Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

Science A

Unit Chemistry C1b (Oils, Earth and Atmosphere)

Chemistry

Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHY1BP

F&H

Tuesday 15 November 2011 Morning Session

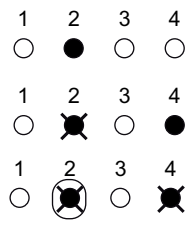
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 14 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

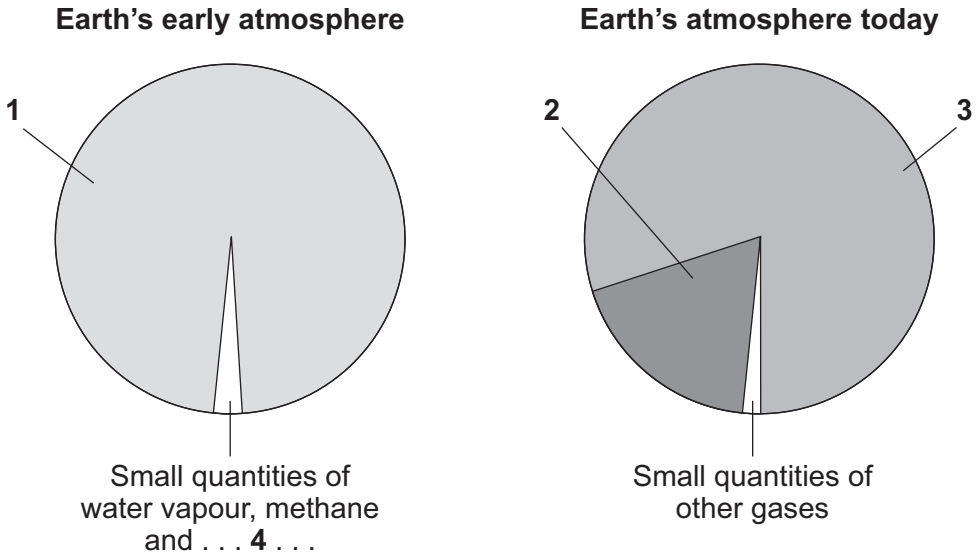
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

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



Match gases, **A**, **B**, **C** and **D**, with the labels **1–4** on the pie charts.

A ammonia

B carbon dioxide

C nitrogen

D oxygen

QUESTION TWO

Different polymers have different properties.

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

A can withstand high temperatures and is non-stick

B can be stretched into fibres

C makes a very light, solid foam which is a good heat insulator

D strong, rigid and a good electrical insulator

	Uses
1	to make disposable cups for hot drinks
2	to make the coating on frying pans
3	to make shirts and trousers
4	to make the handles of tools

QUESTION THREE

This question is about vegetable oils.

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

A burned in oxygen

B reacted with bromine water

C reacted with hydrogen

D shaken with water

Vegetable oils are . . . **1** . . . to form emulsions.

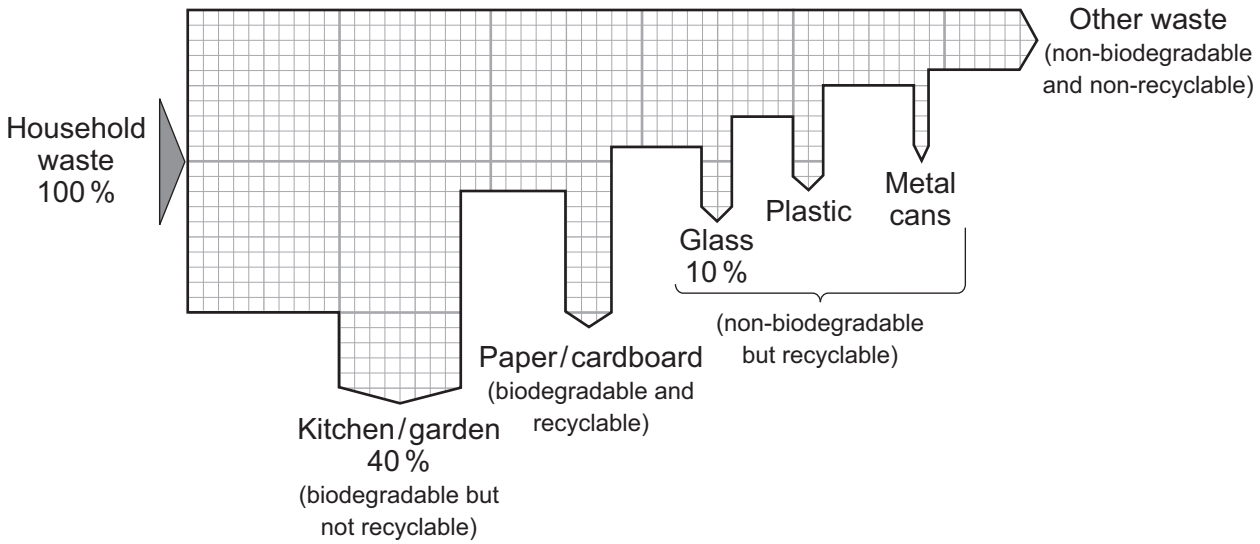
Vegetable oils are . . . **2** . . . to become harder.

Vegetable oils are . . . **3** . . . to release energy.

Vegetable oils are . . . **4** . . . to test for unsaturation.

QUESTION FOUR

The diagram shows the composition of typical household waste.



Match percentages (%), **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A 5 %

B 10 %

C 40 %

D 55 %

	Percentage (%)
1	the percentage of waste that is plastic
2	the percentage of waste that is metal
3	the percentage of waste that is recyclable
4	the percentage of waste that is biodegradable

QUESTION FIVE

The table shows the abundance in the Earth's atmosphere of each of four noble gases.

Noble gas	Abundance (percentage in the atmosphere by volume)
Argon	0.9300
Neon	0.0018
Helium	0.0005
Krypton	0.0001

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

A abundance

B colour

C density

D reactivity

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

Neon is used in electric discharge tubes for advertising signs because it produces a bright . . . **2** . . . .

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

Krypton is the noble gas in the table with the lowest . . . **4** . . . .

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

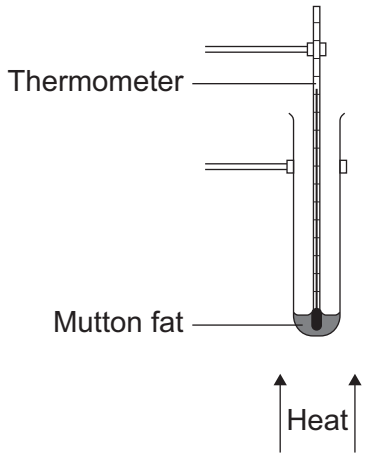
The melting points of most fats are below 100 °C.

A student wanted to measure the melting point of mutton fat.

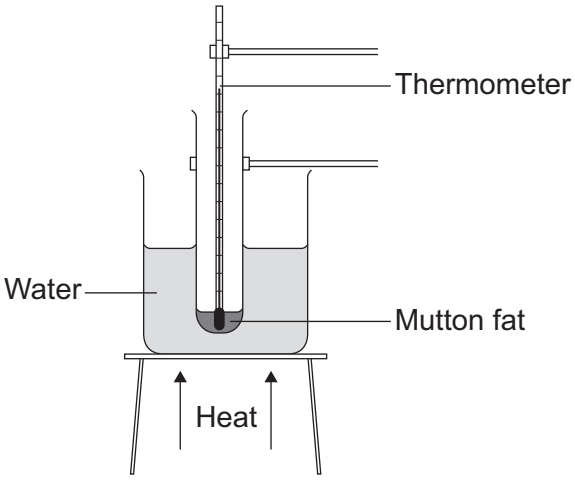
The student first used the equipment shown below as **Apparatus 1**. He was only able to estimate the melting point over a range of about 10 °C.

He then used the equipment shown as **Apparatus 2**. He was now able to measure the melting point more accurately.

Apparatus 1



Apparatus 2



6A One reason that **Apparatus 2** was an improvement over **Apparatus 1** is that . . .

1 a higher temperature can be achieved.

2 the temperature of the mutton fat rises more slowly.

3 the water boils before the mutton fat.

4 the water reaches a higher temperature than the mutton fat.

Using **Apparatus 2**, the student measured the melting point of the mutton fat three times.

The student then repeated the experiment for some more fats and oils.

The results are shown in the table.

Fat or oil	Melting point in °C		
	Test 1	Test 2	Test 3
Mutton fat	45	44	42
Beef fat	35	37	32
Coconut oil	26	25	25
Palm oil	37	34	37

6B The independent variable in each experiment is . . .

1 the temperature of the water.

2 the melting point of the fat or oil.

3 the fat or oil used.

4 the amount of heat applied.

6C The student obtained the most reliable results for . . .

1 beef fat.

2 coconut oil.

3 mutton fat.

4 palm oil.

6D The melting point of peanut oil is between 0 °C and 20 °C.

How could the student modify **Apparatus 2** so that it could be used to find the melting point of peanut oil?

1 use a smaller quantity of oil in the tube

2 heat the water more gently

3 use a mixture of ice and water in the beaker

4 use a more accurate thermometer

QUESTION SEVEN

Scientists working for a plastics company tested three different types of poly(ethene) to see how much they would stretch before tearing.

7A The scientists used identical apparatus, equal-sized pieces of poly(ethene), and carried out all the tests at the same temperature.

They did this so that . . .

1 all the variables were kept the same.

2 it was easier and cheaper to carry out the tests.

3 all the measurements would be accurate.

4 only the independent variable would affect the results.

7B Cling film, a very thin sheet of poly(ethene), is used to wrap sandwiches.

Which row in the table shows two properties of poly(ethene) that make it suitable for use as cling film?

	Property 1	**Property 2**
1	tears when stretched	is easily coloured and printed
2	is easily coloured and printed	is transparent
3	is transparent	is airtight
4	is airtight	easily melts when heated

7C Sandwiches could be wrapped in paper and packed in paper bags.

Paper is made from wood. When a tree is cut down, another tree can be planted to replace it.

An advantage of using paper instead of cling film is that . . .

1 the use of paper bags is sustainable.

2 paper is non-biodegradable.

3 paper has been used for hundreds of years.

4 paper does not blow about in the wind like plastic.

7D Poly(ethene) can be recycled.

A problem that has to be overcome at the recycling centre is that poly(ethene) . . .

1 is mixed with other polymers.

2 is difficult to melt down.

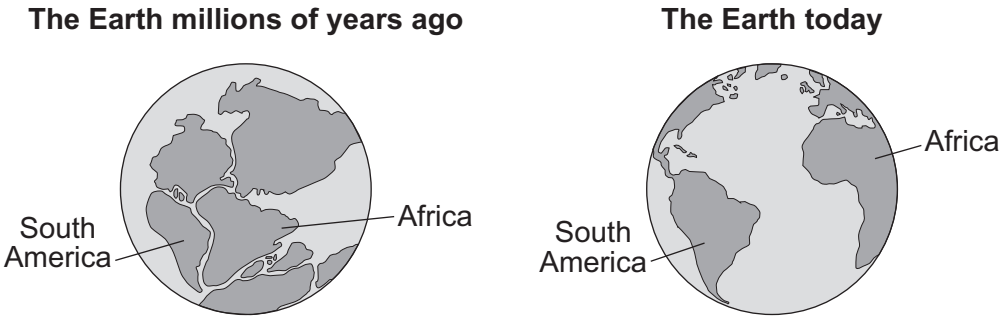
3 is a poor conductor of electricity.

4 is not biodegradable.

Turn over for the next question

QUESTION EIGHT

The diagram shows the positions of Africa and South America millions of years ago and today.



8A Alfred Wegener put forward a theory to explain the change in their positions.

His theory was that . . .

1 the continents had drifted apart.

2 the continents had been forced apart by earthquakes.

3 volcanic eruptions had caused them to separate.

4 the shrinking crust had forced them apart.

8B At the time, many scientists did not accept Wegener's theory.

Why did they doubt his theory?

1 They thought that the Earth's crust was too thick.

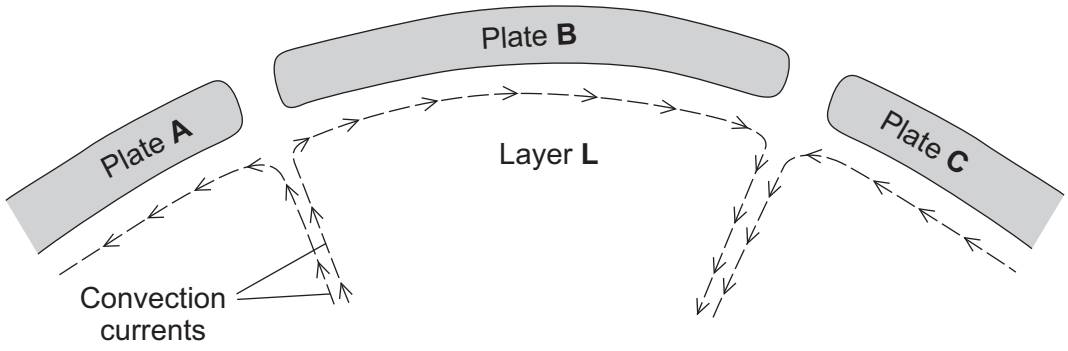
2 They had no way to explain how the continents could move.

3 They thought that the Earth was expanding.

4 They thought that the continents moved too slowly.

The discovery of tectonic plates made many more scientists accept Wegener's theory.

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



8C Which row in the table correctly names the parts of the Earth in the plates and in Layer **L**?

	Plates	**Layer L**
1	crust	mantle
2	crust and upper mantle	core
3	crust	core
4	crust and upper mantle	mantle

8D Which plates are moving towards each other?

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

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

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

4 plates **A**, **B** and **C**

QUESTION NINE

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.

Hydrocarbon **K** (large molecule) $\rightarrow$ C_6H_{12} + C_3H_6 + C_3H_8

9A What are the conditions needed for this reaction to take place most successfully?

1 heat hydrocarbon **K** vapour over a hot catalyst

2 heat hydrocarbon **K** vapour with hydrogen

3 heat hydrocarbon **K** with a dilute acid

4 heat hydrocarbon **K** at 40 °C

9B The formula for hydrocarbon **K** is . . .

1 C_9H_{18}

2 $C_{12}H_{24}$

3 $C_{12}H_{26}$

4 $C_{26}H_{12}$

9C Which row in the table shows the products that react with bromine water and the colour change seen when they react?

	Product(s)	**Colour change**
1	C_6H_{12} and C_3H_6	from yellow-brown to colourless
2	C_3H_6 and C_3H_8	from yellow-brown to colourless
3	C_6H_{12} and C_3H_6	from colourless to yellow-brown
4	C_3H_8 only	from yellow-brown to colourless

9D Two of the products can form polymers because . . .

1 they are obtained from crude oil by fractional distillation.

2 they are saturated compounds.

3 their molecules have a double carbon carbon bond.

4 they vaporise at temperatures below 20 °C.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

Section One

Questions **ONE** and **TWO**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The table shows the abundance in the Earth's atmosphere of each of four noble gases.

Noble gas	Abundance (percentage in the atmosphere by volume)
Argon	0.9300
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Match properties, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A abundance

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

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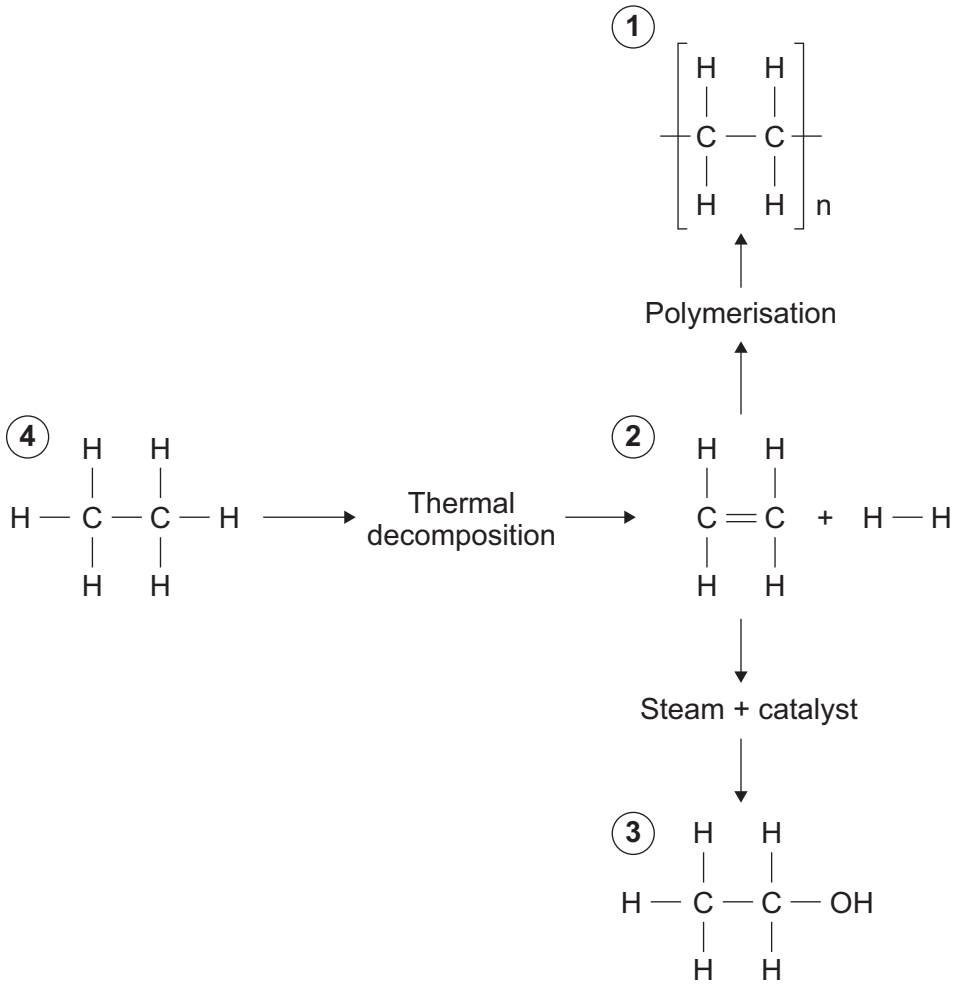
Helium is used in balloons because it has a low . . . **3** . . . .

Krypton is the noble gas in the table with the lowest . . . **4** . . . .

QUESTION TWO

The flow chart shows a series of chemical reactions.



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

A Ethane

B Ethanol

C Ethene

D Poly(ethene)

Section Two

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

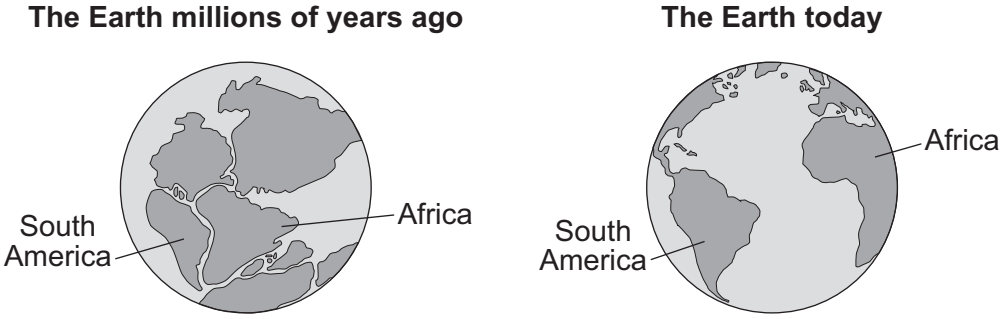
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows the positions of Africa and South America millions of years ago and today.



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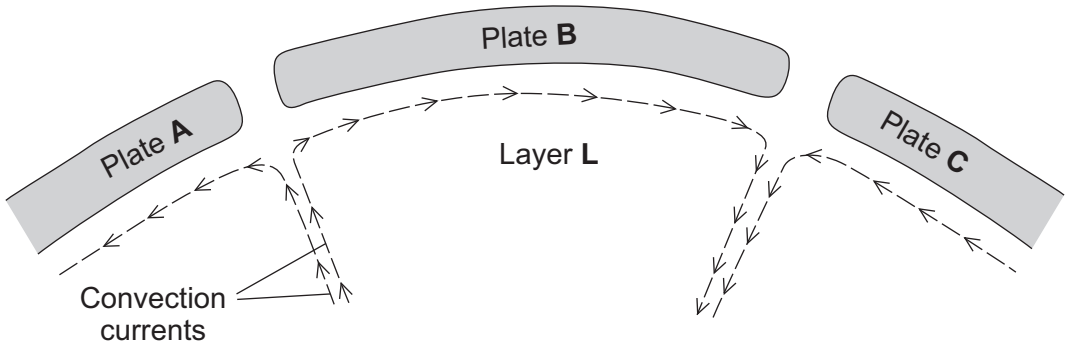

3C Which row in the table correctly names the parts of the Earth in the plates and in Layer **L**?

	Plates	**Layer L**
1	crust	mantle
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3	crust	core
4	crust and upper mantle	mantle

3D Which plates are moving towards each other?

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

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

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

4 plates **A**, **B** and **C**

QUESTION FOUR

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.

Hydrocarbon **K** (large molecule) $\rightarrow$ C_6H_{12} + C_3H_6 + C_3H_8

4A What are the conditions needed for this reaction to take place most successfully?

1 heat hydrocarbon **K** vapour over a hot catalyst

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4B The formula for hydrocarbon **K** is . . .

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4D Two of the products can form polymers because . . .

1 they are obtained from crude oil by fractional distillation.

2 they are saturated compounds.

3 their molecules have a double carbon carbon bond.

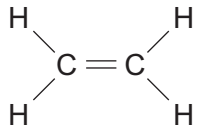
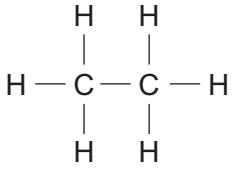
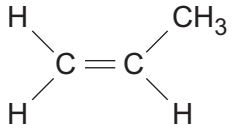
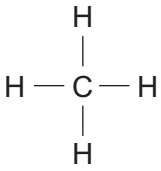
4 they vaporise at temperatures below 20 °C.

Turn over for the next question

QUESTION FIVE

Polymers have properties that depend on what they are made from and the conditions under which they are made.

5A Which row in the table contains two molecules that are both easily made into polymers?

1	C_3H_6	
2	C_4H_{10}	
3	C_5H_{12}	
4	C_4H_8	

Poly(ethene) was first produced by heating ethene under high pressure and to high temperatures. Later, it was found that poly(ethene) could be produced at much lower temperatures and pressures if an aluminium catalyst was used.

5B An advantage of using a catalyst is that the poly(ethene) could be . . .

1 improved by including aluminium in its structure.

2 manufactured with different alkenes.

3 manufactured by polymerisation of ethane.

4 more economic to produce.

5C The poly(ethene) produced using lower temperatures and pressures has a higher density.

This has enabled manufacturers to . . .

1 develop a wider range of products.

2 use different types of monomer to make poly(ethene).

3 use the polymers as fuels.

4 develop products that do not burn.

5D Many products are made using poly(ethene).

Which of the following is likely to be the most environmentally friendly way to deal with these products when they become waste?

1 allow the poly(ethene) to biodegrade

2 put the poly(ethene) in landfill sites

3 burn the poly(ethene) and use the energy released to produce electricity

4 melt the poly(ethene) and make new products

Turn over for the next question

QUESTION SIX

The atmosphere is made up of many different gases.

The abundance, melting points, and the boiling points of the noble gases are given in the table.

Noble gas	Abundance (percentage in the atmosphere by volume)	Melting point in °C	Boiling point in °C
Helium	0.0005	–272	–269
Neon	0.0018	–248	–229
Argon	0.93	–189	–186
Krypton	0.0001	–157	–153
Xenon	0.000009	–112	–108

6A Which of the following statements about the gases in the atmosphere is correct?

1 There is about 10 times as much argon as krypton.

2 There is about 20 times as much oxygen as argon.

3 There is about 4 times as much oxygen as nitrogen.

4 There is about 5 times as much nitrogen as oxygen.

6B Which noble gas is liquid over the largest temperature range?

1 neon

2 krypton

3 helium

4 argon

6C Which row in the table below correctly describes the properties of the noble gases?

	Melting point / boiling point	Use	Position in the periodic table
1	Melting point above room temperature (20 °C)	Provides a reactive atmosphere	In group 0
2	Melting point below room temperature (20 °C)	Provides an unreactive atmosphere	In group 7
3	Boiling point below room temperature	Provides a reactive atmosphere	In group 1
4	Boiling point is higher than the melting point	Provides an unreactive atmosphere	In group 0

6D The average concentration of carbon dioxide in the atmosphere is about 390 parts per million (0.039 %).

Which row in the table below shows the best way to measure this amount?

	Instrument reading to . . .	How readings are taken and used
1	10 parts per million	In several locations in a small area and take an average
2	2 parts per million	Average the highest and lowest values obtained
3	10 parts per million	Take values from industrialised areas and take an average
4	2 parts per million	Average the values taken over a large number of randomly selected locations

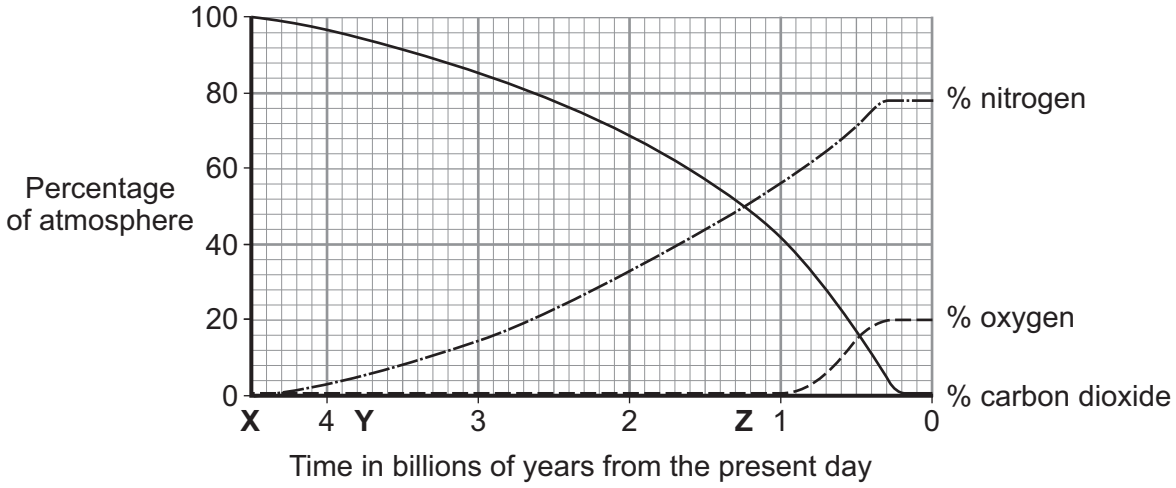
Turn over for the next question

QUESTION SEVEN

This question is about changes in the Earth's atmosphere that have occurred over time.

The Earth's early atmosphere was mainly carbon dioxide with small amounts of methane and ammonia.

The graph shows how the percentages of carbon dioxide, nitrogen and oxygen may have changed over time.



7A About how many years after the Earth was formed (**X**) did the percentage of carbon dioxide in the atmosphere fall to 60 %?

1 1.3 billion years

2 1.6 billion years

3 2.4 billion years

4 2.9 billion years

7B At a particular stage in the Earth's formation, some of the iron on its surface was oxidised.

What gas in the atmosphere could **not** have caused this change?

1 nitrogen

2 carbon dioxide

3 oxygen

4 water vapour

7C Between times **Y** and **Z**, the amount of carbon dioxide in the atmosphere was reduced.

Which of the following statements could explain this reduction?

Most of the carbon dioxide . . .

1 dissolved in the oceans.

2 was absorbed by plants.

3 was absorbed to form carbonate rocks in the mantle.

4 became locked up in coal, oil and natural gas.

7D The graph showing the percentages of the various gases has . . .

1 categoric variables plotted against a discrete variable.

2 discrete variables plotted against a continuous variable.

3 continuous variables plotted against a continuous variable.

4 continuous variables plotted against a discrete variable.

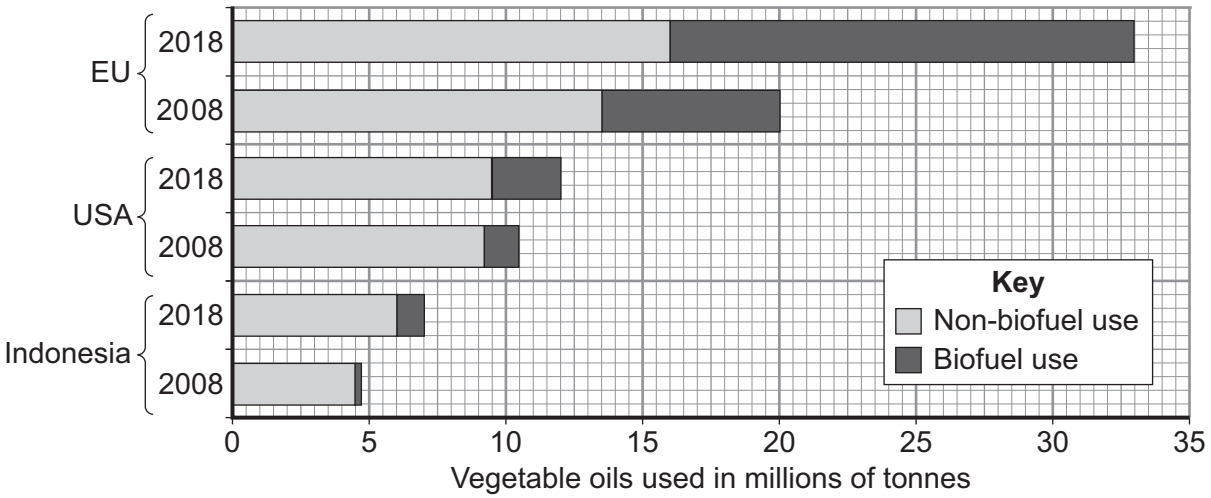
Turn over for the next question

QUESTION EIGHT

Vegetable oils are an important raw material for the production of biofuels.
An increase in the proportion of vegetable oils used for biofuels will reduce a country's dependence on crude oil.

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

The bar chart shows the use of vegetable oils in the European Union (EU), the USA and Indonesia in 2008. It also shows the projected use of vegetable oils in 2018. Indonesia is a country in south-east Asia.



8A What is the projected proportion of vegetable oils that will be used in the USA in 2018 to produce biofuels?

1 0.21

2 0.29

3 0.36

4 0.48

8B What is the projected percentage increase in the use of biofuels in the EU between 2008 and 2018?

1 22 %

2 75 %

3 162 %

4 250 %

8C The main environmental reason for the projected increase in the use of biofuels is . . .

1 the increase in the price of crude oil.

2 pressure to meet targets for reduced carbon dioxide emissions.

3 the discovery of large areas of unused agricultural land.

4 that biofuels do not produce any harmful waste gases when they burn.

8D Some pressure groups argue against the increased use of biofuels. They make many statements in support of their cause.

Which of the following is probably a false statement?

Increased use of biofuels will . . .

1 result in the loss of some animal and plant species.

2 create food shortages in some parts of the world.

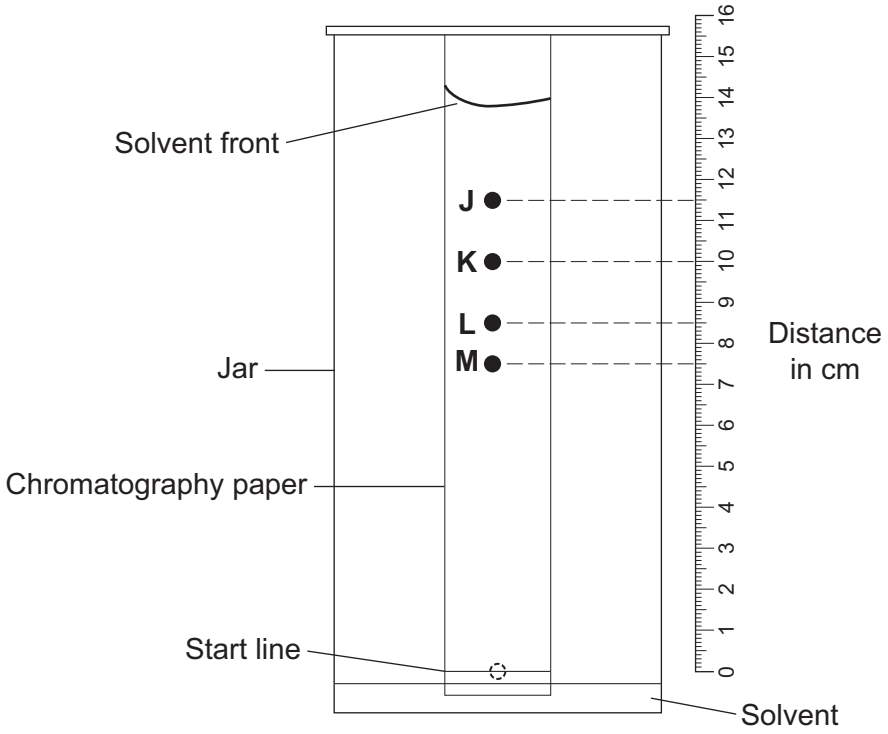
3 cause water shortages in some countries.

4 cause petroleum diesel prices to rise.

Turn over for the next question

QUESTION NINE

The colours from a sweet were dissolved in a solvent. A spot of the solution was put onto some chromatography paper. The paper was then placed in a jar. After a period of time, the colours were separated as shown in the diagram.



$$\text{the } R_f \text{ value for a colour} = \frac{\text{distance moved by the colour}}{\text{distance moved by the solvent}}$$

The substance responsible for a colour can be identified by using its R_f value. This tells you where to look on the chromatogram for this colour.

9A Amaranth has an R_f value of 0.54.

Which of the colours is possibly amaranth?

1 **J**

2 **K**

3 **L**

4 **M**

Indigo carmine has an R_f value of 0.58 and amaranth has an R_f value of 0.54.

9B There must be some doubt about whether a particular spot is indigo carmine or amaranth because . . .

1 the solvent front is not straight.

2 the length of time the chromatography paper was in the solvent is not known.

3 the scale is marked in 10 mm divisions.

4 only colours from one sweet were used.

9C The test was done four times for one particular colour.
R_f values of 0.51, 0.53, 0.58 and 0.61 were obtained.

This data tells us that . . .

1 the colour is amaranth.

2 the colour is indigo carmine.

3 the colour could be indigo carmine or amaranth.

4 the method cannot detect different colours.

9D It is recommended that indigo carmine should not be eaten by children.

The evidence from this investigation should lead to . . .

1 these sweets being banned.

2 further investigation with additional chemical tests.

3 these sweets being banned for children only.

4 this test being repeated more times.

END OF TEST

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