

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
March 2009



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

CHY1BP

CHEMISTRY
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Wednesday 4 March 2009 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

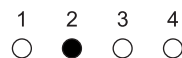
Instructions

- 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

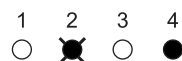
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

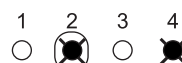


- Do **not** extend beyond the circles.

- 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

This question is about gases.

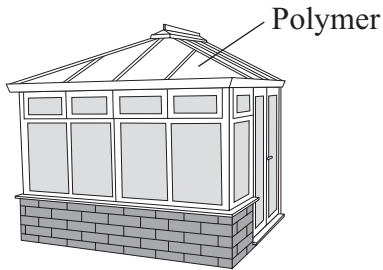
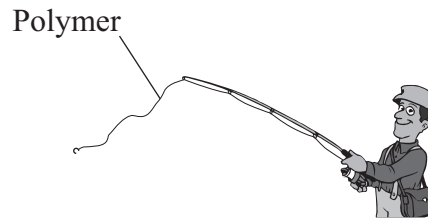
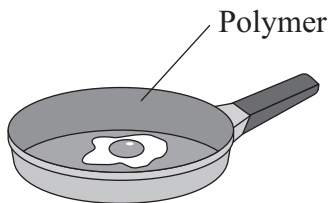
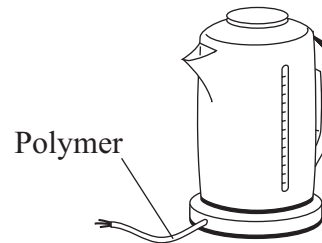
Match gases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

- A** oxygen
- B** noble gas
- C** air
- D** water vapour

1	It condensed to form the Earth's oceans.
2	It is a mixture.
3	It makes up about 20% of the Earth's atmosphere.
4	It is used in discharge tubes.

QUESTION TWO

The drawings show four different uses for polymers.

Use A**Use B****Use C****Use D**

The table shows some of the properties of four different polymers.

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

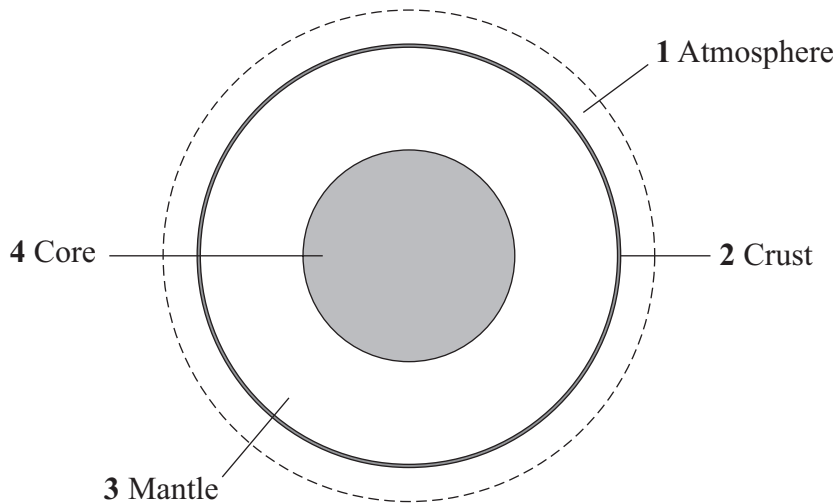
Properties of the polymer	
1	strong, does not rot and can be pulled into fine threads
2	tough, slippery and can be heated strongly
3	flexible, can be coloured and is a good electrical insulator
4	rigid, transparent and can easily be cut into any shape

Turn over ►

QUESTION THREE

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 the plates drift apart
- B** where convection currents occur, creating plate movements
- C** where global warming occurs
- D** where iron and nickel are found as metals

QUESTION FOUR

This question is about vegetable oils.

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

- A** spreads
- B** additives
- C** fuels
- D** emulsions

Vegetable oils do not mix with water, but when shaken with water they form . . . **1**

Vegetable oils can be burned as . . . **2** . . . or hardened to form . . . **3**

The shelf-life of the vegetable oils after hardening can be improved by using . . . **4**

Turn over for the next question

Turn over ►

QUESTION FIVE

This question is about four vegetable oils.

	Type of oil	Melting point in °C	Iodine number	Cetane number
A	Palm	35	63	65
B	Rapeseed	5	100	45
C	Sunflower	-18	120	60
D	Corn	-15	125	53

The higher the iodine number, the more unsaturated the oil is.

The higher the cetane number, the easier it is to set the oil alight with a flame.

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

1	the oil that is most difficult to ignite
2	the oil with the lowest melting point
3	the oil that will be first to solidify if cooled from 100 °C
4	the oil with the highest number of double bonds in each molecule

Turn over for the next question

Turn over ►

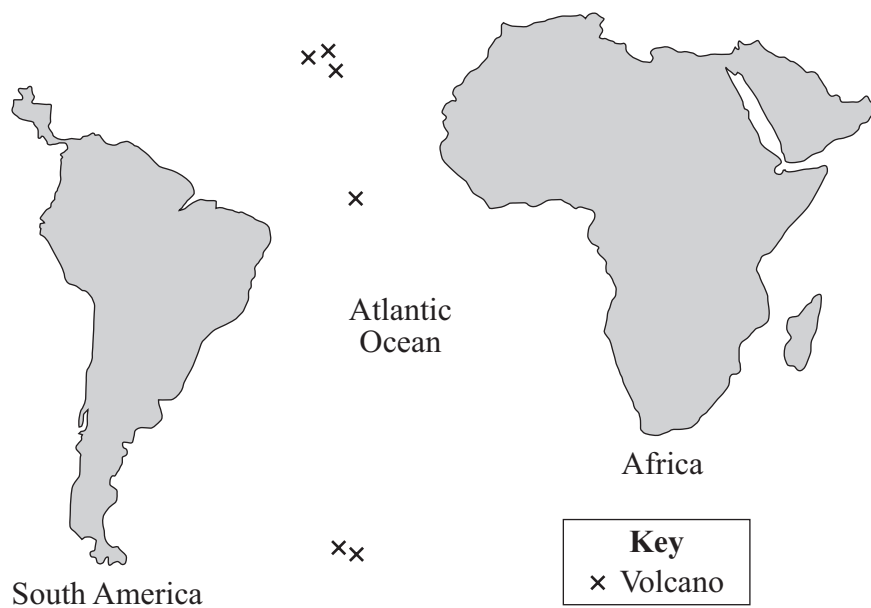
SECTION TWOQuestions **SIX** to **NINE**.

Each of these questions has four parts.

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

QUESTION SIX

The diagram shows the positions of South America and Africa.



Early in the 20th century, a scientist called Alfred Wegener put forward a theory that South America and Africa had once been joined together, but since then had separated.

6A What name is given to this separation of the continents?

- 1 crustal shrinking
- 2 continental expansion
- 3 continental drift
- 4 crustal cracking

6B Many scientists did **not** accept Wegener's theory because . . .

- 1 they thought that continents only moved towards each other.
- 2 they thought that continents moved too slowly.
- 3 they had no way of explaining how the continents could move.
- 4 they believed that the Earth was expanding.

6C Later in the 20th century, more scientists accepted Wegener's theory.

What new evidence made them change their ideas?

- 1 the existence of tectonic plates
- 2 the positions of volcanoes
- 3 the shapes of the continents
- 4 the sizes of the continents

6D Volcanic eruptions occur in the places shown on the diagram.

This is most likely to be because at these places . . .

- 1 the Earth's crust is very thick.
- 2 the Earth's crust is shrinking.
- 3 there is a boundary between tectonic plates.
- 4 earthquakes happen only rarely.

Turn over for the next question

Turn over ►

QUESTION SEVEN

Ice-cream is a foam because it has small air bubbles trapped inside it.

Ice-cream is sold by volume. Ice-cream manufacturers increase the volume of air in a product so that they make more money.

A student investigated the volume of air in four different ice-creams, **K**, **L**, **M** and **N**. The four ice-creams were kept in the same freezer.

For each ice-cream, the following procedure was carried out:

- the student measured the volume of some ice-cream straight from the freezer
- the ice-cream was then melted down, allowing the air to escape
- the volume of the ice-cream was re-measured to give the final volume.

The results are shown in the table.

Ice-cream	K	L	M	N
Initial volume in cm ³	100	100	100	100
Final volume in cm ³	96	91	87	95

7A Which ice-cream originally contained the most air?

- 1** **K**
- 2** **L**
- 3** **M**
- 4** **N**

7B The investigation was fair because . . .

- 1** the same volume of ice-cream was used each time.
- 2** four samples of ice-cream were used.
- 3** the investigation was repeated.
- 4** the temperature of the ice-creams was kept constant during the investigation.

7C The student could have improved the reliability of the investigation by . . .

- 1 allowing the ice-cream to melt over a longer period of time.
- 2 checking that the temperature was constant throughout the investigation.
- 3 using more than four ice-cream samples.
- 4 repeating the investigation.

7D Ice-creams often contain additives such as colourings.

These can be identified by using . . .

- 1 filtration.
- 2 hydrogenation.
- 3 chromatography.
- 4 emulsification.

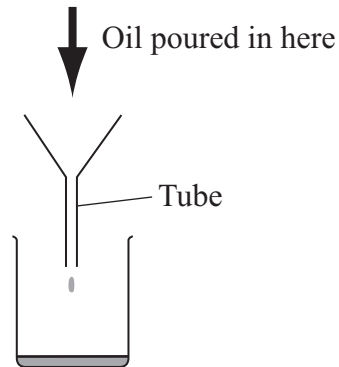
Turn over for the next question

Turn over ►

QUESTION EIGHT

Viscosity indicates the ability of a liquid to flow. Viscosities can be compared by measuring the time taken for a known volume of oil to flow through a tube of a given diameter.

The longer the time taken to flow through the tube, the more viscous the oil is.



The table below shows how the viscosity of an oil varies with the temperature of the oil.

Temperature of oil in °C	Time taken for all of the oil to pass through the tube, in seconds
20	70
30	52
40	37
50	35
60	18
70	10

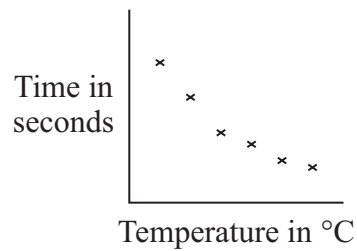
8A Which one of the following describes the relationship between the temperature of the oil and its viscosity?

- 1 The oil becomes more viscous as the temperature increases.
- 2 The oil becomes less viscous as the temperature increases.
- 3 Viscosity remains constant when the temperature changes.
- 4 There is no relationship between temperature and viscosity.

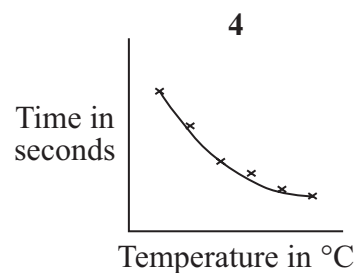
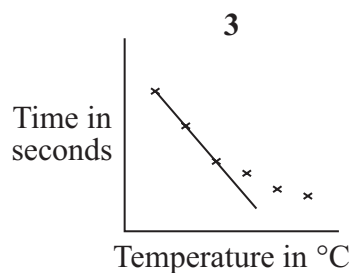
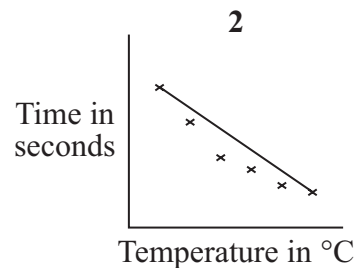
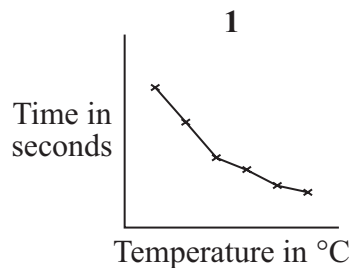
8B The independent variable is . . .

- 1 temperature.
- 2 viscosity.
- 3 time.
- 4 type of oil.

8C The results plotted on a temperature–time graph looked like this.



Which one of the following shows the most appropriate line for the plotted results?



8D The precision of this experiment could be improved by . . .

- 1 taking readings at smaller temperature intervals.
- 2 using two different oils.
- 3 repeating the experiment at 50 °C.
- 4 using a larger diameter tube for the oil to pass through.

Turn over ►

QUESTION NINE

Scientists have developed a process to convert plastics such as nylon back to their original monomers.

9A What is the monomer used to make the polymer called poly(chloroethene)?

- 1 ethene
- 2 ethane
- 3 chloroethene
- 4 chloroethane

9B Which of the following is **not** an advantage of returning a polymer back to its monomer?

- 1 reduces the amount of plastic going into landfill sites
- 2 oil reserves will last longer
- 3 uses up excess supplies of monomers
- 4 avoids recycling of plastics

9C Plastics that can be broken down by microorganisms are described as . . .

- 1 unsaturated.
- 2 thermosetting.
- 3 thermoplastic.
- 4 biodegradable.

9D At a supermarket, customers can get vouchers for school equipment when they use their own bags for shopping.

The advantage of this scheme is that . . .

- 1 the supermarket can order more bags.
- 2 less plastic has to be manufactured.
- 3 queues will be shorter.
- 4 the plastic will be easier to recycle.

END OF TEST

There are no questions printed on this page

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 four vegetable oils.

	Type of oil	Melting point in °C	Iodine number	Cetane number
A	Palm	35	63	65
B	Rapeseed	5	100	45
C	Sunflower	–18	120	60
D	Corn	–15	125	53

The higher the iodine number, the more unsaturated the oil is.

The higher the cetane number, the easier it is to set the oil alight with a flame.

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

1	the oil that is most difficult to ignite
2	the oil with the lowest melting point
3	the oil that will be first to solidify if cooled from 100 °C
4	the oil with the highest number of double bonds in each molecule

QUESTION TWO

This question is about vegetable oils.

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

- A** catalysed
- B** emulsified
- C** unsaturated
- D** hardened

The amount of double carbon carbon bonds in an oil can be estimated by reacting the oil with bromine. If the bromine reacts, this shows the oil to be . . . **1**

The double carbon carbon bonds in the oil can be removed by heating with hydrogen in the presence of nickel. This is an example of a reaction that has been . . . **2**

As a result of this reaction with hydrogen, the oil is . . . **3**

A vegetable oil can be . . . **4** . . . by shaking the oil with water.

Turn over for the next question

Turn over ►

SECTION TWOQuestions **THREE** to **NINE**.

Each of these questions has four parts.

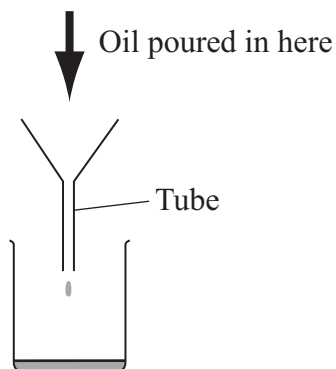
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Viscosity indicates the ability of a liquid to flow. Viscosities can be compared by measuring the time taken for a known volume of oil to flow through a tube of a given diameter.

The longer the time taken to flow through the tube, the more viscous the oil is.



The table below shows how the viscosity of an oil varies with the temperature of the oil.

Temperature of oil in °C	Time taken for all of the oil to pass through the tube, in seconds
20	70
30	52
40	37
50	35
60	18
70	10

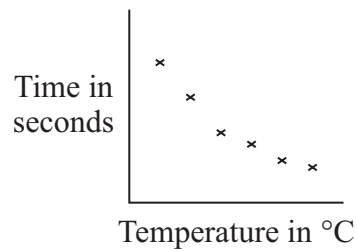
3A Which one of the following describes the relationship between the temperature of the oil and its viscosity?

- 1 The oil becomes more viscous as the temperature increases.
- 2 The oil becomes less viscous as the temperature increases.
- 3 Viscosity remains constant when the temperature changes.
- 4 There is no relationship between temperature and viscosity.

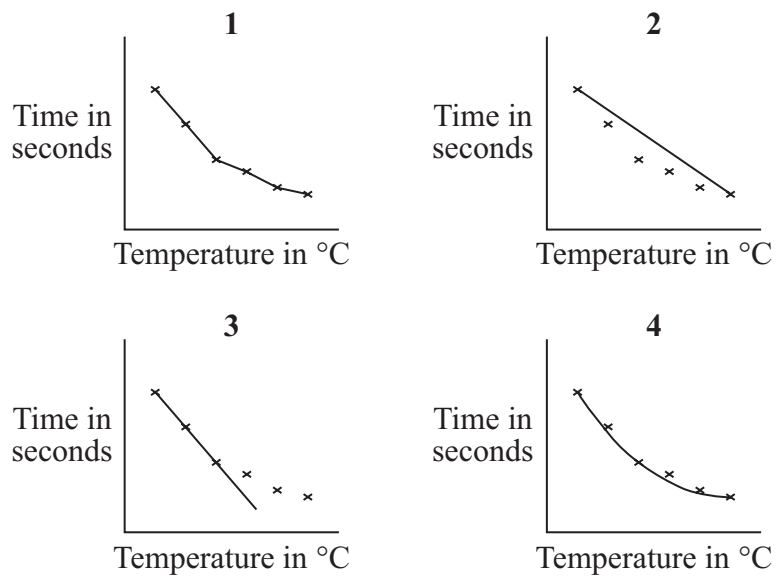
3B The independent variable is . . .

- 1 temperature.
- 2 viscosity.
- 3 time.
- 4 type of oil.

3C The results plotted on a temperature–time graph looked like this.



Which one of the following shows the most appropriate line for the plotted results?



3D The precision of this experiment could be improved by . . .

- 1 taking readings at smaller temperature intervals.
- 2 using two different oils.
- 3 repeating the experiment at 50 °C.
- 4 using a larger diameter tube for the oil to pass through.

Turn over ►

QUESTION FOUR

Scientists have developed a process to convert plastics such as nylon back to their original monomers.

4A What is the monomer used to make the polymer called poly(chloroethene)?

- 1 ethene
- 2 ethane
- 3 chloroethene
- 4 chloroethane

4B Which of the following is **not** an advantage of returning a polymer back to its monomer?

- 1 reduces the amount of plastic going into landfill sites
- 2 oil reserves will last longer
- 3 uses up excess supplies of monomers
- 4 avoids recycling of plastics

4C Plastics that can be broken down by microorganisms are described as . . .

- 1 unsaturated.
- 2 thermosetting.
- 3 thermoplastic.
- 4 biodegradable.

4D At a supermarket, customers can get vouchers for school equipment when they use their own bags for shopping.

The advantage of this scheme is that . . .

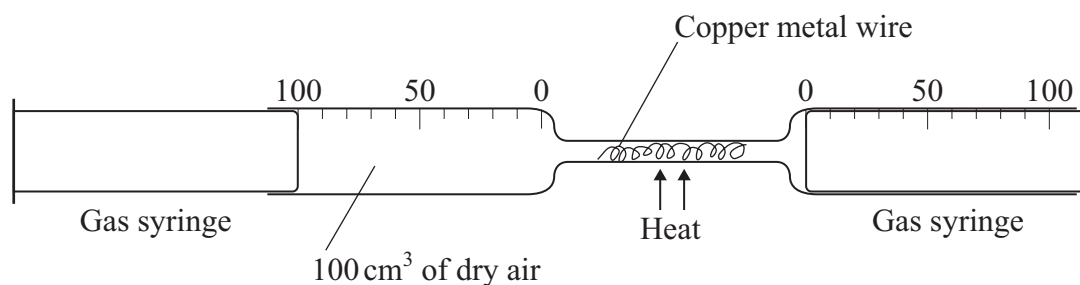
- 1 the supermarket can order more bags.
- 2 less plastic has to be manufactured.
- 3 queues will be shorter.
- 4 the plastic will be easier to recycle.

Turn over for the next question

Turn over ►

QUESTION FIVE

The diagram shows some apparatus that is used to investigate the composition of air.



100 cm³ of dry air was passed backwards and forwards over heated copper metal wire, using the gas syringes.

The copper reacts with oxygen in the dry air to produce copper oxide.

The process was continued until there was no further reduction in the volume of the gases in the syringes. The apparatus was then allowed to cool.

5A Why is it important to continue heating to a constant volume?

- 1 The volume of air is greater at higher temperatures.
- 2 Copper oxide will decompose as the apparatus cools.
- 3 To be sure that all the oxygen in the air has reacted.
- 4 So that all of the copper has been converted to copper oxide.

5B What was the final volume of gas left in the syringes at the end of the experiment?

- 1 40 cm³
- 2 60 cm³
- 3 80 cm³
- 4 100 cm³

5C Which substance will be the main gas left in the syringes at the end of the experiment?

- 1 nitrogen
- 2 oxygen
- 3 carbon dioxide
- 4 a noble gas

5D Which of the following is the balanced symbol equation for the reaction between copper and oxygen?

- 1 $\text{Cu} + \text{O}_2 \rightarrow \text{CuO}$
- 2 $\text{Cu} + 2\text{O}_2 \rightarrow \text{CuO}$
- 3 $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$
- 4 $2\text{Cu} + 2\text{O}_2 \rightarrow 2\text{CuO}$

Turn over for the next question

Turn over ►

QUESTION SIX

This question is about cracking large hydrocarbon molecules.

Cracking is achieved by using either a high temperature and pressure without a catalyst, or a low temperature and pressure with a catalyst.

Whichever method is chosen:

- the energy for cracking is provided by burning fossil fuels;
- the zeolite catalysts used are not very expensive;
- the catalyst is not used up in the process;
- the cracking plant is often built near the oil refinery.

6A Which of the following occurs during cracking?

- 1 Small hydrocarbon molecules join together.
- 2 The hydrocarbon molecules become saturated.
- 3 The hydrocarbon molecules react together.
- 4 The hydrocarbon molecules are decomposed.

6B In which equation do the products include two different alkenes?

- 1 $C_{15}H_{32} \rightarrow 2C_2H_4 + C_3H_6 + C_8H_{18}$
- 2 $C_{15}H_{32} \rightarrow C_2H_2 + C_5H_{10} + C_8H_{18} + H_2$
- 3 $C_{15}H_{32} \rightarrow C_8H_{18} + C_7H_{14}$
- 4 $C_{15}H_{32} \rightarrow C_7H_{16} + C_8H_{16}$

6C Which of the following shows only products that could be directly obtained by cracking $C_{10}H_{22}$?

- 1 alkanes up to $C_{20}H_{44}$, hydrogen and ethene
- 2 alkanes up to C_8H_{18} , carbon dioxide and ethene
- 3 propene, poly(ethene) and hydrogen
- 4 alkanes up to C_8H_{18} , ethene and propene

6D These are the formulae for three hydrocarbons:



Which row in the table shows the hydrocarbons that could form polymers, and gives the correct reason why they can polymerise?

	Hydrocarbons	Reason
1	C_2H_4 and C_2H_6	their molecules are saturated
2	C_2H_4 and C_3H_6	their molecules have a double carbon carbon bond
3	C_2H_4 and C_3H_6	their molecules are saturated
4	C_2H_4 and C_2H_6	their molecules have a double carbon carbon bond

Turn over for the next question

Turn over ►

QUESTION SEVEN

This question is about materials used for carrier bags.

7A Plastic bags are made from poly(ethene).

What is the best description of the manufacture of poly(ethene)?

- 1** Ethene molecules join together, keeping their double bonds.
- 2** Unsaturated ethene molecules join together to make long saturated molecules.
- 3** Ethane molecules line up and join 'end to end'.
- 4** Ethane molecules are made into poly(ethene) using high pressure and a catalyst.

7B Which row in the table correctly identifies an advantage and a disadvantage of using poly(ethene) to make bags?

	Advantage	Disadvantage
1	easily coloured and printed	very expensive to make
2	airtight	high melting point
3	lightweight	not biodegradable
4	easy to produce	made from renewable sources

Supermarkets sell bags made of jute to customers. These bags can be re-used many times.

Jute is made from plant material, but jute bags are more expensive to make than plastic bags.

7C What is the best description of the benefits of using jute as a replacement for poly(ethene) in bags?

- 1** It is made from renewable sources and it will not rot.
- 2** It is made from non-renewable sources that remove carbon dioxide from the atmosphere.
- 3** It saves on the use of oil and helps to reduce the waste that goes to landfill.
- 4** It saves the customer money and it is biodegradable.

7D Which of the following questions is unsuitable for scientific investigation?

- 1 Can plastics be made that are easily biodegradable?
- 2 Should there be laws to make supermarkets give up using plastic bags?
- 3 Can plastics be made that biodegrade as easily as jute?
- 4 Are there better materials than plastic and jute to use for making carrier bags?

Turn over for the next question

Turn over ►

QUESTION EIGHT

Movements in the Earth's crust can cause dramatic events such as volcanic eruptions.

8A Which of the following does **not** happen at plate boundaries?

- 1 Volcanoes form and lava is released.
- 2 Heat is produced by radioactive processes.
- 3 Subduction occurs and rocks melt.
- 4 Sea-floor spreading occurs and ridges form.

8B Scientists can predict with reasonable accuracy . . .

- 1 the areas in which volcanoes are likely to occur from data about previous eruptions.
- 2 the position of a volcanic eruption from movements of convection currents in the mantle.
- 3 the size of a volcanic eruption from the frequency of previous eruptions in the area.
- 4 the number of volcanic eruptions from slight movements of the Earth's crust.

Scientists measure the temperature of the gases coming out of a volcano. Raised temperatures are an indication of increased volcanic activity.

8C Which row in the table shows:

- the most appropriate method to present the data
- the expected trend which might predict an eruption?

	Method of presenting the data	Expected trend
1	line graph	direct proportionality
2	scattergram	positive correlation
3	bar chart	increasing volume of bars
4	pie chart	increase in the area of the sectors representing higher temperatures

8D The temperatures recorded by the scientists were found to be reproducible but consistently lower than the accurate value.

This was probably due to . . .

- 1 their readings being invalid.
- 2 their readings being taken with thermometers that were **not** sensitive enough.
- 3 their readings being averages that included anomalous results.
- 4 their thermometers being incorrectly calibrated.

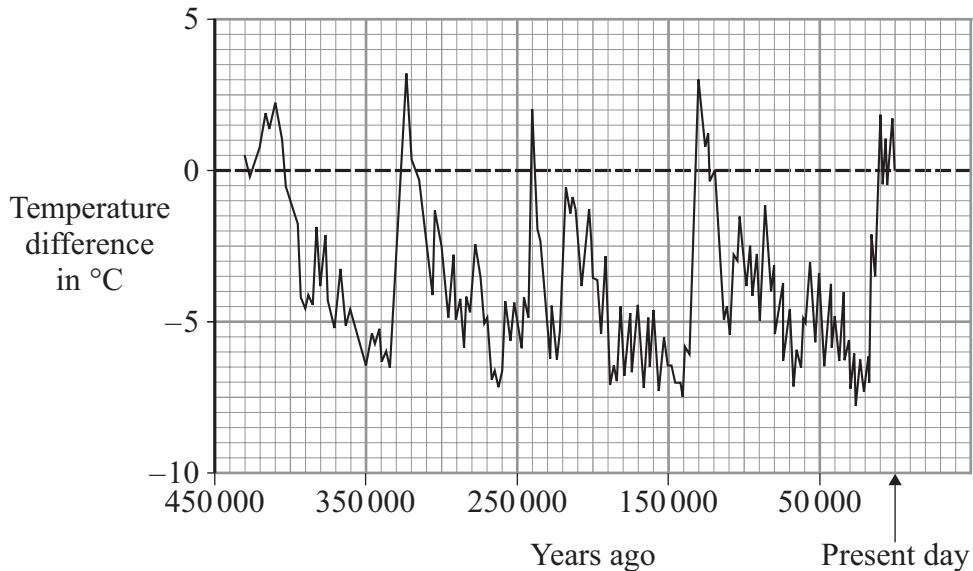
Turn over for the next question

Turn over ►

QUESTION NINE

Humans have only been on Earth for about the past 25 000 years. Before that, the Earth's climate had been changing between ice ages and much warmer periods when all the ice melted.

The graph below shows estimated global temperatures over the past 450 000 years compared with the global temperature today.



9A Which of the following can be deduced from the graph?

- 1 The graph shows that the onset of an ice age is more rapid than its retreat.
- 2 The gradual rise in temperature that occurs periodically is due to the increased burning of fossil fuels.
- 3 The Earth's climate appears to be entering another ice age.
- 4 It takes about 25 000 years on average for all the ice to melt from each ice age.

9B The estimated global temperature over the past 450 000 years has . . .

- 1 changed within a range of about 10 °C.
- 2 on average been 5 °C lower than the Earth's present temperature.
- 3 never been more than 3 °C above the Earth's present temperature.
- 4 generally been higher than the present temperature.

9C The graph has . . .

- 1 a continuous variable plotted against a categoric variable.
- 2 a discrete variable plotted against a control variable.
- 3 a discrete variable plotted against a discrete variable.
- 4 a continuous variable plotted against a continuous variable.

9D Which of the following suggests that the Earth has cooled since its formation?

- 1 the gradual rise in the amount of carbon dioxide in the atmosphere
- 2 the condensation of water vapour to form oceans
- 3 the gradual formation of mountains due to the crust cooling
- 4 the reduction in the frequency of earthquakes

END OF TEST

There are no questions printed on this page