water, shaken then left to stand



Mixture of rapeseed oil, water and egg yolk, shaken then left to stand

The results of the experiment suggest that . . .

1 rapeseed oil dissolves in water.

2 rapeseed oil is unsuitable for use in mayonnaise.

3 egg yolk is an emulsifier.

4 egg yolk improves the colour of the mayonnaise.

9D The preservative in the mayonnaise has an E-number.

This means that this preservative . . .

1 is a natural ingredient.

2 adds to the flavour of the mayonnaise.

3 is a permitted additive.

4 improves the appearance of the mayonnaise.

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 sunflower oil.

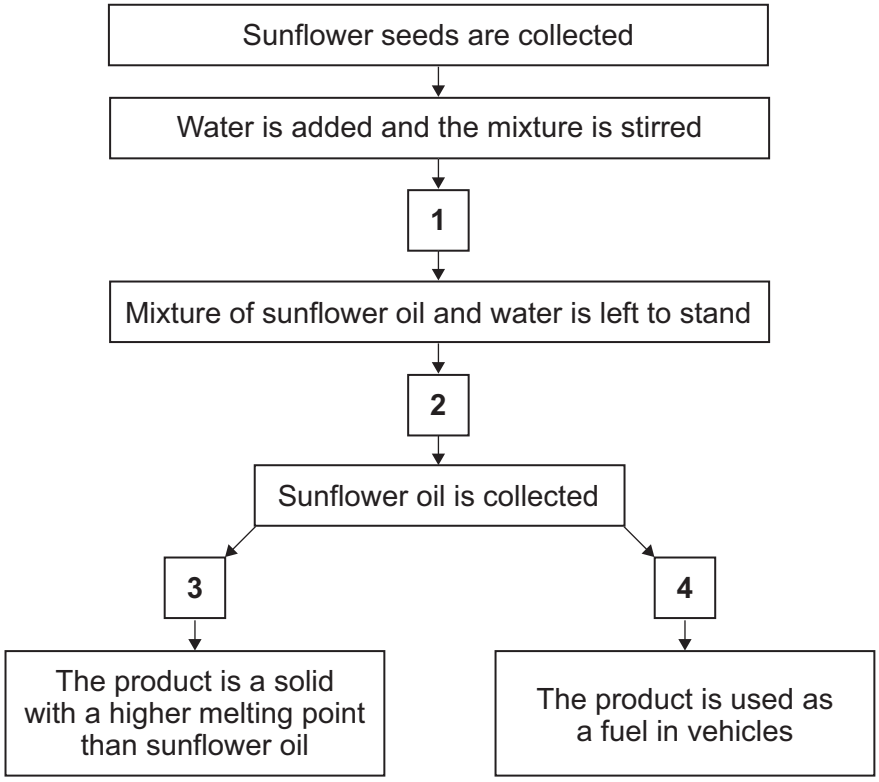
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Sunflower oil separates as a layer above the water.

B Sunflower oil is reacted with hydrogen at 60 °C.

C Sunflower oil is mixed with petroleum diesel.

D Mixture of sunflower seeds and water is pressed.

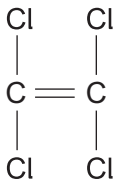


QUESTION TWO

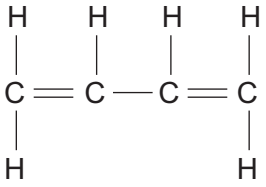
This question is about four carbon compounds.

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

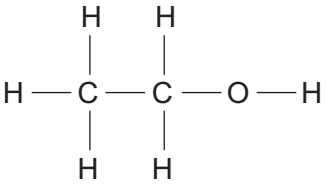
A



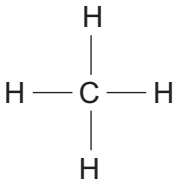
B



C



D



	Description
1	It is not a hydrocarbon but burns to give carbon dioxide and water.
2	It is a saturated hydrocarbon used as a fuel.
3	It will not produce water vapour if it burns.
4	It belongs to a group of compounds with the general formula C_nH_{2n-2}

Turn over for the next question

Section Two

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

Each of these questions has four parts.

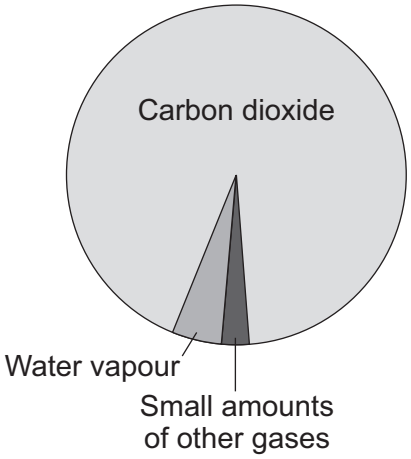
In each part choose only **one** answer.

Mark your choices on the answer sheet.

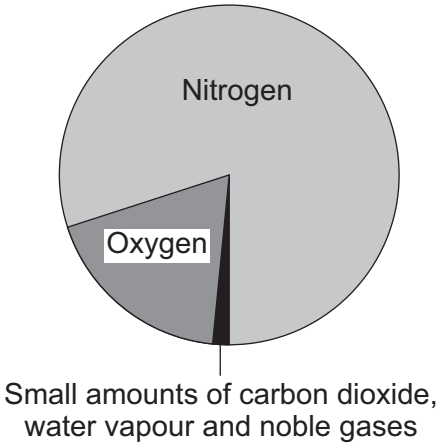
QUESTION THREE

The pie charts show the amounts of gases in the Earth's early atmosphere and in the Earth's atmosphere today.

Earth's early atmosphere



Earth's atmosphere today



3A Very small amounts of a hydrocarbon gas are thought to have been in the Earth's early atmosphere.

This gas is . . .

1 ammonia, NH_3

2 helium, He

3 methane, CH_4

4 oxygen, O_2

3B As the Earth's early atmosphere was forming, it contained water vapour.

Which row in the table shows where the water vapour came from **and** why the quantity in the atmosphere reduced?

	Water vapour came from	**Water vapour reduced because**
1	evaporation from the ground.	it condensed to form the oceans.
2	evaporation from the ground.	there was less rainfall.
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3C Why was there no oxygen in the Earth's early atmosphere?

1 There was no carbon dioxide for the plants to use to make oxygen.

2 Living organisms had used up the oxygen.

3 There were no plants on Earth.

4 Oxygen is a very reactive gas.

3D The quantity of carbon dioxide in the Earth's atmosphere today is very different from the quantity that was in the Earth's early atmosphere.

One of the reasons why it is very different is that . . .

1 there are a lot of cars on our roads today.

2 it is locked up as carbon in fossil fuels.

3 most homes use fossil fuels for central heating.

4 plants produce carbon dioxide by photosynthesis.

Turn over for the next question

QUESTION FOUR

This ingredients list was on a jar of mayonnaise.

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Sugar
Egg yolk
Cornflower
Vinegar
Colourings
Preservative E202

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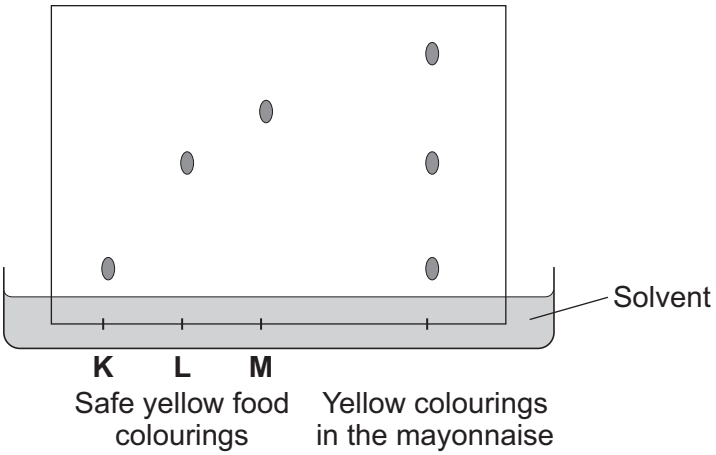

4A The test to detect and identify the colours is called . . .

1 distillation.

2 extraction.

3 vaporisation.

4 chromatography.

4B The test results show that in the mayonnaise . . .

1 none of the colourings is safe.

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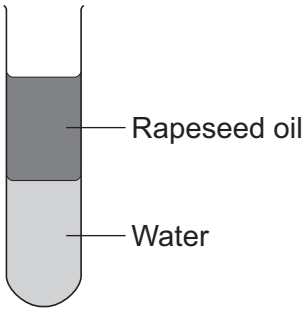
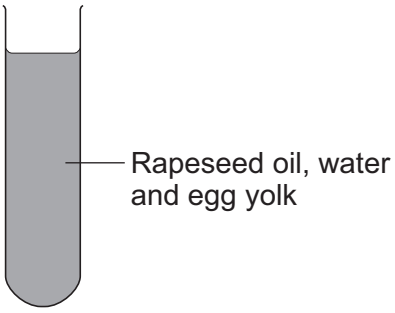
4C The diagrams show an experiment using some of the ingredients in the mayonnaise.



Mixture of rapeseed oil and water, shaken then left to stand



Mixture of rapeseed oil, water and egg yolk, shaken then left to stand

The results of the experiment suggest that . . .

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2 rapeseed oil is unsuitable for use in mayonnaise.

3 egg yolk is an emulsifier.

4 egg yolk improves the colour of the mayonnaise.

4D The preservative in the mayonnaise has an E-number.

This means that this preservative . . .

1 is a natural ingredient.

2 adds to the flavour of the mayonnaise.

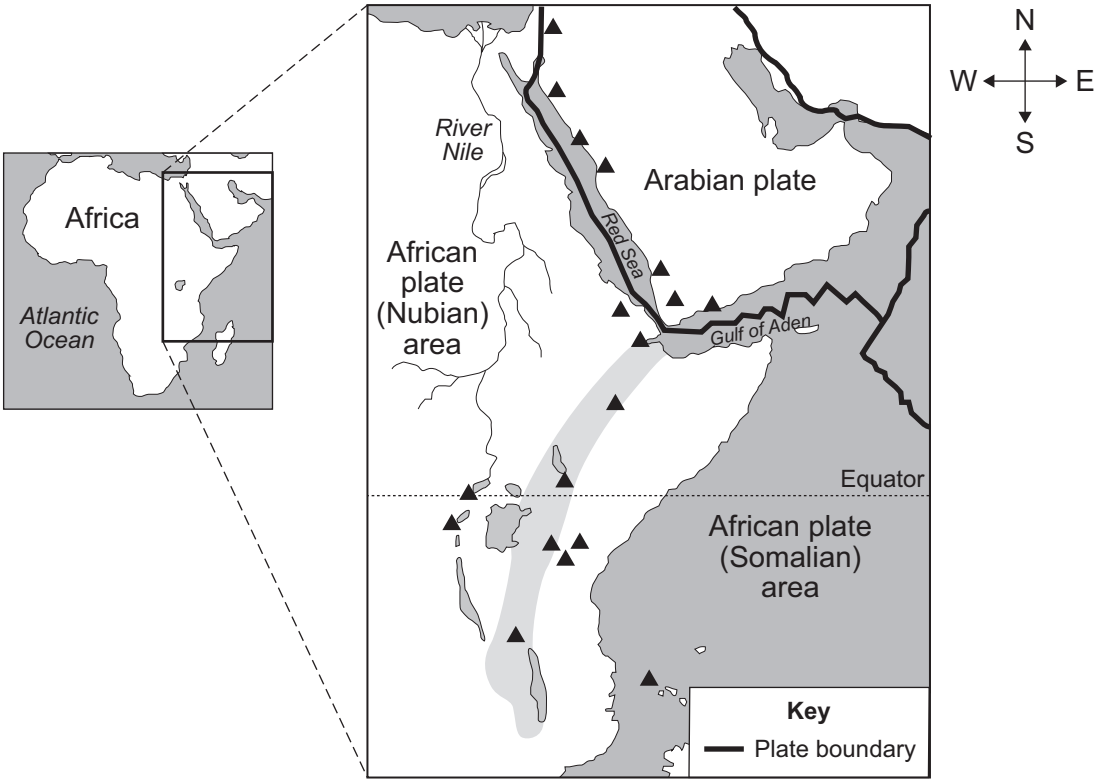
3 is a permitted additive.

4 improves the appearance of the mayonnaise.

Turn over for the next question

QUESTION FIVE

The map shows a part of East Africa.



This part of Africa is gradually being split into separate areas of land along the plate boundary which runs from north west to south east.

The process began about 30 million years ago, resulting in the formation of the Red Sea.

5A The separation in this area was caused by . . .

1 convection currents moving the Arabian plate away from the African plate.

2 the ocean moving the Arabian plate away from the African plate.

3 convection currents forcing the Arabian and African plates together.

4 shrinking of the Earth's crust as it cooled.

5B From their positions, the triangles (▲) on the map most likely represent . . .

1 mountains.

2 volcanoes.

3 lakes.

4 villages.

On the African plate, the Somalian area is beginning to move away from the Nubian area to form a new plate boundary in the zone which has the lighter shading on the map.

5C The Red Sea is about 300 km wide. The new Somalian and Nubian plates are expected to move apart at a similar rate to the Arabian and African plates.

A reasonable estimate for the formation of a sea of similar width to the Red Sea would be . . .

1 1 thousand years.

2 30 thousand years.

3 300 thousand years.

4 30 million years.

5D Where in this region, and when, would you expect earthquakes to occur?

1 along the Equator, every ten years

2 close to plate boundaries, every twenty years

3 close to plate boundaries, but it is difficult to predict when

4 in the shaded area, when the plates stop moving

Turn over for the next question

QUESTION SIX

The question is about vegetable oils.

6A Many vegetable oils contain unsaturated compounds.

This means that . . .

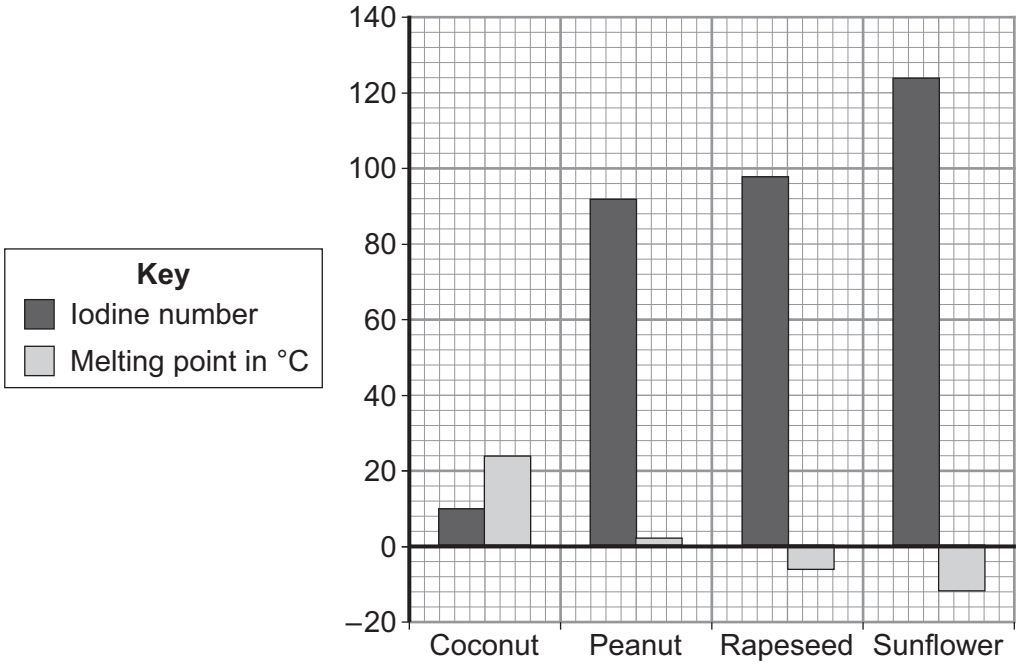
1 they are soluble in water.

2 they can form an emulsion with water.

3 they contain double carbon carbon bonds.

4 they do not contain single carbon carbon bonds.

The chart shows some information about four vegetable oils.



The iodine number of a vegetable oil is the number of grams of iodine that will react with 100 g of the oil.

The higher the iodine number, the more unsaturated the compounds are in the vegetable oil.

6B The bar chart indicates that the lower the melting point of a vegetable oil, . . .

1 the less iodine it will react with.

2 the more unsaturated compounds are in the oil.

3 the lower the iodine number.

4 the more saturated compounds are in the oil.

6C How much iodine will 1 g of coconut oil react with?

1 0.01 g

2 0.1 g

3 1.0 g

4 10.0 g

6D Which row in the table describes what happens when a vegetable oil reacts with hydrogen **and** correctly describes how the product is different from the vegetable oil?

	Reaction of vegetable oil with hydrogen	**Product**
1	increase in compounds with C = C	harder
2	increase in compounds with C = C	softer
3	decrease in compounds with C = C	harder
4	decrease in compounds with C = C	softer

Turn over for the next question

QUESTION SEVEN

About 90 % of the world's supply of ethanol is produced by using yeast for the fermentation of sugars obtained from plants. A solution of about 8 % ethanol in water is obtained.
Ethanol can be used to produce ethene.

Reaction **P** shows carbon dioxide being removed from the atmosphere by plants to make sugar.
Reaction **Q** shows carbon dioxide being released by yeast into the atmosphere during respiration.
Reaction **R** shows the formation of ethene from ethanol.

Reaction **P** $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Reaction **Q** $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

Reaction **R** $C_2H_5OH \rightarrow C_2H_4 + H_2O$

7A In these reactions, what is the net change in the number of molecules of carbon dioxide in the atmosphere during the production of one molecule of ethene?

1 1

2 2

3 4

4 6

Ethanol can also be produced by the reaction of ethene with steam.

This is a continuous process because the reactants flow steadily into the reactor and the ethanol flows out.

7B How is the ethene for this process obtained?

1 by fractional distillation of crude oil

2 by cracking fractions from crude oil

3 by polymerisation of crude oil

4 by vaporisation of crude oil

7C An advantage of producing ethanol from ethene rather than by fermentation is that . . .

1 higher temperatures are required.

2 catalysts are used.

3 the ethanol is purer.

4 the reaction is slower.

7D It may be better to obtain ethene from biologically-produced ethanol rather than from crude oil.

One reason for this is that . . .

1 ethene can be produced in unlimited quantities.

2 crude oil is a non-renewable resource.

3 poly(ethene) made from biologically produced ethanol will be biodegradable.

4 the fermentation of sugar is done in batches, whereas production of ethene from crude oil is continuous.

Turn over for the next question

QUESTION EIGHT

This question is about the cracking of hydrocarbons.

8A Which of the following is a correctly balanced equation for the cracking of $C_{15}H_{32}$ in which two different alkenes are produced?

1 $C_{15}H_{32} \rightarrow 2C_2H_4 + C_3H_6 + C_8H_{18}$

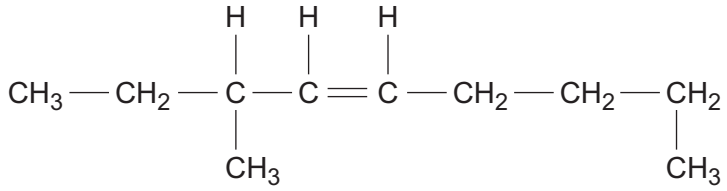
2 $C_{15}H_{32} \rightarrow 2CH_4 + C_3H_6 + C_4H_{10} + C_6H_{12}$

3 $C_{15}H_{32} \rightarrow 2C_3H_6 + C_9H_{20}$

4 $C_{15}H_{32} \rightarrow C_4H_{10} + C_5H_{10} + C_6H_{14}$

8B Which of the following hydrocarbons that could be produced by the cracking of C_9H_{20} has the general formula C_nH_{2n} and decolourises bromine water?

1



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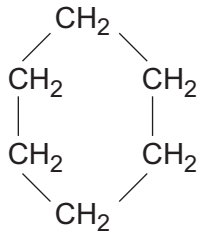

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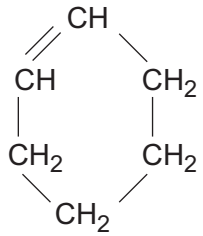

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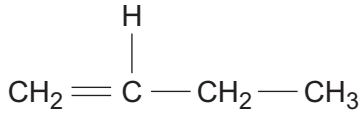
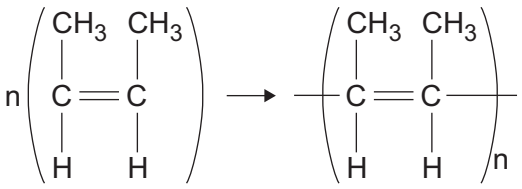


8C Which of the following equations represents the polymerisation of butene?

1



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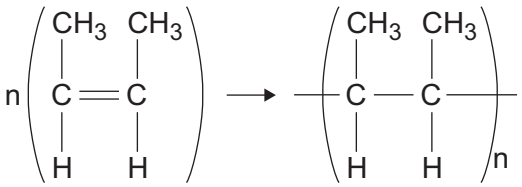

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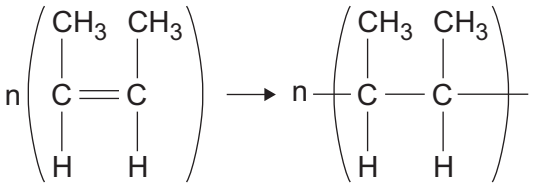

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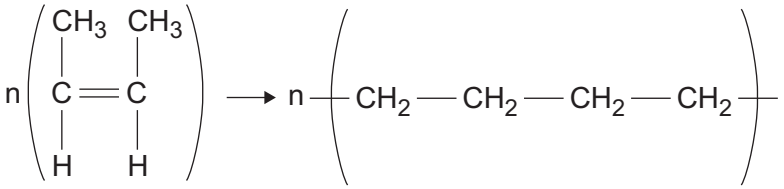
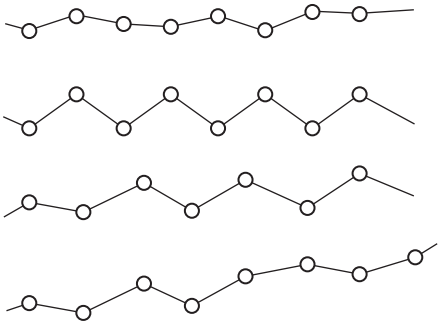


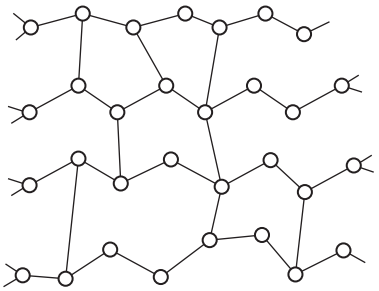
Question 8 continues on the next page

8D The diagram shows the structures of a thermosoftening polymer and a thermosetting polymer.

Thermosoftening polymer



Thermosetting polymer



Which row in the table describes the properties of the two types of polymer?

	Thermosoftening polymer		**Thermosetting polymer**	
	Property 1	**Property 2**	**Property 1**	**Property 2**
1	Polymer molecules able to slide	Chemical bonds between the chains	Melt on heating	Short chain lengths
2	Long chain lengths	No chemical bonds between the chains	Chemical bonds between the chains	Polymer molecules able to slide
3	Long chain lengths	No chemical bonds between the chains	Do not melt on heating	Chemical bonds between the chains
4	Chemical bonds between the chains	Melt on heating	No chemical bonds between the chains	Long chain lengths

Turn over for the next question

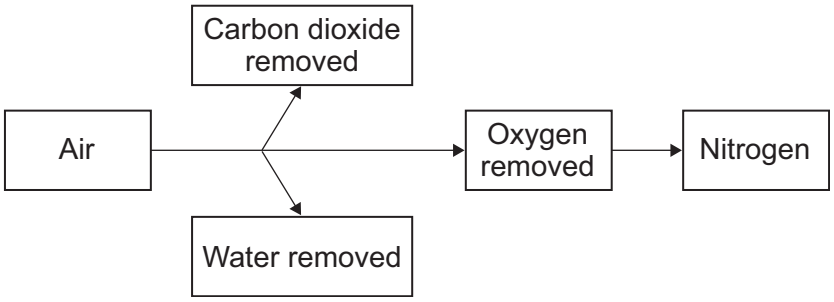
QUESTION NINE

The table below gives information about the gases in the air after removal of any water vapour.

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 0.1
Neon	−248	−246	Less than 0.1
Argon	−189	−186	0.9
Krypton	−157	−153	Less than 0.1
Xenon	−112	−108	Less than 0.1

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 heating ammonium nitrate.

He found that there was a slight 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 heavier 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 have a very low density.

3 are unreactive.

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 that 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 Why is the carbon dioxide removed before the air is liquefied?

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 nitrogen, argon, oxygen

4 argon, oxygen, nitrogen

END OF TEST

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