| Surname | | Other Names | |
|---|---|---|---|
| Centre Number | | | Candidate Number | | | | |
| Candidate Signature | | | | | | | | | |

General Certificate of Secondary Education
March 2008

**SCIENCE A** **CHY1BP**
**Unit Chemistry C1b (Oils, Earth and Atmosphere)**

**CHEMISTRY**
**Unit Chemistry C1b (Oils, Earth and Atmosphere)**

Wednesday 5 March 2008 Morning Session

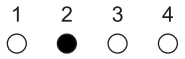
**For this paper you must have:**
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

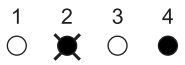
Time allowed: 30 minutes

**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.

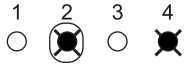
**Instructions for recording answers**
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:




- 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 **SIX**.

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 found in the atmosphere.

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

**A** argon (noble gas)

**B** carbon dioxide

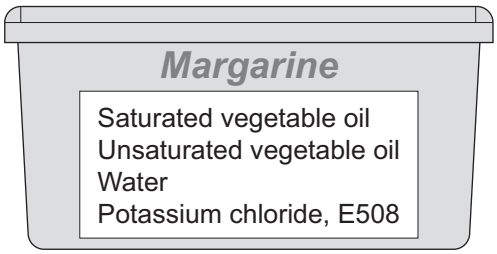
**C** nitrogen

**D** oxygen

| | |
|---|---|
| **1** | It makes up the largest percentage of today's atmosphere. |
| **2** | It is used in electric discharge tubes. |
| **3** | It is released into the atmosphere when fossil fuels burn. |
| **4** | It is given out by plants during photosynthesis. |

## QUESTION TWO

Margarine is an emulsion.




Match ingredients, **A**, **B**, **C** and **D**, on the packet of margarine with the numbers **1–4** in the table.

**A** saturated vegetable oil

**B** unsaturated vegetable oil

**C** water

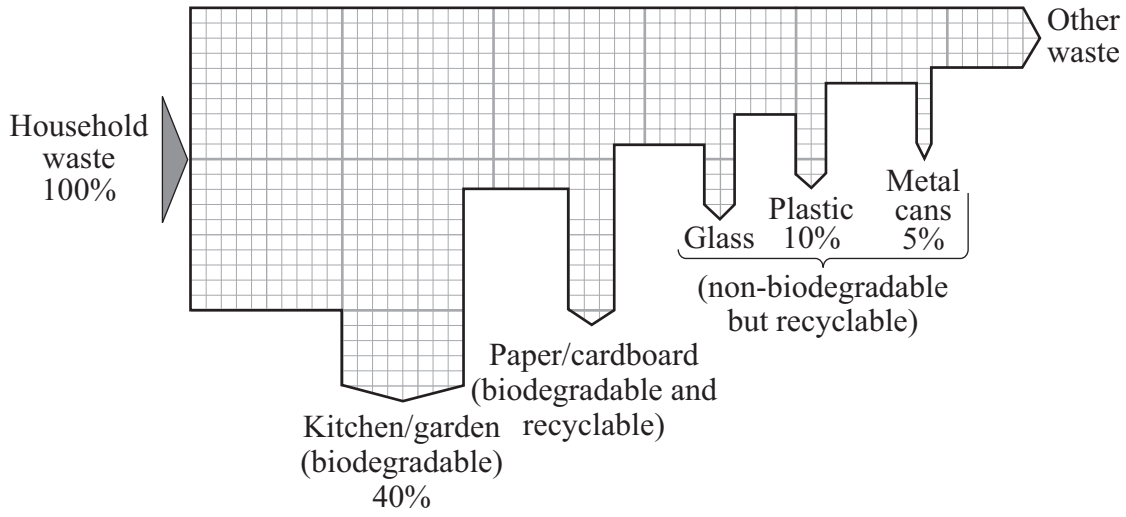
**D** potassium chloride, E508

| | **How the ingredients can be described** |
|---|---|
| **1** | It is a permitted additive. |
| **2** | It can be detected by its reaction with bromine. |
| **3** | All its carbon carbon bonds are single. |
| **4** | It is mixed with oils to form the emulsion. |

**Turn over for the next question**

## QUESTION THREE

The Sankey diagram shows the composition of typical household waste.




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

**A** 10%

**B** 15%

**C** 20%

**D** 55%

| | **Percentage (%)** |
|---|---|
| **1** | the percentage of waste that is glass |
| **2** | the percentage of waste that is paper and cardboard |
| **3** | the percentage of waste that is **not** biodegradable or recyclable |
| **4** | the percentage of waste that is biodegradable |

## QUESTION FOUR

This question is about the cracking of hydrocarbons.

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

**A** alkanes

**B** alkenes

**C** catalysts

**D** polymers

Cracking hydrocarbons produces unsaturated hydrocarbons called . . . **1** . . . .

It also produces saturated hydrocarbons called . . . **2** . . . .

Molecules of unsaturated hydrocarbons can be joined together to form . . . **3** . . . .

These reactions can often be speeded up by using . . . **4** . . . .

## QUESTION FIVE

The table shows some of the properties of four polymers.

| | Polymer | Properties |
|---|---|---|
| **A** | Polystyrene | brittle, cheap |
| **B** | PTFE | withstands high temperatures, non-stick |
| **C** | Perspex | rigid, transparent |
| **D** | Acrilan | strong, can be stretched into fibres |

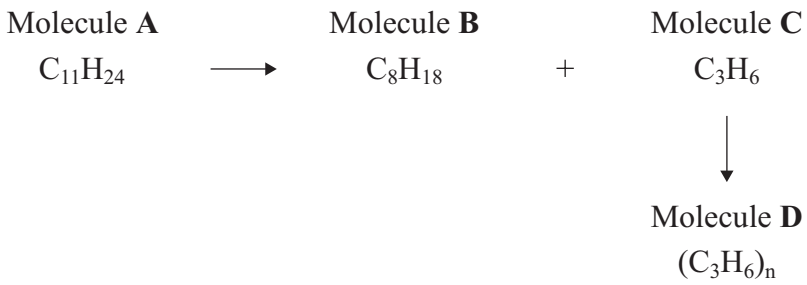
Match polymers, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

| | How the polymer could be used |
|---|---|
| **1** | It could be used as a substitute for glass. |
| **2** | It could be used as a substitute for wool. |
| **3** | It could be used to make throw-away packaging. |
| **4** | It could be used as a coating on cooking pans. |

## QUESTION SIX

This question is about cracking.

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




Molecule . . . **1** . . . has been cracked.

Molecule . . . **2** . . . is an alkene.

Molecule . . . **3** . . . is a polymer.

Molecule . . . **4** . . . is the smallest alkane in the reaction.

**Turn over for the next question**

## SECTION TWO

Questions **SEVEN** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

## QUESTION SEVEN

The table contains information about the percentages of fats in four different types of food.

| Food | Saturated fat | Monounsaturated fat | Polyunsaturated fat |
|---|---|---|---|
| Butter | 66% | 30% | 4% |
| Corn oil | 13% | 25% | 62% |
| Olive oil | 14% | 9% | 77% |
| Sunflower oil | 11% | 69% | 20% |

High levels of cholesterol in the blood can increase the risk of heart disease.

Saturated fats can increase blood cholesterol levels, but unsaturated fats can have the opposite effect.

**7A** The food which would probably increase cholesterol levels the most is . . .

**1** butter.

**2** corn oil.

**3** olive oil.

**4** sunflower oil.

**7B** The food that contains the highest percentage of unsaturated fat is . . .

**1** butter.

**2** corn oil.

**3** olive oil.

**4** sunflower oil.

**7C** Butter is a solid fat but the other three foods in the table are oils.

This is because . . .

**1** butter has a higher melting point than the oils.

**2** butter has a lower boiling point than the oils.

**3** butter has a higher density than the oils.

**4** butter contains a lower percentage of polyunsaturated fat than the oils.

**7D** Some margarines made from olive oil or sunflower oil contain artificial colourings.

These colourings can be detected and identified by . . .

**1** reacting with a catalyst.

**2** distillation.

**3** reacting with bromine.

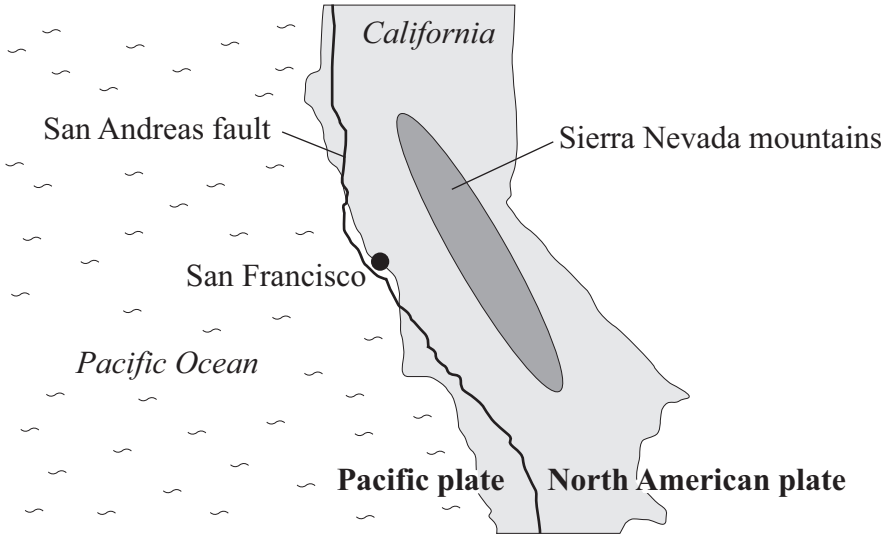
**4** chromatography.

**Turn over for the next question**

## QUESTION EIGHT

This question is about earthquakes in California.

The diagram shows the positions of San Francisco and the San Andreas fault.




There were major earthquakes in the San Francisco region in 1836, 1838, 1868 and 1906.

The massive 1906 earthquake occurred a few years before Alfred Wegener's theory about tectonic plate movement was proposed.

**8A** Scientists expect an earthquake to occur in the San Francisco area in the future.

They do **not** have the information to give the exact date because . . .

**1** earthquakes occur at random intervals.

**2** earthquakes occur only once every twenty years.

**3** earthquakes occur only after a volcano has erupted.

**4** earthquakes usually occur under the sea.

**8B** Earthquakes occur in the California region because . . .

**1** the Earth's crust is very thin.

**2** the region has lots of mountains.

**3** the boundary of two tectonic plates runs through California.

**4** the region is very hot and the land dries out too much.

**8C** Before Wegener's theory, scientists thought that mountains were formed by . . .

**1** the shrinking of the Earth's crust.

**2** rocks melting.

**3** volcanic activity.

**4** molten rock being forced through the mantle and crust to the surface of the Earth.

**8D** Wegener's theory suggested that mountains were formed by . . .

**1** expansion of the Earth's mantle.

**2** large-scale movements of the Earth's crust.

**3** convection currents in the Earth's core.

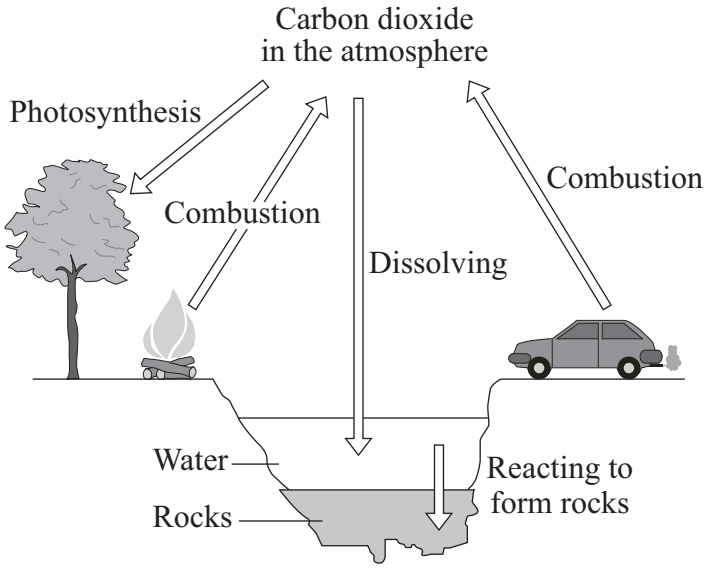
**4** volcanoes erupting.

**Turn over for the next question**

## QUESTION NINE

This question is about the balance of carbon dioxide in the atmosphere.

The diagram below shows some of the processes involved in the atmosphere.




The total UK carbon dioxide emissions (million tonnes) from vehicles between 1990 and 2002 are listed in the table.

| Year | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|
| **Carbon dioxide emissions in million tonnes** | 58.5 | 68.9 | 75.2 | 79.7 | 84.3 | 84.5 | 88.3 | 86.3 | 86.0 |

Source: National Statistics website: *www.statistics.gov.uk*
Greenhouse gas emissions from the UK transport industry.


**9A** The data for total UK carbon dioxide emissions from vehicles could be obtained by . . .

**1** measuring the carbon dioxide in the atmosphere.

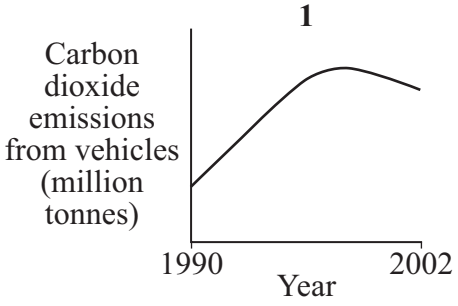
**2** calculating the amount of carbon dioxide produced from the amount of fuel used by vehicles.

**3** counting the number of vehicles on the road.

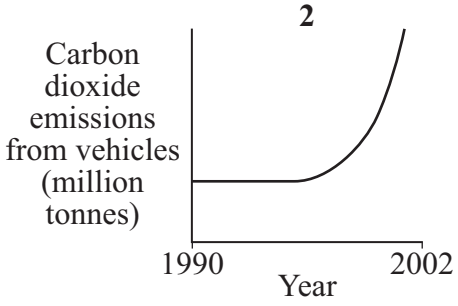
**4** measuring the amount of carbon dioxide in the air near a busy motorway.

**9B** A graph plotted using the data 'Year' ($x$-axis) against 'Carbon dioxide emissions from vehicles' ($y$-axis) would look like which one of the following?

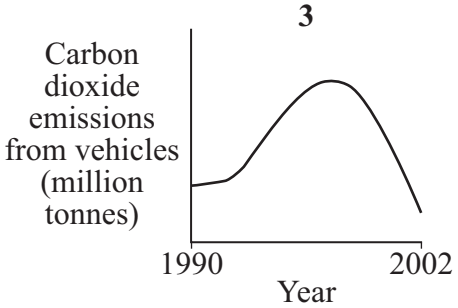
**1**



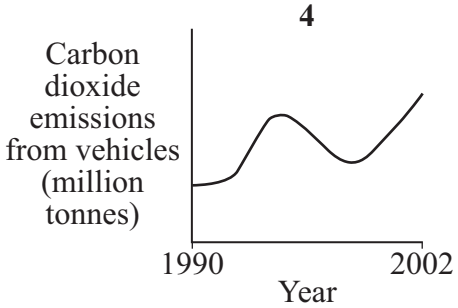

**2**




**3**




**4**




**9C** The increase in the amount of carbon dioxide in the air over the past 40 years is thought to be due mainly to . . .

**1** increased growth of plants.

**2** increased burning of fossil fuels.

**3** the formation of carbonate rocks.

**4** the release of carbon dioxide from oceans due to global warming.

**9D** The amount of carbon dioxide in the atmosphere could be reduced by . . .

**1** taking more flights in aeroplanes.

**2** cutting down trees in your garden.

**3** walking to work instead of using a car.

**4** driving a car with a larger engine.

**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**.

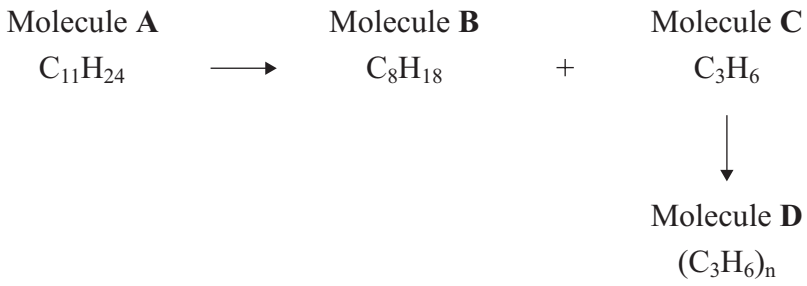
Use **each** answer only **once**.

Mark your choices on the answer sheet.

## QUESTION ONE

This question is about cracking.

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




Molecule . . . **1** . . . has been cracked.

Molecule . . . **2** . . . is an alkene.

Molecule . . . **3** . . . is a polymer.

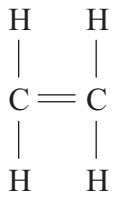
Molecule . . . **4** . . . is the smallest alkane in the reaction.

## QUESTION TWO

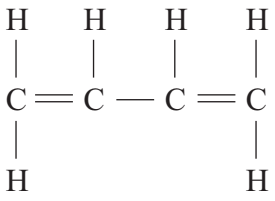
This question is about the formulae for four hydrocarbon compounds.

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

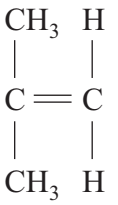
**A**



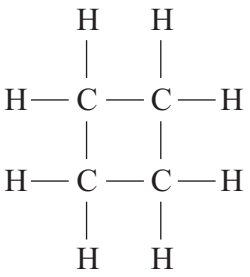
**B**

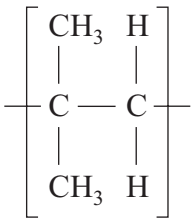


**C**



**D**



| Hydrocarbon compound | Description |
|---|---|
| **1** | It does **not** fit the general formula $C_nH_{2n}$ |
| **2** | It could be produced by cracking any of the other three. |
| **3** | It cannot be polymerised without further treatment. |
| **4** | It would produce a polymer with the repeating unit:  |

## SECTION TWO

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

Each of these questions has four parts.

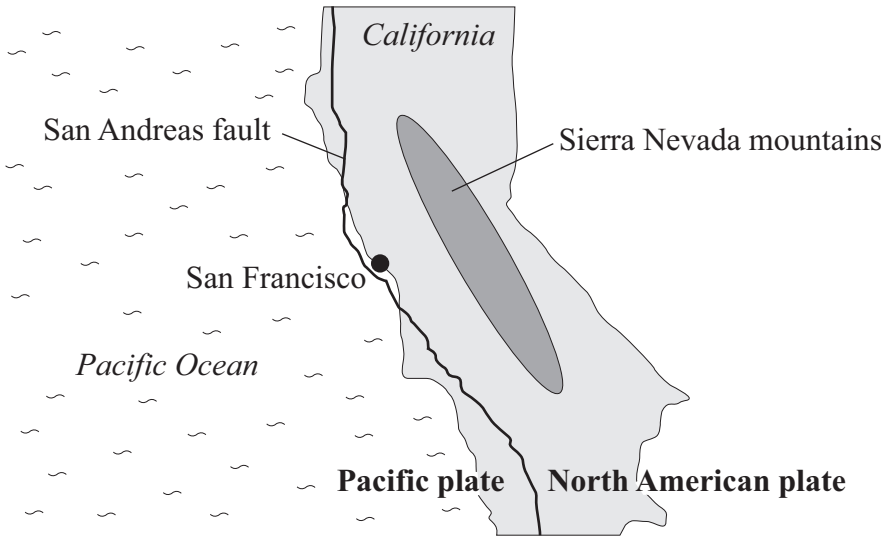
In each part choose only **one** answer.

Mark your choices on the answer sheet.

## QUESTION THREE

This question is about earthquakes in California.

The diagram shows the positions of San Francisco and the San Andreas fault.




There were major earthquakes in the San Francisco region in 1836, 1838, 1868 and 1906.

The massive 1906 earthquake occurred a few years before Alfred Wegener's theory about tectonic plate movement was proposed.

**3A** Scientists expect an earthquake to occur in the San Francisco area in the future.

They do **not** have the information to give the exact date because . . .

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**3B** Earthquakes occur in the California region because . . .

**1** the Earth's crust is very thin.

**2** the region has lots of mountains.

**3** the boundary of two tectonic plates runs through California.

**4** the region is very hot and the land dries out too much.

**3C** Before Wegener's theory, scientists thought that mountains were formed by . . .

**1** the shrinking of the Earth's crust.

**2** rocks melting.

**3** volcanic activity.

**4** molten rock being forced through the mantle and crust to the surface of the Earth.

**3D** Wegener's theory suggested that mountains were formed by . . .

**1** expansion of the Earth's mantle.

**2** large-scale movements of the Earth's crust.

**3** convection currents in the Earth's core.

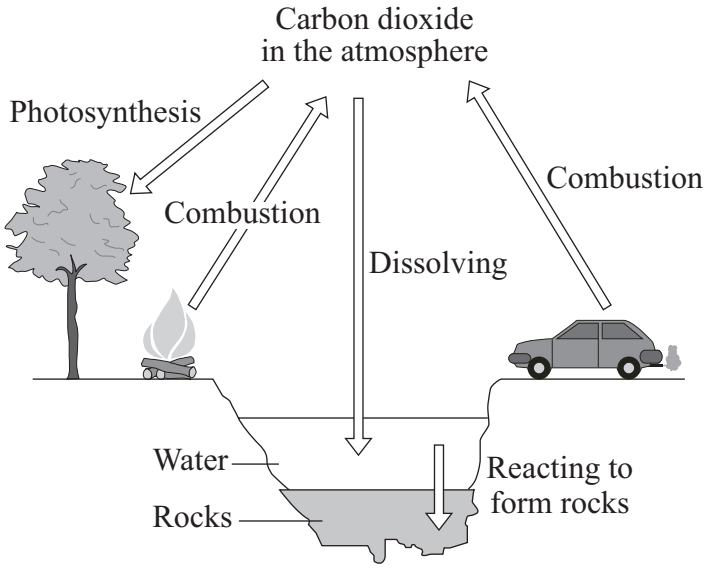
**4** volcanoes erupting.

**Turn over for the next question**

## QUESTION FOUR

This question is about the balance of carbon dioxide in the atmosphere.

The diagram below shows some of the processes involved in the atmosphere.




The total UK carbon dioxide emissions (million tonnes) from transport between 1990 and 2002 are listed in the table below.

| Year | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
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| **Carbon dioxide emissions in million tonnes** | 58.5 | 68.9 | 75.2 | 79.7 | 84.3 | 84.5 | 88.3 | 86.3 | 86.0 |

Source: National Statistics website: *www.statistics.gov.uk*
Greenhouse gas emissions from the UK transport industry.


**4A** The data for total UK carbon dioxide emissions from vehicles could be obtained by . . .

**1** measuring the carbon dioxide in the atmosphere.

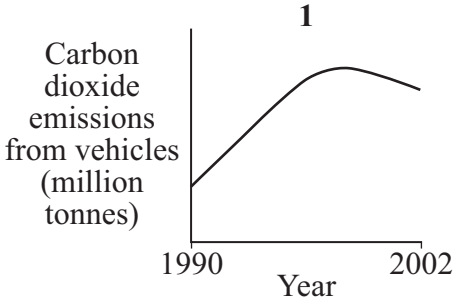
**2** calculating the amount of carbon dioxide produced from the amount of fuel used by vehicles.

**3** counting the number of vehicles on the road.

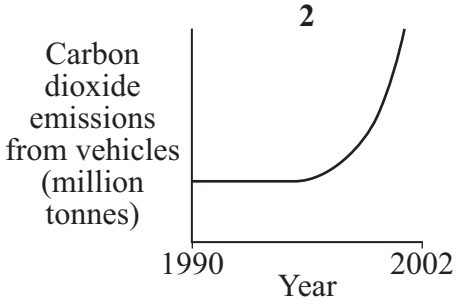
**4** measuring the amount of carbon dioxide in the air near a busy motorway.

**4B** A graph plotted using the data 'Year' ($x$-axis) against 'Carbon dioxide emissions from vehicles' ($y$-axis) would look like which one of the following?

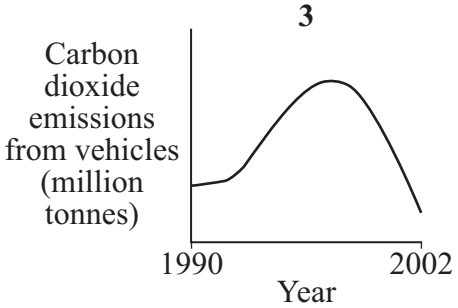
**1**



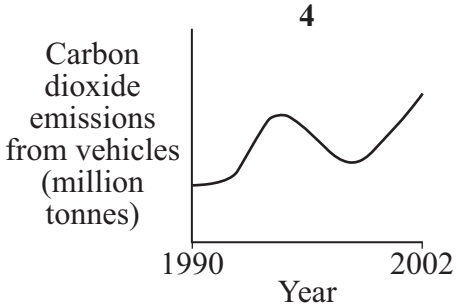

**2**




**3**




**4**




**4C** The increase in the amount of carbon dioxide in the air over the past 40 years is thought to be due mainly to . . .

**1** increased growth of plants.

**2** increased burning of fossil fuels.

**3** the formation of carbonate rocks.

**4** the release of carbon dioxide from oceans due to global warming.

**4D** The amount of carbon dioxide in the atmosphere could be reduced by . . .

**1** taking more flights in aeroplanes.

**2** cutting down trees in your garden.

**3** walking to work instead of using a car.

**4** driving a car with a larger engine.

## QUESTION FIVE

The diagram shows part of the Periodic Table of the elements published in 1869.

**Groups**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Li | Be | B | C | N | O | F |
| Na | Mg | Al | Si | P | S | Cl |
| K | Ca | | | | | |

About 30 years later, five noble gases were discovered.

**5A** How were the noble gases fitted into the Periodic Table?

**1** They were put one each into the first five groups.

**2** They were put into Groups 3 to 7.

**3** A new group was created for them.

**4** They were not included in the table.

**5B** Which one of the following explains why it took so long to discover the noble gases?

**1** They have only very recently been found in high concentrations on Earth.

**2** They are of very low density and are therefore found only in the upper atmosphere.

**3** They are chemically unreactive and therefore difficult to detect.

**4** They are so like the other gases in the atmosphere that they are difficult to separate.

The Earth's atmosphere contains about 0.9% argon.

**5C** How much argon is there in a room with a volume of 50 cubic metres?

**1** $0.018\,m^3$

**2** $1.80\,m^3$

**3** $0.45\,m^3$

**4** $4.50\,m^3$

**5D** Which one of the following correctly describes the use of argon in discharge tubes for advertising signs?

**1** It is radioactive, giving out a coloured glow.

**2** It gives out a coloured glow under high voltage.

**3** It is chemically unreactive and therefore harmless if it escapes.

**4** It is of very low density and helps to support the weight of the tube.

**Turn over for the next question**

## QUESTION SIX

Vegetable oils that are unsaturated can be hardened using hydrogen and nickel at raised temperatures.

The fats formed are used in processed foods. Additives are often mixed with the foods.

**6A** Which one of the following can be produced by the hardening of vegetable oil?

**1** margarine

**2** biodiesel

**3** salad dressing

**4** ice cream

**6B** Which one of the following methods can be used to test the degree of unsaturation in the original oils?

**1** Test how much iodine they react with.

**2** Test how much hydrochloric acid they react with.

**3** Test how much water they react with.

**4** Test how much nickel they react with.

**6C** Which one of the following is a true statement about the hardening process?

**1** It uses nickel so that the nickel present in the fat makes it harder and denser.

**2** It increases the melting point of the oil above room temperature.

**3** It uses hydrogen to catalyse the reaction.

**4** It increases the boiling point of the vegetable oil above room temperature.

**6D** Which one of the following correctly describes the use of additives in processed food?

**1** Only the artificial additives need to be listed in the ingredients.

**2** All additives in food can be identified by chromatography.

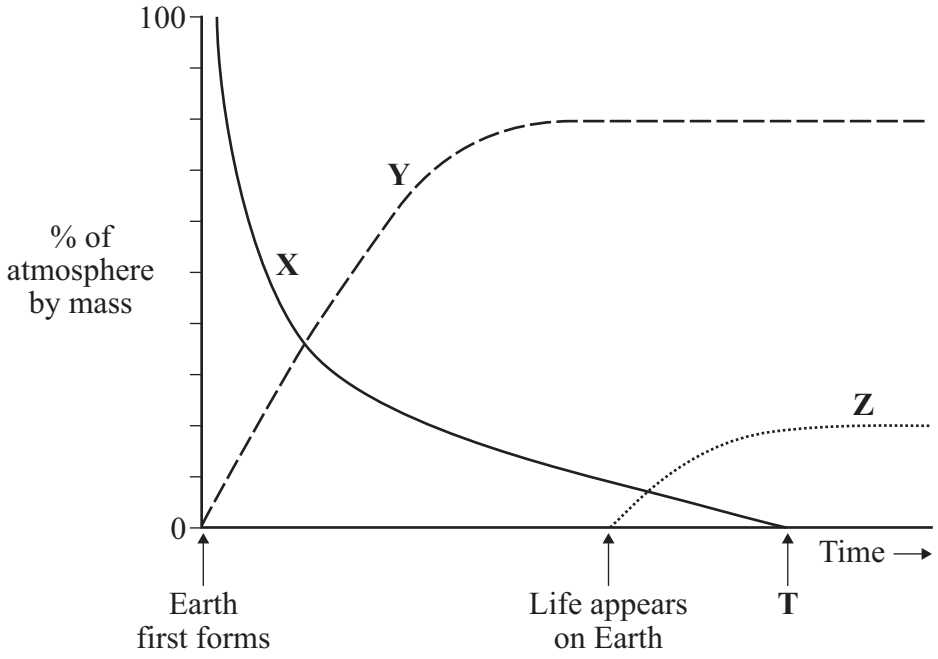
**3** Additives are used to improve appearance, taste and shelf-life.

**4** Additives are used only to make spreading easier.

**Turn over for the next question**

## QUESTION SEVEN

The diagram below shows how the levels of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere have changed with time.




**7A** What is the ratio, by mass, of gas **Z** to gas **Y** at time **T**?

**1** 1:4

**2** 1:5

**3** 4:1

**4** 5:1

**7B** Which one of the following correctly matches the lines on the graph?

**1** **X** is carbon dioxide, **Y** is nitrogen and **Z** is oxygen

**2** **X** is oxygen, **Y** is nitrogen and **Z** is carbon dioxide

**3** **X** is nitrogen, **Y** is oxygen and **Z** is carbon dioxide

**4** **X** is carbon dioxide, **Y** is oxygen and **Z** is nitrogen

**7C** During the last 200 million years, . . .

**1** the burning of fossil fuels has decreased the proportion of oxygen in the Earth's atmosphere.

**2** intense volcanic activity has substantially changed the atmosphere of the Earth.

**3** the percentage of carbon dioxide in the Earth's atmosphere has decreased considerably.

**4** the proportion of nitrogen in the Earth's atmosphere has remained fairly constant.

**7D** It is thought that there is no oxygen in the atmosphere of the planet Venus.

This is because . . .

**1** animals used it up in respiration.

**2** it is locked up in sedimentary rocks.

**3** it is locked up in fossil fuels.

**4** there are no plants to produce it by photosynthesis.

**Turn over for the next question**

## QUESTION EIGHT

This question is about Brazil and its energy reserves available to run cars, and the effect that burning fuels have on the environment.

Brazil is a poor country and is deeply in debt to many nations. It does not have enough oil and coal to meet its needs and importing these fuels is very expensive. It does not produce enough electricity to meet its needs, which makes electricity very expensive in Brazil.

However, Brazil has a massive land area and a favourable climate for growing a large amount of crops such as sugar cane.

The table shows the products formed by burning four different fuels in a car engine.

| Fuel | Sulfur dioxide formed | Carbon monoxide formed | Carbon dioxide formed | Water formed |
|---|---|---|---|---|
| **Hydrogen** | ✗ | ✗ | ✗ | ✓ |
| **Ethanol** | ✗ | ✗ | ✓ | ✓ |
| **Syngas** | ✗ | ✓ | ✓ | ✓ |
| **Petrol** | ✓ | ✓ | ✓ | ✓ |

**8A** Which one of the four fuels would produce the least air pollution?

**1** hydrogen

**2** ethanol

**3** syngas

**4** petrol

**8B** Brazil could try to improve its economy and reduce its debt by using cars powered by . . .

**1** hydrogen obtained by the electrolysis of water.

**2** ethanol obtained from plants.

**3** syngas obtained from coal.

**4** petrol obtained from crude oil.

**8C** To investigate the possible effects of burning fuels on the temperature of the Earth, it would be best to consult past records giving . . .

**1** temperatures accurate to 1 °C over 5 years.

**2** temperatures accurate to 1 °C over 50 years.

**3** temperatures accurate to 0.1 °C over 5 years.

**4** temperatures accurate to 0.1 °C over 50 years.

**8D** To assess the evidence about fuels, it would be best to consult scientists . . .

**1** employed by car manufacturers.

**2** employed by farmers.

**3** employed by oil companies.

**4** employed by universities.

**Turn over for the next question**

## QUESTION NINE

The general equation for the complete combustion of an alkane is:

$$2C_nH_{2n+2} + (3n+1)O_2 \rightarrow 2nCO_2 + 2(n+1)H_2O$$

Use this information to help you to answer the following questions.

**9A** Why are alkanes with few carbon atoms likely to be better fuels?

**1** They require less oxygen so are less likely to be completely burned.

**2** They require less oxygen so are more likely to be completely burned.

**3** They require more oxygen so are less likely to be completely burned.

**4** They require more oxygen so are more likely to be completely burned.

**9B** The formula of hexane is $C_6H_{14}$

How many molecules of oxygen are needed to burn one molecule of hexane?

**1** $9\frac{1}{2}$

**2** 19

**3** $21\frac{1}{2}$

**4** 43

**9C** What is the general equation for the combustion of an alkene ($C_nH_{2n}$)?

**1** $C_nH_{2n} + 1\frac{1}{2}nO_2 \rightarrow nCO_2 + nH_2O$

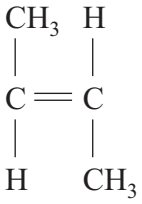
**2** $C_nH_{2n} + 1\frac{1}{2}nO_2 \rightarrow nCO_2 + 2nH_2O$

**3** $C_nH_{2n} + 3nO_2 \rightarrow nCO_2 + nH_2O$

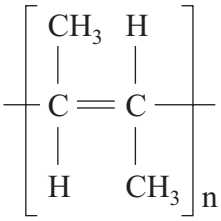
**4** $C_nH_{2n} + 3nO_2 \rightarrow nCO_2 + 2nH_2O$

**9D** Alkene molecules can be bonded together to form polymers.

Which polymer would be produced from this alkene?



**1**



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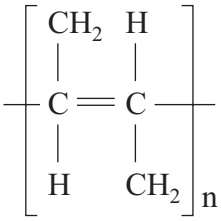
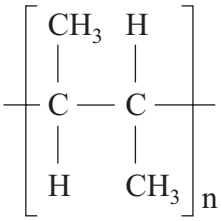
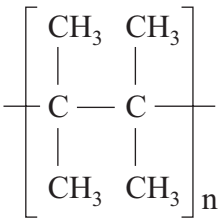


**3**



**4**



**END OF TEST**

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