

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



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

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

CHY1BP
F&H

Friday 22 June 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
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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 18 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**.

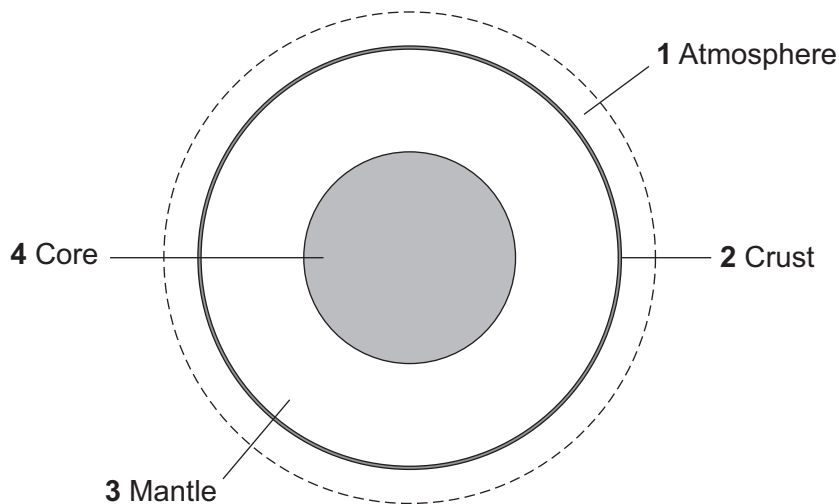
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the structure of the Earth.

The diagram below shows the layers in and around the Earth.



The Earth's magnetism is thought to be due to the presence of metallic iron and nickel in the centre of the Earth.

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

- A** where earthquakes occur
- B** where convection currents occur, causing the tectonic plates to move
- C** where there is a mixture of gases
- D** where iron and nickel are found as metals

QUESTION TWO

This question is about four substances.

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

- A** bromine
- B** ethene
- C** poly(propene)
- D** water

	Description
1	It forms an emulsion if shaken with an oil
2	It is a polymer
3	It is an unsaturated hydrocarbon
4	It reacts with unsaturated oils to form a colourless compound

Turn over for the next question

Turn over ►

QUESTION THREE

The table shows five noble gases and their boiling points.

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

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

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

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

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

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

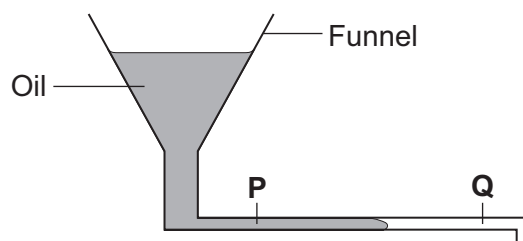
Xenon has the highest ... **4**

QUESTION FOUR

Viscosity is a measure of how easily a liquid flows.

The more viscous an oil is, the more slowly it will flow.

A student compared the viscosities of four different oils, **W**, **X**, **Y** and **Z**, at different temperatures. He used the apparatus shown in the diagram.



First he used oil **W**.

- Oil **W** was heated to 20°C and was then poured into the funnel.
- The time taken for oil **W** to flow from **P** to **Q** was recorded.
- The student repeated the procedure for oil **W** at temperatures of 30°C, 40°C and 50°C.

The student then used oils **X**, **Y** and **Z** in the same way.

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

- A** the colour of the oil
- B** the time the oil takes to flow from **P** to **Q**
- C** the distance between **P** and **Q**
- D** the four temperatures used for each oil

An independent variable is . . . **1**

The dependent variable is . . . **2**

A control variable used to make the investigation fair is . . . **3**

A variable that does not affect the result of the investigation is . . . **4**

Turn over ►

QUESTION FIVE

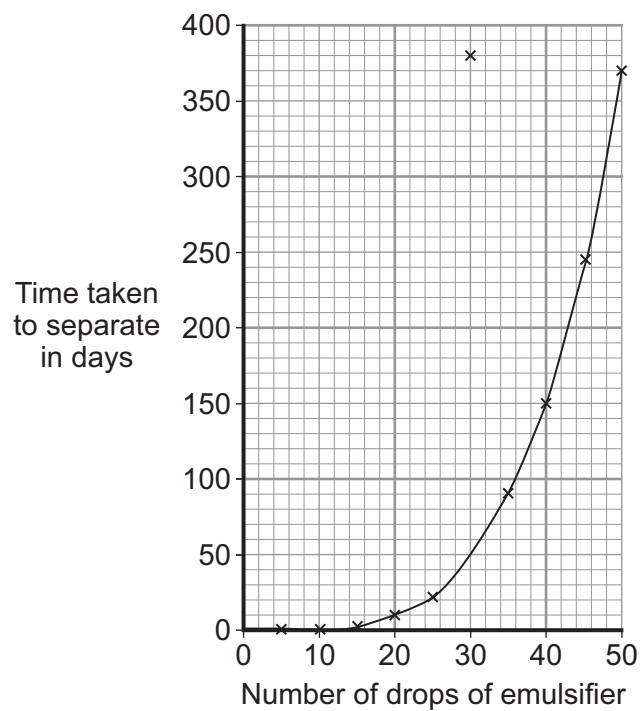
The water and oil used in making a salad dressing will separate if allowed to stand.

A scientist wanted to know how much emulsifier she needed to add to stop the oil and water in salad dressing from separating.

- She mixed equal volumes of oil and water.
- Then she added 5 drops of emulsifier.
- She shook the mixture and timed how long it took for the mixture to begin separating.

She repeated the experiment, adding different numbers of drops of emulsifier each time.

She used her results to plot a line graph.



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

A 38

B 90

C 380

D 600

1	It is an anomalous result
2	It is the time, in days, before separation of the oil and water when 35 drops of emulsifier are used
3	It is the minimum number of drops of emulsifier needed to prevent the salad dressing from separating before reaching 120 days
4	It is a reasonable estimate for the time taken, in days, for the oil and water to separate if 60 drops of emulsifier were used

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

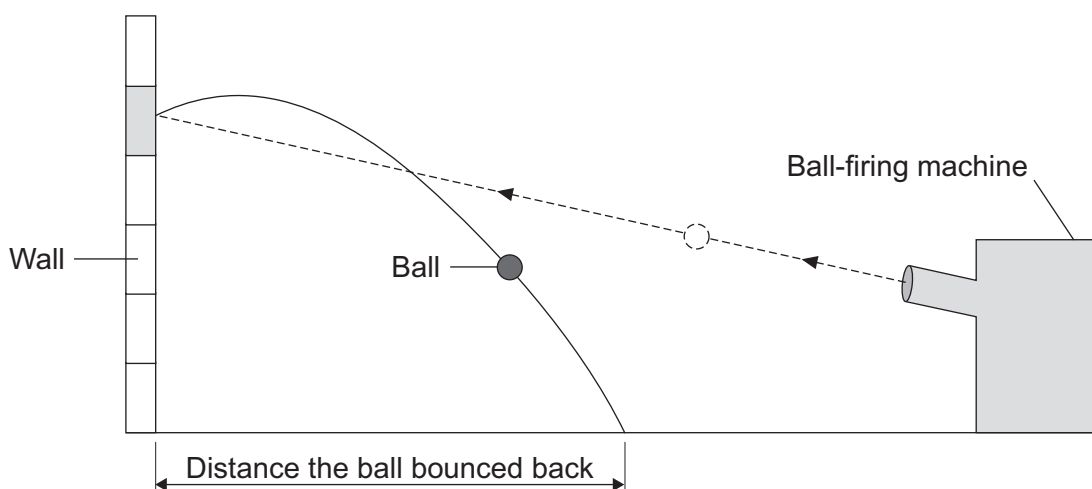
A student compared two balls to find out how well they bounced back from a wall. He used a machine to fire the balls at the wall. The machine was at a fixed distance from the wall.

One ball was made from rubber and the other from a polymer.

The student:

- set the machine to fire the ball at a speed of 2 metres per second
- fired the rubber ball from the machine to a point on a wall
- measured the distance that the ball bounced back from the wall
- repeated the experiment, but made the machine fire the ball at different speeds.

The student repeated the whole experiment using the polymer ball.



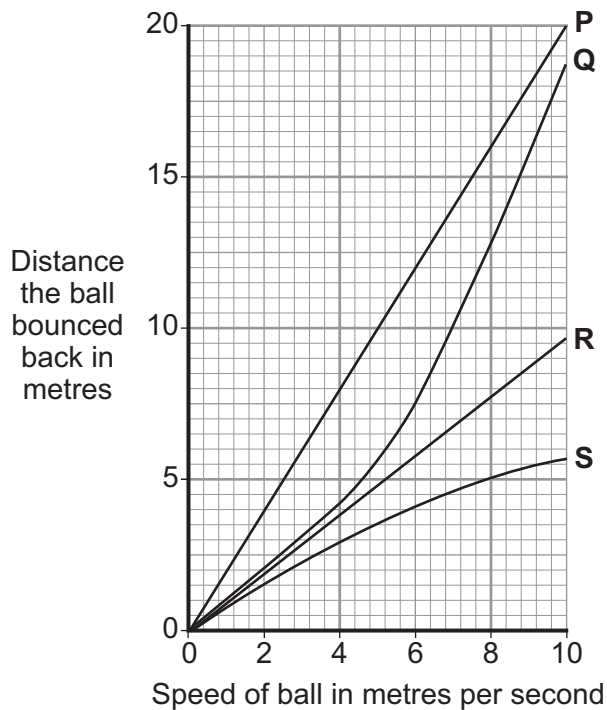
The results are shown in the table.

Speed of ball in metres per second	Distance the ball bounced back from the wall in metres	
	Rubber ball	Polymer ball
2	2.1	4.0
4	4.2	8.1
6	7.5	12.1
8	12.8	17.3
10	18.7	20.0

6A The results show that for each speed . . .

- 1 the rubber ball bounced back higher than the polymer ball.
- 2 the polymer ball bounced back further than the rubber ball.
- 3 the rubber ball and the polymer ball bounced back an equal distance.
- 4 the rubber ball bounced back further than the polymer ball.

6B Which of the lines, **P**, **Q**, **R** or **S**, on the graph, represents the results for the rubber ball?



- 1 P
- 2 Q
- 3 R
- 4 S

Question 6 continues on the next page

Turn over ►

6C To improve the reliability of the results, the student could repeat the experiment . . .

- 1 using balls of several different sizes.
- 2 several times for each speed.
- 3 using balls made from different polymers.
- 4 firing the balls at different points on the wall.

6D The student could get more precise measurements if he . . .

- 1 fired the balls at a higher speed.
- 2 repeated the experiments and calculated the mean.
- 3 measured the distances in centimetres.
- 4 fired the balls at a point higher on the wall.

Turn over for the next question

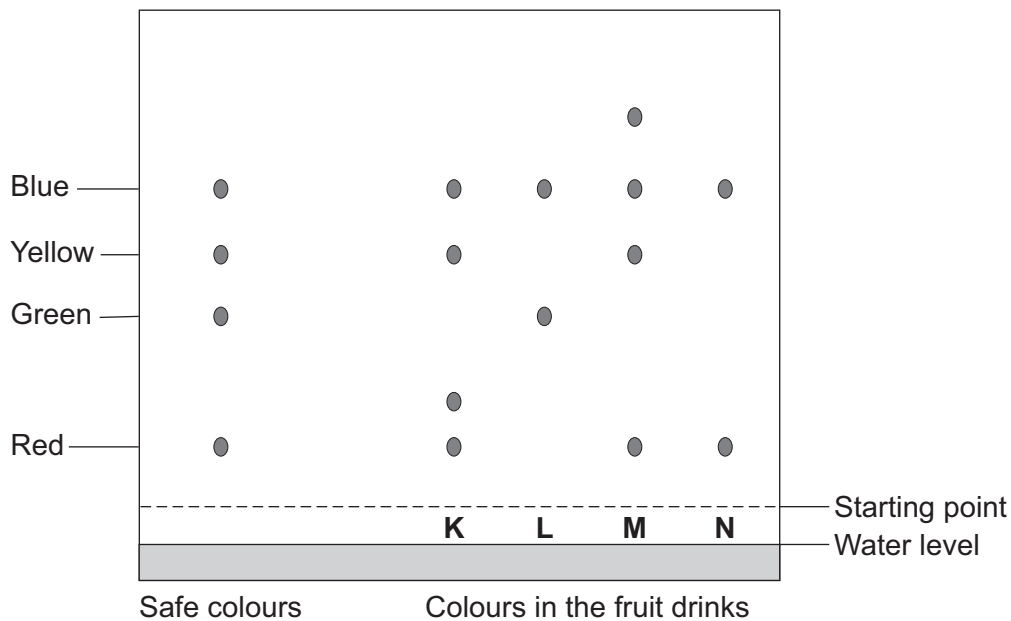
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QUESTION SEVEN

A student investigated the colours in four fruit drinks, **K**, **L**, **M** and **N**, using chromatography. The solvent used was water.

The results were compared with those of safe colours allowed in fruit drinks.

The results are shown in the chromatogram.



7A The chromatogram shows that . . .

- 1 all the fruit drinks contain only two colours.
- 2 blue, yellow, green and red safe colours are soluble in water.
- 3 only fruit drink **K** contains more than two colours.
- 4 fruit drinks **L** and **N** are more dilute than the other fruit drinks.

7B The student should investigate fruit drink **M** more fully because . . .

- 1 drink **M** contains four colours.
- 2 the mixture of colours makes drink **M** a dark brown colour.
- 3 people will not buy a fruit drink containing the colours red, yellow and blue.
- 4 drink **M** contains a colour that the student has not identified.

7C The chromatogram for the four fruit drinks shows that . . .

- 1 only **K** is safe to drink.
- 2 only **L** and **N** are safe to drink.
- 3 only **K**, **L** and **N** are safe to drink.
- 4 **K**, **L**, **M** and **N** are safe to drink.

7D A test shows that a different fruit drink on sale in the shops contains a colour that could be harmful to some people.

What should the manufacturer do **immediately**?

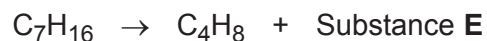
- 1 give employees protective gloves when handling this fruit drink
- 2 replace the colour in the fruit drink with another that is safe
- 3 stop production of all fruit drinks
- 4 withdraw the fruit drink from all shops and advise the public not to drink it

Turn over for the next question

Turn over ►

QUESTION EIGHT

The equation for the thermal decomposition of a hydrocarbon is:



8A What name is given to this process?

- 1 combustion
- 2 condensation
- 3 cracking
- 4 hydrogenation

8B In this process, . . .

- 1 hot gases are mixed with water.
- 2 hot vapours are passed over a hot catalyst.
- 3 liquids are mixed with water.
- 4 liquids are passed over a catalyst.

8C Substance **E** will have the formula . . .

- 1 CH_4
- 2 C_3H_6
- 3 C_3H_8
- 4 C_9H_{20}

8D The substance with the formula C_4H_8 is . . .

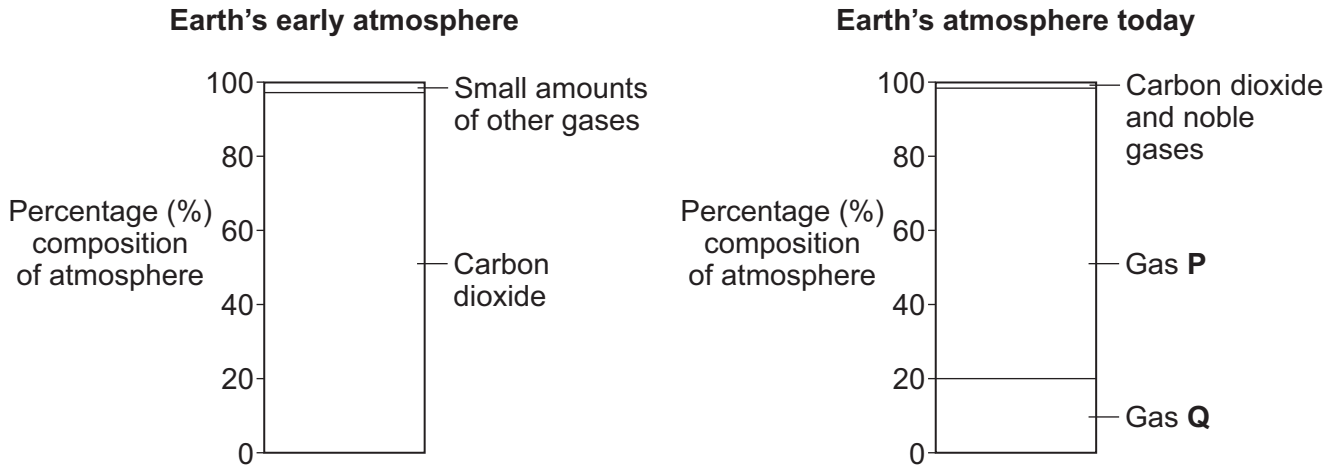
- 1 an alkane.
- 2 an alkene.
- 3 a saturated hydrocarbon.
- 4 a polymer.

Turn over for the next question

Turn over ►

QUESTION NINE

The bar charts show the composition of Earth's early atmosphere and the composition of the Earth's atmosphere today.



9A What is gas **P**?

- 1 carbon dioxide
- 2 oxygen
- 3 nitrogen
- 4 sulfur dioxide

9B The Earth's early atmosphere is thought to have contained a small amount of a hydrocarbon gas.

This gas is . . .

- 1 ammonia.
- 2 methane.
- 3 hydrogen.
- 4 helium.

9C Fossil fuels consist mainly of carbon compounds.

What was the **initial** source of the carbon to form these compounds?

- 1 the skeletons of dead animals
- 2 carbonate rocks
- 3 the atmosphere
- 4 the oceans

9D There was no oxygen in the Earth's atmosphere until 2 billion years ago because . . .

- 1 it had been locked up in sedimentary rocks as carbonates.
- 2 it had been used in the formation of fossil fuels.
- 3 there were no plants on the Earth's surface.
- 4 it had reacted with the ammonia to form nitrogen.

END OF TEST

Turn over ►

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

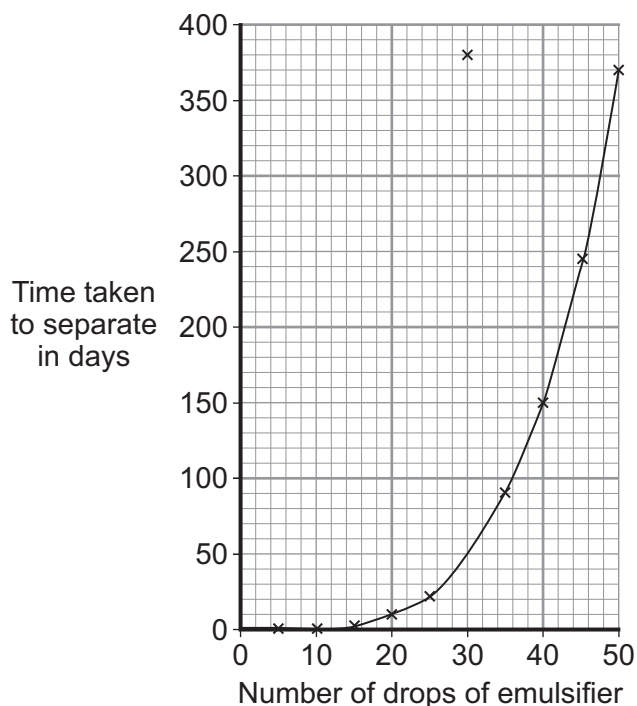
The water and oil used in making a salad dressing will separate if allowed to stand.

A scientist wanted to know how much emulsifier she needed to add to stop the oil and water in salad dressing from separating.

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- She shook the mixture and timed how long it took for the mixture to begin separating.

She repeated the experiment, adding different numbers of drops of emulsifier each time.

She used her results to plot a line graph.



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

A 38

B 90

C 380

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1	It is an anomalous result
2	It is the time, in days, before separation of the oil and water when 35 drops of emulsifier are used
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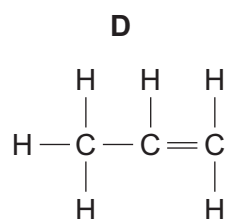
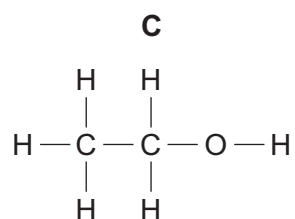
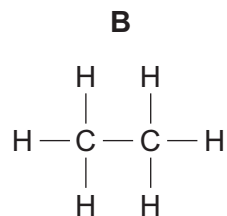
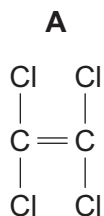
Turn over for the next question

Turn over ►

QUESTION TWO

This question is about the formulae of four compounds.

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



1	It is an unsaturated hydrocarbon.
2	It is a saturated hydrocarbon.
3	It is not a hydrocarbon and will burn to produce carbon dioxide and water vapour.
4	It is not a hydrocarbon but can form a polymer.

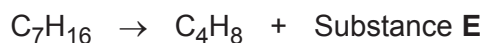
Section TwoQuestions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION THREE

The equation for the thermal decomposition of a hydrocarbon is:

**3A** What name is given to this process?

- 1 combustion
- 2 condensation
- 3 cracking
- 4 hydrogenation

3B In this process, . . .

- 1 hot gases are mixed with water.
- 2 hot vapours are passed over a hot catalyst.
- 3 liquids are mixed with water.
- 4 liquids are passed over a catalyst.

3C Substance **E** will have the formula . . .

- 1 CH_4
- 2 C_3H_6
- 3 C_3H_8
- 4 C_9H_{20}

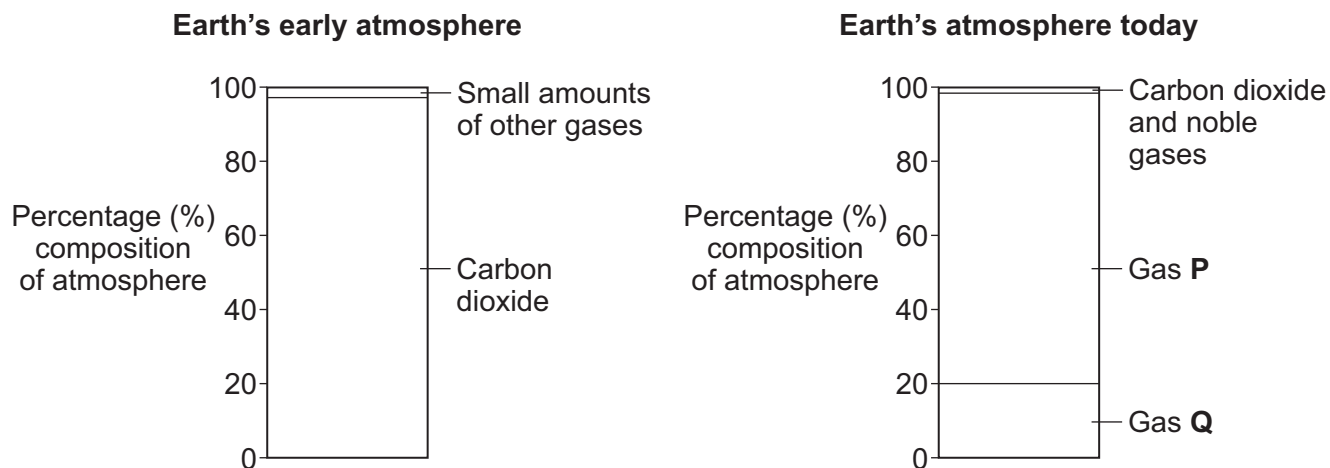
3D The substance with the formula C_4H_8 is . . .

- 1 an alkane.
- 2 an alkene.
- 3 a saturated hydrocarbon.
- 4 a polymer.

Turn over ►

QUESTION FOUR

The bar charts show the composition of Earth's early atmosphere and the composition of the Earth's atmosphere today.



4A What is gas **P**?

- 1 carbon dioxide
- 2 oxygen
- 3 nitrogen
- 4 sulfur dioxide

4B The Earth's early atmosphere is thought to have contained a small amount of a hydrocarbon gas.

This gas is . . .

- 1 ammonia.
- 2 methane.
- 3 hydrogen.
- 4 helium.

4C Fossil fuels consist mainly of carbon compounds.

What was the **initial** source of the carbon to form these compounds?

- 1 the skeletons of dead animals
- 2 carbonate rocks
- 3 the atmosphere
- 4 the oceans

4D There was no oxygen in the Earth's atmosphere until 2 billion years ago because . . .

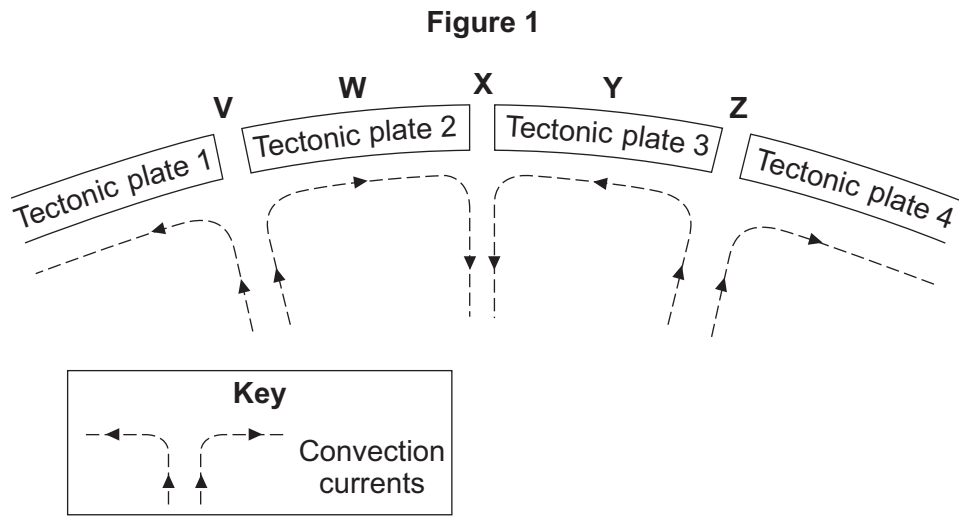
- 1 it had been locked up in sedimentary rocks as carbonates.
- 2 it had been used in the formation of fossil fuels.
- 3 there were no plants on the Earth's surface.
- 4 it had reacted with the ammonia to form nitrogen.

Turn over for the next question

Turn over ►

QUESTION FIVE

Figure 1 represents a section close to the surface of the Earth.



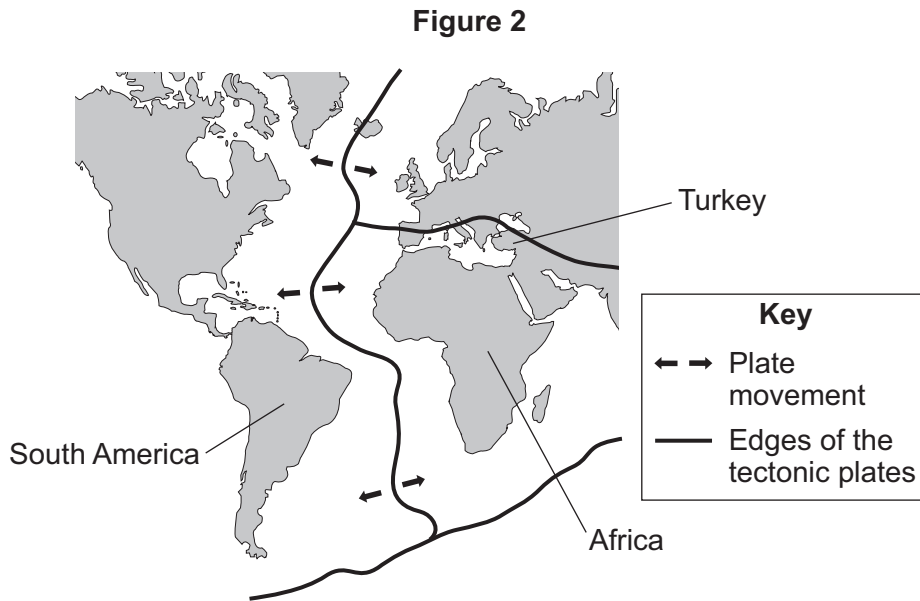
5A Which row in the table correctly shows the tectonic plates that are moving towards each other, and the speed with which they are moving?

	Tectonic plates moving towards each other	Speed
1	Tectonic plates 3 and 4	A few centimetres a year
2	Tectonic plates 2 and 3	A few metres a year
3	Tectonic plates 2 and 3	A few centimetres a year
4	Tectonic plates 3 and 4	A few metres a year

5B At which points on **Figure 1** would earthquakes be most likely to occur?

- 1** V, W and Y
- 2** V, X and Z
- 3** W, Y and Z
- 4** X, Y and Z

Figure 2 shows some information about tectonic plates.



5C The plate boundary between South America and Africa is shown on **Figure 2**.

Which positions on **Figure 1** could represent this plate boundary?

- 1 V and X
- 2 V and Z
- 3 W and X
- 4 W and Z

5D Turkey has a lot of earthquakes.

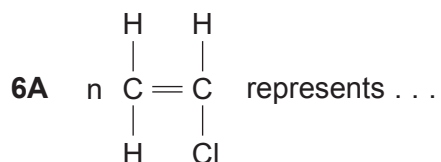
People are not sure when the next earthquake will happen because . . .

- 1 earthquakes happen only about every five or ten years.
- 2 scientists cannot measure the strength of an earthquake accurately.
- 3 the models that scientists use cannot give accurate predictions.
- 4 tectonic plates move towards or away from each other in different places.

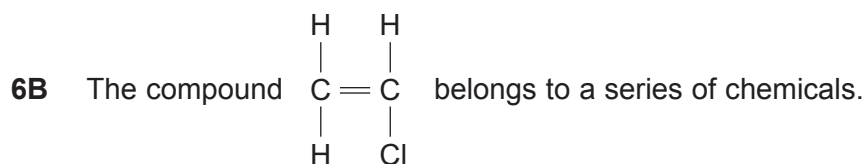
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QUESTION SIX

The equation shows how poly(chloroethene) is made.



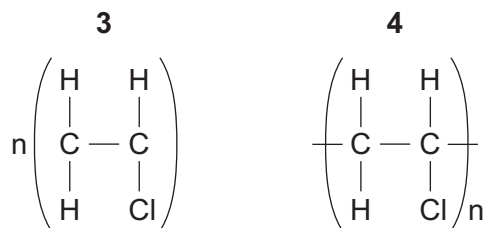
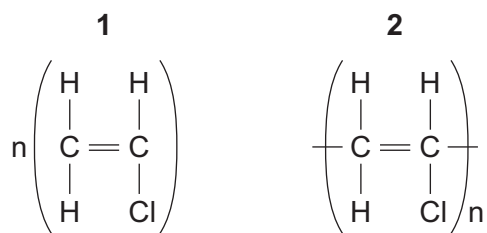
- 1 one molecule of chloroethane.
- 2 one molecule of chloroethene.
- 3 many molecules of chloroethane.
- 4 many molecules of chloroethene.



The general formula for this series of chemicals is . . .

- 1 $\text{C}_n\text{H}_n\text{Cl}$
- 2 $\text{C}_n\text{H}_{2n-1}\text{Cl}$
- 3 $\text{C}_n\text{H}_{n-1}\text{Cl}$
- 4 $\text{C}_n\text{H}_{2n}\text{Cl}$

6C The formula for poly(chloroethene) is . . .



6D The word *thermosoftening* is used to describe how poly(chloroethene) behaves when heated.

This means that poly(chloroethene) must therefore . . .

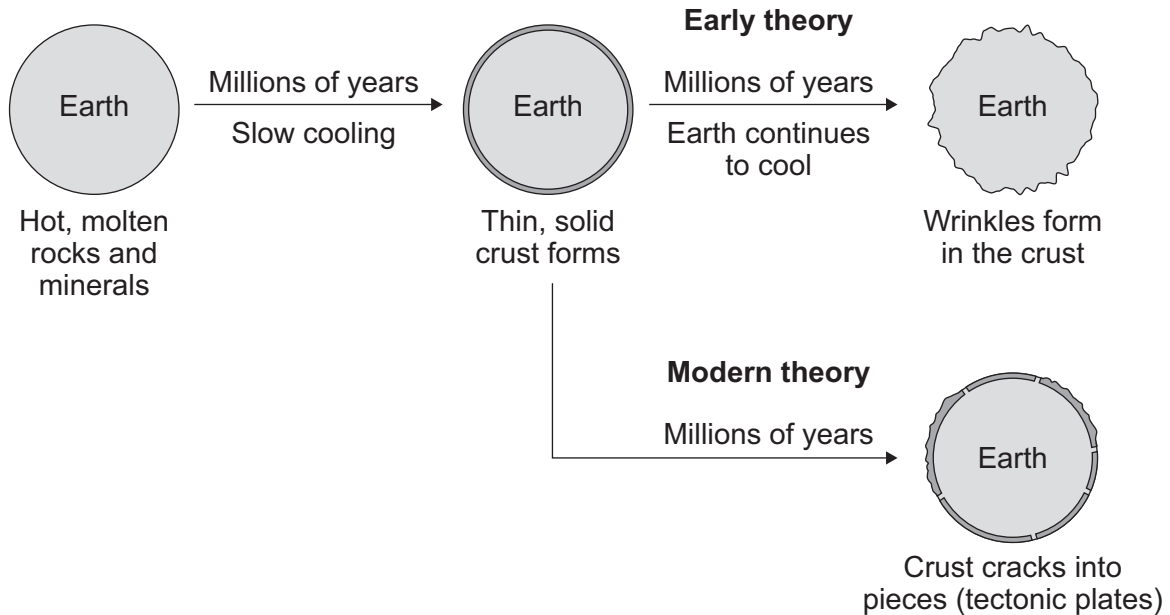
- 1 **not** be used for packaging in warm countries because it will become brittle.
- 2 only contain short chain molecules that move around easily on heating.
- 3 have chemical bonds between the chains, which strengthen on heating.
- 4 be capable of being shaped on heating.

Turn over for the next question

Turn over ►

QUESTION SEVEN

The flow diagram shows two different theories that scientists used to explain the formation of mountain ranges on Earth.



7A How are mountain ranges formed according to the **Early theory**?

- 1 The Earth cools and shrinks, forming wrinkles in the crust.
- 2 The Earth heats and expands so molten rock and minerals escape through the crust.
- 3 The Earth cools and shrinks so the crust cracks into pieces.
- 4 The Earth heats and expands causing tectonic plates to rise.

7B According to the **Modern theory**, mountain ranges form . . .

- 1 when tectonic plates float up from the sea bed.
- 2 when earthquakes cause some of the tectonic plates to rise.
- 3 because the Earth is heating up, causing tectonic plates to bend.
- 4 when the tectonic plates move towards each other.

Scientists have suggested that the Earth has a core, mantle and crust.

One theory is that the core is made of iron and nickel.

A later and controversial theory is that the core is like a nuclear reactor made of the radioactive elements uranium and plutonium.

7C Why are scientists unable to prove which theory about the core is correct?

- 1 Iron and nickel are also radioactive elements.
- 2 It is not possible to drill boreholes to the core.
- 3 Tectonic plates are moving too quickly to allow drilling through the crust.
- 4 It is too dangerous to drill into the core if it contains radioactive elements.

7D Which row in the table shows how the 'controversial theory' can be used to explain why the Earth's tectonic plates move?

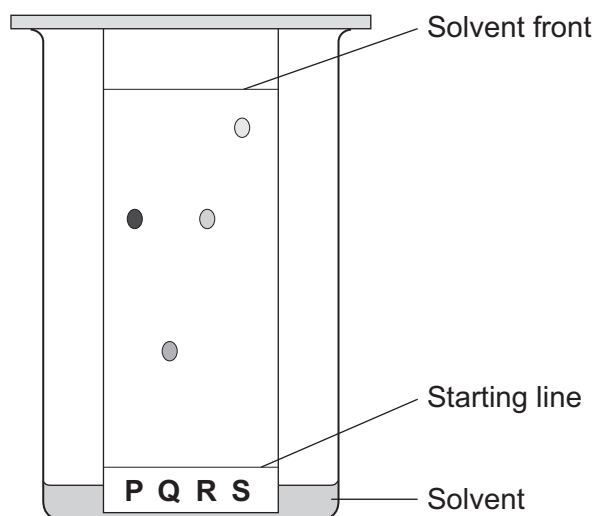
1	core releases energy	convection currents in the mantle move the plates
2	core absorbs energy	convection currents in the mantle move the plates
3	core releases energy	convection currents in the core move the plates
4	core absorbs energy	convection currents in the core move the plates

Turn over for the next question

Turn over ►

QUESTION EIGHT

The diagram shows an investigation using paper chromatography.



As the solvent rises up the paper it moves the colours depending on their attraction for the solvent and the paper.

The greater the attraction of a colour for the solvent and the less the attraction for the paper, the further the colour moves.

An R_f value is defined as:

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

The R_f value for a particular substance is different in different solvents.

8A In the investigation shown in the diagram, what was the R_f value of colour **S**?

- 1 0.0
- 2 0.5
- 3 0.7
- 4 0.9

The R_f values for the colours, **P**, **Q**, **R** and **S**, in four different solvents, are shown in the table.

	Solvent			
	Water	Ethanol	Propanone	Tetrachloromethane
Colour P	0.5	0.9	0.7	0.5
Colour Q	0.0	0.8	0.6	0.2
Colour R	0.5	0.7	0.6	0.1
Colour S	0.2	0.6	0.4	0.2

8B From the information on the diagram and in the table, it is correct to say that . . .

- 1 colours **P** and **R** are the same.
- 2 colours **Q** and **S** are the same.
- 3 **P**, **Q**, **R** and **S** are four different colours.
- 4 chromatography works on any colour.

8C Which colour is **not** soluble in water?

- 1 **P**
- 2 **Q**
- 3 **R**
- 4 **S**

8D Using the data in the table above, which solvent could be used to separate a mixture of all four colours, **P**, **Q**, **R** and **S**?

- 1 water
- 2 ethanol
- 3 propanone
- 4 tetrachloromethane

Turn over for the next question

Turn over ►

QUESTION NINE

Read the information about fuels.

- Petroleum diesel fuel is made from crude oil. Biodiesel fuel is made from vegetable oils.
- The use of biodiesel will reduce the amount of crude oil used. However, large areas of agricultural land will be needed to grow the crops from which the vegetable oils are extracted.
- In a diesel engine, the fuel flows from the fuel tank, along fuel pipes, to the combustion chamber where it ignites.
- Biodiesel is thicker than petroleum diesel and is more difficult to ignite (has a lower cetane number).
- Biodiesel also has a higher melting point than petroleum diesel.
- Biodiesel biodegrades in about a quarter of the time that it takes for petroleum diesel to biodegrade.

9A Research into the production and use of biodiesel continues.

The main reason for the research is that . . .

- 1 many countries have large areas of undeveloped land.
- 2 crude oil is a non-renewable energy source.
- 3 no harmful gases are produced when biodiesel burns.
- 4 biodiesel can only be produced from a small number of plant species.

9B For biodiesel to work effectively in an engine it should have . . .

- 1 a high melting point.
- 2 a high viscosity.
- 3 a high cetane number.
- 4 a high boiling point.

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

- 1 Plants use carbon dioxide for photosynthesis.
- 2 There are fewer alkanes in biodiesel.
- 3 Biodiesel does not contain any hydrocarbons.
- 4 Plants produce carbon dioxide in respiration.

9D Spills of fuels from oil tankers cause considerable damage in the marine environment.

Spills of biodiesel are less harmful to the environment than spills of petroleum diesel because biodiesel . . .

- 1 would 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 more quickly.

END OF TEST

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