AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.1.4

How carbon dioxide decreased

Past-paper questions

Tier	**Higher**
Question groups	**41**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

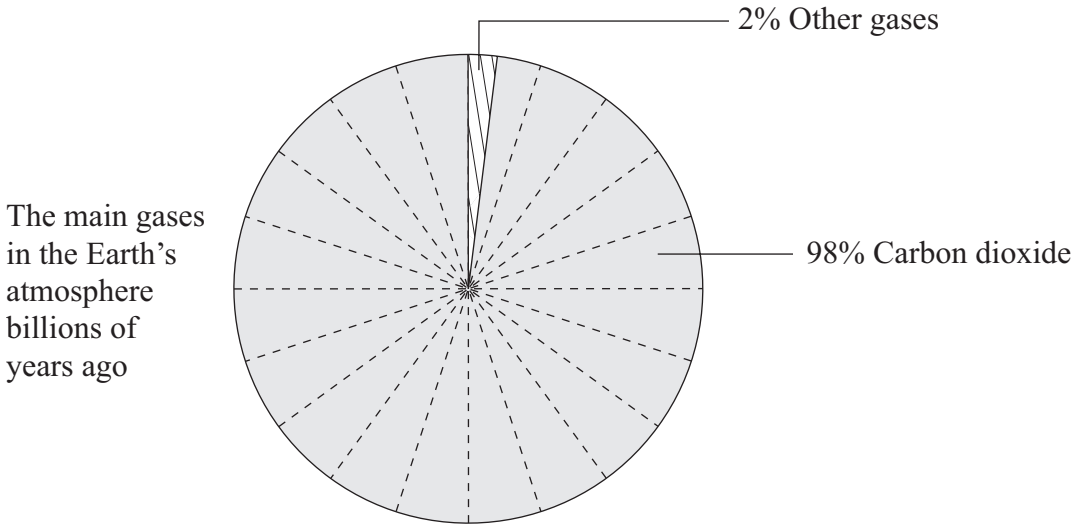
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.9.1.4 How carbon dioxide decreased

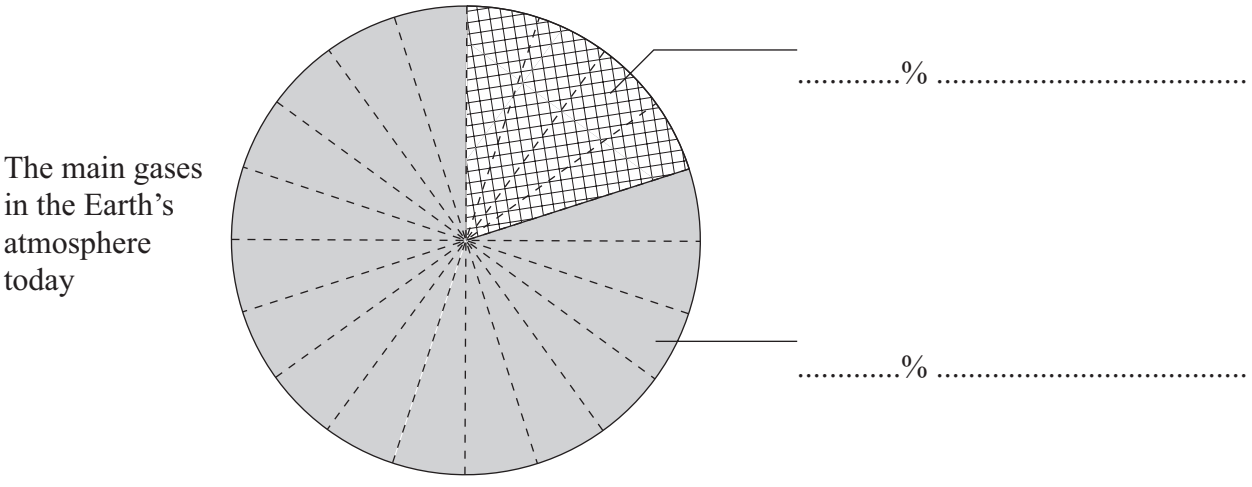
Question 01

January 2007 | CHY1H | Original Q2 | Legacy

2 Life on Earth would not exist without the atmosphere.
Billions of years ago the composition of the Earth's atmosphere was very different from the composition today.



(a) Label the pie chart below to show the percentages and names of the two main gases in the Earth's atmosphere today.



(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 01 · continued

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(b) There is evidence that the composition of the Earth's atmosphere is still changing. One possible reason is that many power stations generate electricity by burning fossil fuels such as coal, oil or natural gas. Sulfur dioxide, SO_2, is produced when coal burns in air.

(i) What environmental problem does sulfur dioxide cause?

.....

.....

(1 mark)

(ii) How could this environmental problem be reduced in coal-fired power stations?

.....

.....

(1 mark)

(iii) Gas-fired power stations burn methane, CH_4, in air.

Complete the word equation for this reaction.

methane + ... → carbon dioxide + ...

(2 marks)

(c) Excess carbon dioxide should be prevented from entering the atmosphere.

Explain why.

.....

.....

.....

.....

(2 marks)

Question 2 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 01 · continued

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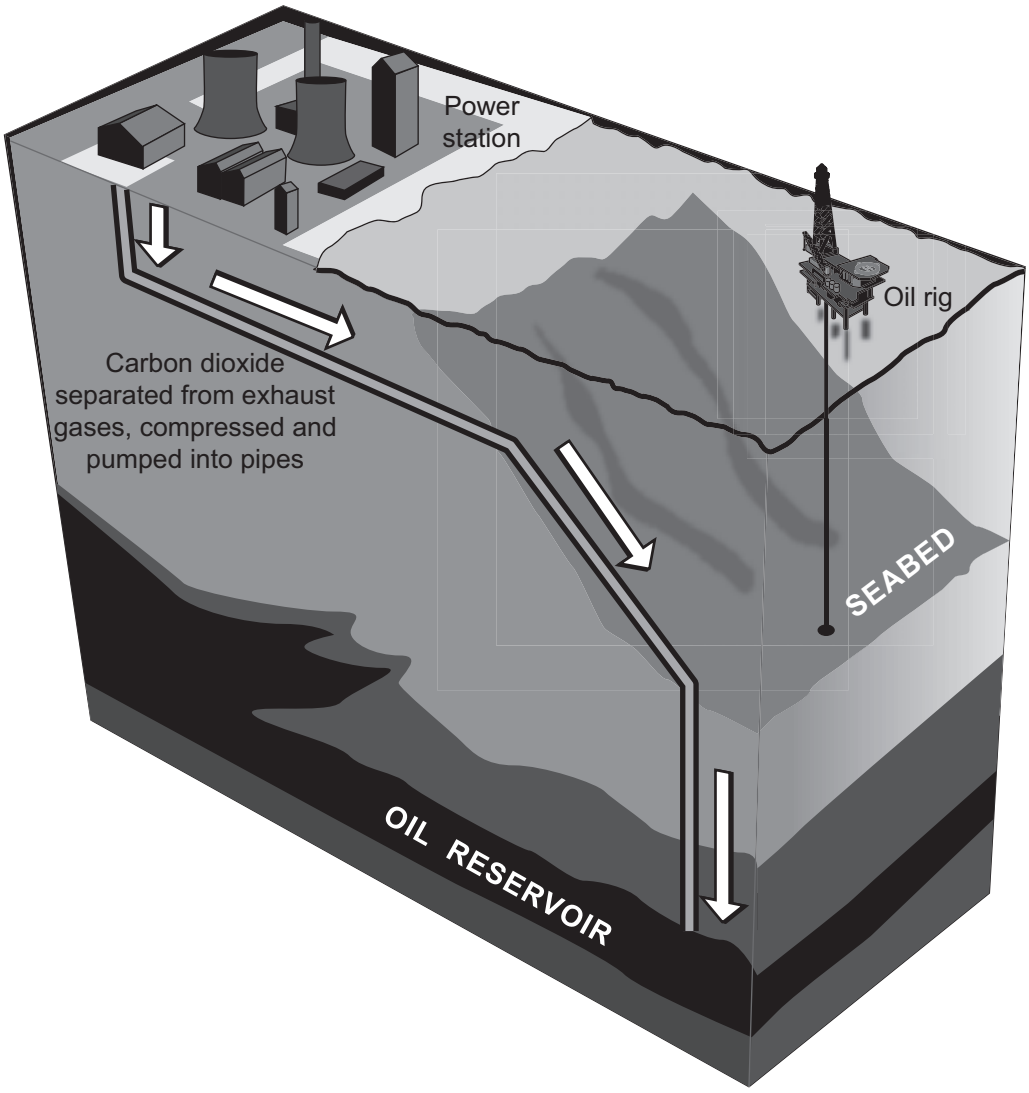
(d) Carbon dioxide is produced when fossil fuels burn in power stations. The diagram represents one idea to prevent excess carbon dioxide from entering the atmosphere.



Use the diagram to explain how carbon dioxide can be prevented from entering the atmosphere.

.....

.....

.....

.....

(2 marks)

10

4.9.1.4 How carbon dioxide decreased

Question 02

March 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

Crude oil is a non-renewable energy source. Petrol is a fuel obtained from the fractional distillation of crude oil.

Gasohol is also a fuel. It is a mixture of 90 % petrol and 10 % ethanol. The ethanol can be produced from the waste stems and leaves when crops have been harvested. So ethanol is a renewable energy source.

	Mass in grams of gas produced by completely burning 10 cm^3 of fuel		
Fuel	Carbon dioxide from petrol	Carbon dioxide from ethanol	Water vapour
Petrol	26.4	0	12.6
Gasohol	23.8	1.5	12.2

3A What is the total mass of carbon dioxide produced when 10 cm^3 of gasohol is burned?

1 22.3 g

2 23.8 g

3 25.3 g

4 26.4 g

3B How much more carbon dioxide is produced when 10 cm^3 of petrol is burned than when 10 cm^3 of gasohol is burned?

1 0.4 g

2 1.1 g

3 1.6 g

4 24.9 g

4.9.1.4 How carbon dioxide decreased

Question 02 · continued

3C Why is the water vapour produced by burning fuels not a problem?

1 It condenses to a liquid.

2 It does not cause corrosion.

3 It is not a pollutant.

4 Very little is produced.

3D Carbon dioxide causes environmental problems.

Why is carbon dioxide from burning ethanol thought to be less of a problem than carbon dioxide from burning petrol?

1 Not as much carbon dioxide is produced.

2 The carbon dioxide produced has different chemical properties.

3 It is just recycling carbon dioxide removed from the air by plants.

4 The ethanol is not produced from crude oil.

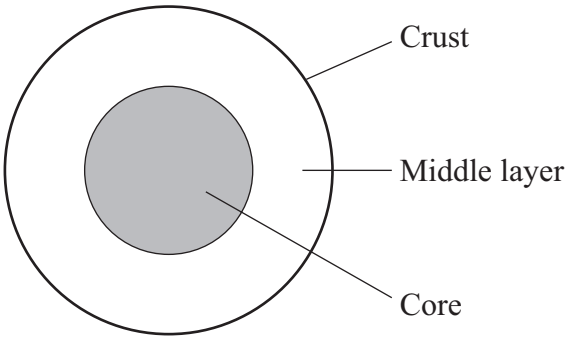
4.9.1.4 How carbon dioxide decreased

Question 03

March 2007 | CHY1B | Original Q5 | Legacy

QUESTION FIVE

The diagram shows the layered structure of the Earth.



5A The middle layer is called the . . .

1 atmosphere.

2 lava.

3 magma.

4 mantle.

5B The material in the middle layer is moving slowly.

The movement is caused by . . .

1 the rotation of the Earth.

2 the drifting tectonic plates.

3 the cooling of the Earth.

4 heat from natural radioactive processes.

5C Mountains on the Earth's surface are caused by large-scale movements of the Earth's crust but scientists used to believe that they were caused by . . .

1 the movement of low density rocks above those that were more dense.

2 the activity of volcanoes.

3 shrinking of the crust after it was formed.

4 weathering and erosion.

4.9.1.4 How carbon dioxide decreased

Question 03 · continued March 2007 | CHY1B | Original Q5 | Legacy

5D Much of the carbon dioxide that was present in Earth's early atmosphere is now locked up in . . .

1 fossil fuels and sedimentary carbonate rocks.

2 volcanic rocks and fossil fuels.

3 metal ores and sedimentary carbonate rocks.

4 landfill sites and volcanic rocks.

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

Question 04

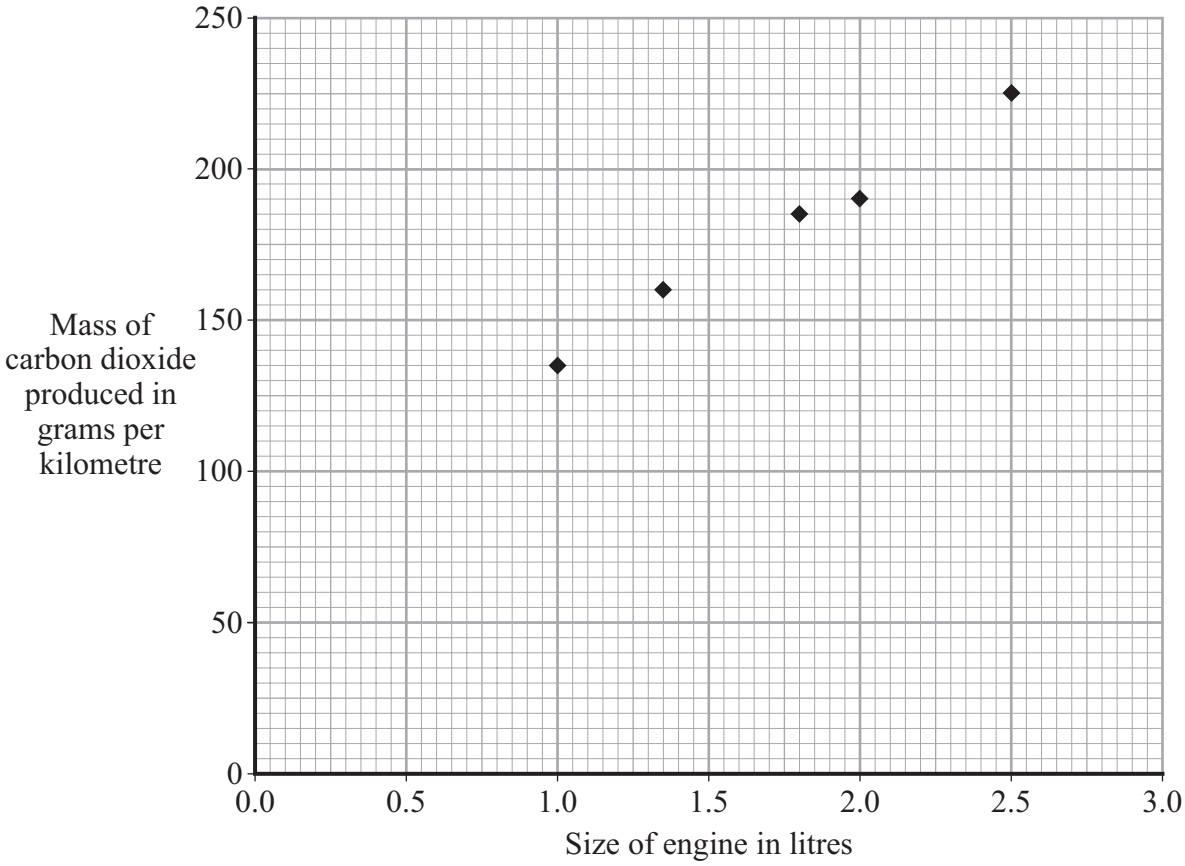
June 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

Technicians at a car manufacturing company carried out tests on carbon dioxide emissions from their new range of cars.

First, they tested a small, lightweight, four-seater car with a 1.0 litre petrol engine.
They repeated the tests on similar cars, under similar conditions but with different engine sizes.

The results of their tests are shown on the graph.



3A What relationship is supported by these data?

1 Large engines produce more carbon dioxide per kilometre than small engines.

2 Small engines are more economical than large engines.

3 The mass of carbon dioxide produced per kilometre is directly proportional to the engine size.

4 A 2.0 litre engine produces twice as much carbon dioxide per kilometre as a 1.0 litre engine

4.9.1.4 How carbon dioxide decreased

Question 04 · continued

3B What could the technicians do to improve the reliability of the data in this investigation?

1 repeat the tests with different numbers of passengers in the cars

2 repeat the tests and calculate the mean (average) mass of carbon dioxide produced

3 repeat the tests and use the lowest mass of carbon dioxide produced

4 repeat the tests and use the highest mass of carbon dioxide produced

3C A car salesman claimed that a large, heavy, eight-seater car with the same 2.5 litre petrol engine would produce only 225 grams of carbon dioxide per kilometre.

Was this a fair claim from the data?

1 No, because the reading on the graph is 230 grams of carbon dioxide per kilometre.

2 No, because the result may be different for a heavier vehicle.

3 Yes, because that is the value shown on the graph.

4 Yes, because a 2.5 litre engine will always give the same results.

3D In another series of tests under the same conditions, the small, lightweight, four-seater car with a 2.0 litre diesel engine produced 150 grams of carbon dioxide per kilometre.

What is the best conclusion about petrol and diesel engines that can be drawn from these data?

1 Diesel engines are more efficient than petrol engines.

2 Diesel engines always produce less carbon dioxide than petrol engines.

3 The type of fuel used in a car engine may affect the amount of carbon dioxide produced.

4 The type of fuel used in a car engine does not affect the amount of carbon dioxide produced.

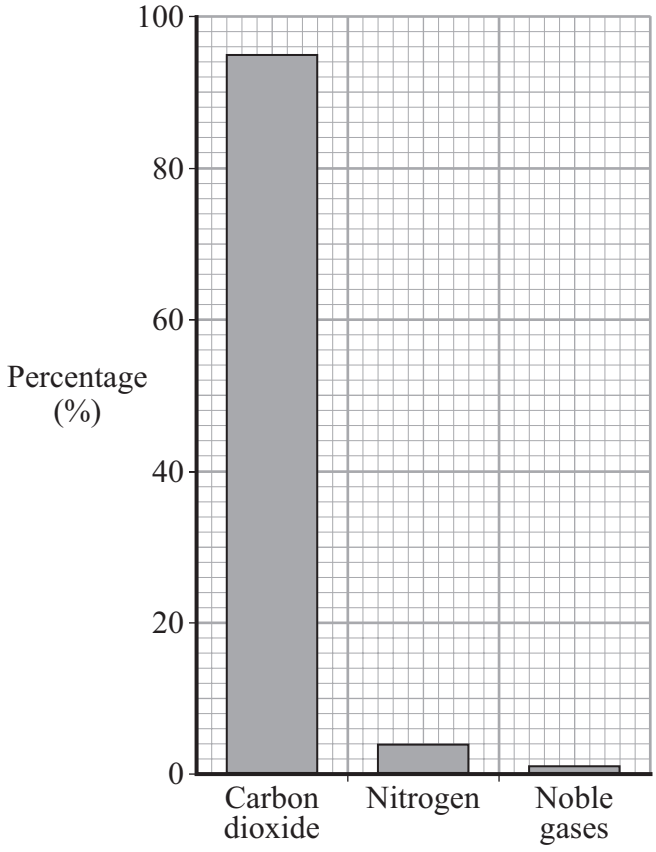
4.9.1.4 How carbon dioxide decreased

Question 05

June 2007 | CHY1B | Original Q5 | Legacy

QUESTION FIVE

The bar chart shows the composition of a sample of the atmosphere on Mars.



5A Earth's early atmosphere also contained a high percentage of carbon dioxide.

Scientists think that most of the carbon dioxide . . .

1 came out of solution from the oceans.

2 was released from volcanoes.

3 was given off as carbonate rocks decomposed.

4 was released as fossil fuels formed.

5B One way in which Earth's atmosphere today is different from that on Mars is that the Earth's atmosphere.. . .

1 contains less nitrogen.

2 contains more carbon dioxide.

3 does not contain noble gases.

4 contains more water vapour.

4.9.1.4 How carbon dioxide decreased

Question 05 · continued

5C The first plants are thought to have appeared on Earth about 2 billion years ago.

What effect did the plants have on the Earth's atmosphere?

1 They increased the percentage of carbon dioxide.

2 They decreased the percentage of nitrogen.

3 They increased the percentage of oxygen.

4 They increased the percentage of ammonia.

5D Filament lamps are normally filled with a noble gas.

The metal filament in a lamp would quickly burn away if the bulb was filled with air because air contains . . .

1 carbon dioxide.

2 nitrogen.

3 oxygen.

4 ammonia.

4.9.1.4 How carbon dioxide decreased

Question 06

November 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The table shows the emissions of sulfur dioxide, in the United Kingdom (UK), by different fuels in 1990 and in 2004.

	Emissions of sulfur dioxide by different fuels in thousands of tonnes		
Fuel type	**1990**	**2004**	**Percentage change between 1990 and 2004**
Coal	2707	578	–79
Other solid fuels	66	20	–70
Petroleum fuel oil	605	78	–87
Other petroleum products (including petrol and diesel)	193	83	–57
Gaseous fuels	9	11	+22
Other emissions of sulfur dioxide	118	58	–51
TOTAL	**3698**	**828**	**–78**

- Since 1990, the amount of coal used in the generation of electricity at power stations has reduced by more than 60%.
- Since 1990, gaseous fuels have gradually been replacing fuel oil for electricity generation and in industry.
- The small amount of sulfur dioxide emitted from petrol and diesel fuel used in vehicles has decreased. It should decrease further with the increased use of low-sulfur petrol and diesel.

4.9.1.4 How carbon dioxide decreased

Question 06 · continued

3A Which fuel had the largest reduction in sulfur dioxide emissions, **in thousands of tonnes**, between 1990 and 2004?

1 coal

2 fuel oil

3 other petroleum products

4 gaseous fuels

3B This data suggests that emissions of sulfur dioxide between 1990 and 2004 . . .

1 decreased for all fuels.

2 decreased by more than 50% for all fuels.

3 decreased by 78% for all fuels except gaseous fuels.

4 decreased by more than 50% for all fuels except gaseous fuels.

3C Which reasonable prediction can be made from the evidence given at the beginning of this question?

1 Sulfur dioxide emissions will begin to increase in the future as the number of vehicles on our roads increases.

2 Overall, sulfur dioxide emissions are likely to continue to decrease.

3 Supplies of fuel oil will be used up in another twenty years.

4 Sulfur dioxide emissions from gaseous fuels will be greater than those from coal in the near future.

3D The data in the table was obtained by estimating the sulfur dioxide emissions from power stations, industrial plants, vehicles, etc.

Sulfur dioxide emissions in the UK could also be monitored by . . .

1 providing each vehicle with a digital readout of sulfur dioxide emitted.

2 measuring the sulfur dioxide concentrations in the air above the largest power stations and industrial plants.

3 measuring the sulfur dioxide concentrations in the air at a large number of sites spread across the UK.

4 measuring the sulfur content of all fuels before they are used.

4.9.1.4 How carbon dioxide decreased

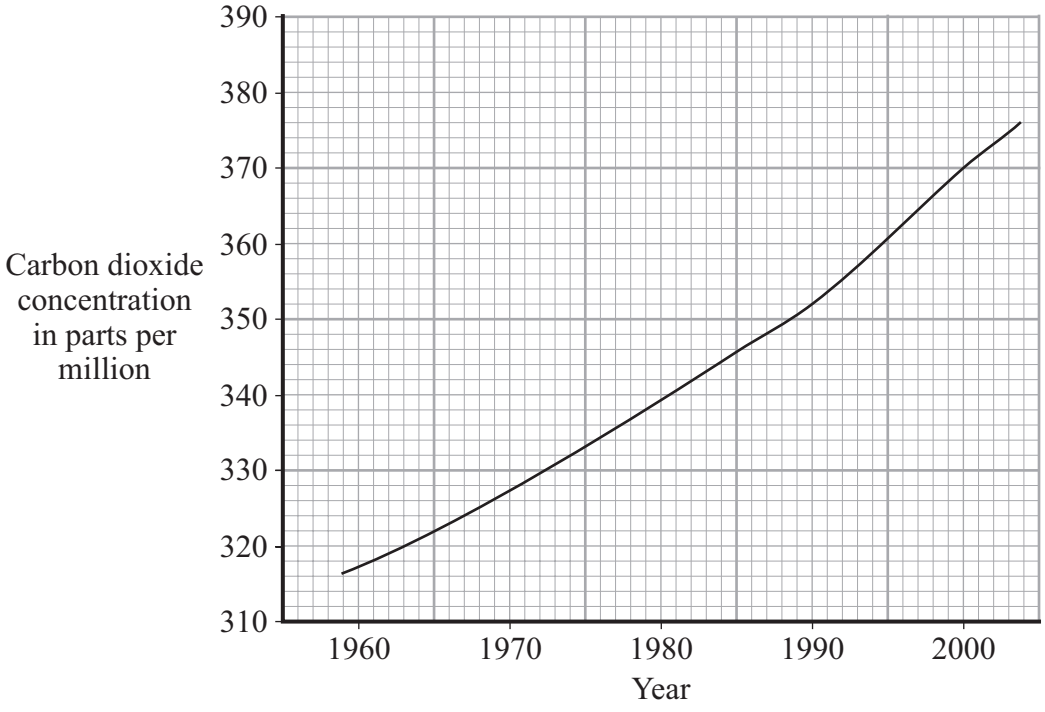
Question 07

November 2007 | CHY1B | Original Q4 | Legacy

QUESTION FOUR

Measurements of carbon dioxide in the atmosphere have been made continuously for almost 50 years at the Mauna Loa Observatory, 4000 metres up a mountain in Hawaii.
This site is far enough away from any large carbon dioxide source to be a reliable measuring point.

Atmospheric carbon dioxide levels measured at Mauna Loa, Hawaii



4A What is the mean (average) rate of increase per year of carbon dioxide (in parts per million) in the atmosphere at Mauna Loa between 1990 and 2000?

1 1.8

2 18.0

3 352.0

4 370.0

4B The change in carbon dioxide concentration over the past 50 years is thought to be a result of . . .

1 increased volcanic activity.

2 an increase in the use of fossil fuels.

3 variations in the Sun's energy output.

4 an increase in ocean temperatures.

4.9.1.4 How carbon dioxide decreased

Question 07 · continued

4C Many scientists think that there is a close link between atmospheric carbon dioxide levels and global warming.
Some political leaders have taken no action to reduce carbon dioxide emissions.

One possible reason is that . . .

1 restrictions on industrial development might result.

2 their countries have few oil reserves.

3 they do not think that scientists are qualified to make important judgements.

4 they do not think that global warming will affect their country.

4D Concerns about carbon dioxide levels and global warming have increased research and technical development in some areas.

Which of these has **not** been part of this development?

1 the use of ethanol as a fuel in cars

2 the use of diesel oil instead of petrol in cars

3 the use of vegetable oils as a fuel in cars

4 the development of electric cars

4.9.1.4 How carbon dioxide decreased

Question 08

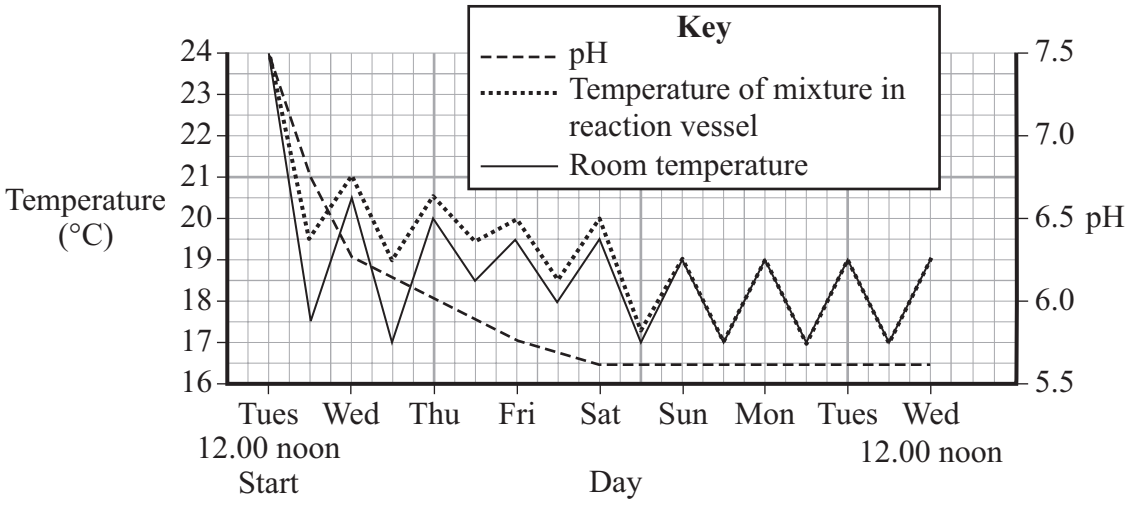
November 2007 | CHY1B | Original Q8 | Legacy

QUESTION EIGHT

Ethanol can be made by the action of yeast on a solution of sugar. This is called fermentation. The sugar is converted to ethanol and carbon dioxide. Carbon dioxide is a slightly acid gas. During fermentation, some of the energy is transferred as thermal energy.

A sugar solution and yeast were put into a reaction vessel.
The temperature of the mixture, the pH of the mixture and the room temperature were recorded over an eight-day period.

The results are shown on the graph.



8A There is a larger difference between the temperature of the mixture and the room temperature during the first few days than there is later.

The probable reason is that . . .

1 fermentation is quicker at the start.

2 the room temperature is steadily decreasing.

3 the pH value of the mixture is decreasing.

4 the room temperature fluctuates.

4.9.1.4 How carbon dioxide decreased

Question 08 · continued November 2007 | CHY1B | Original Q8 | Legacy

8B From the information on the graph, . . .

1 fermentation is completed after 4 days.

2 fermentation is completed after 5 days.

3 fermentation is completed after 6 days.

4 fermentation continues after 8 days.

8C A general conclusion from the graph is that . . .

1 the yeast cannot survive for more than 8 days.

2 the acidity of the mixture increases in the first 4 days.

3 the acidity of the mixture is greater at the start than when fermentation is completed.

4 the temperature of the mixture does not fall below 18.0 °C.

8D One advantage of producing ethanol by fermentation rather than from ethene is that . . .

1 less carbon dioxide is produced in fermentation.

2 there are no waste products.

3 the raw materials are renewable.

4 the ethanol does not need further processing.

4.9.1.4 How carbon dioxide decreased

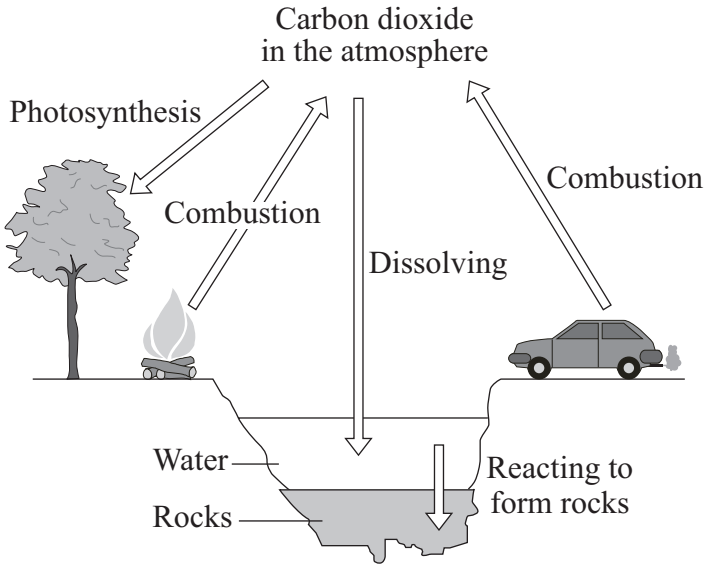
Question 09

March 2008 | CHY1BP | Original Q4 | Legacy

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
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.
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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.

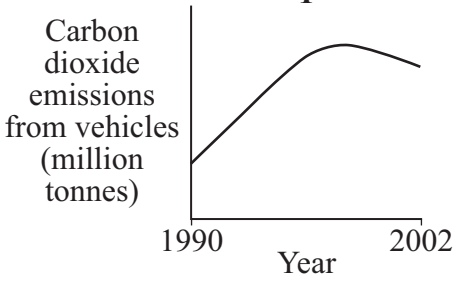
4 measuring the amount of carbon dioxide in the air near a busy motorway.

4.9.1.4 How carbon dioxide decreased

Question 09 · continued March 2008 | CHY1BP | Original Q4 | Legacy

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



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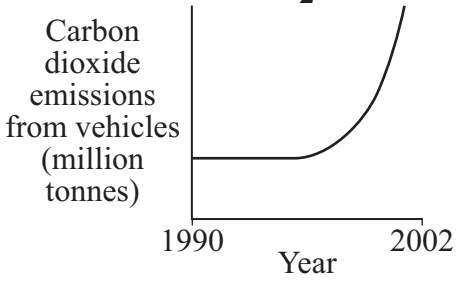

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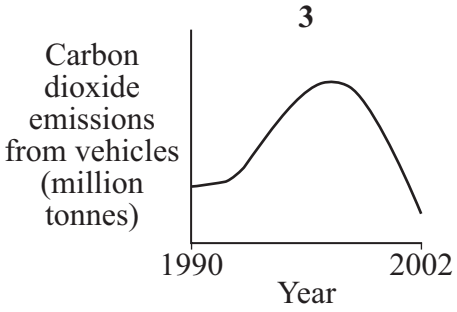

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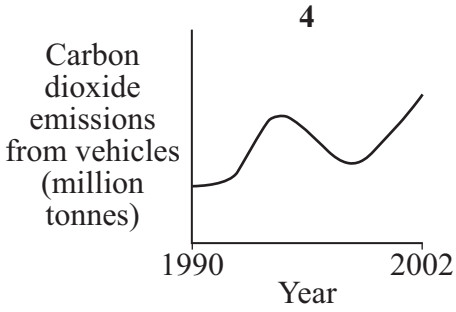


4C The increase in the amount of carbon dioxide in the air over the past 40 years is thought to be due mainly to . . .

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.

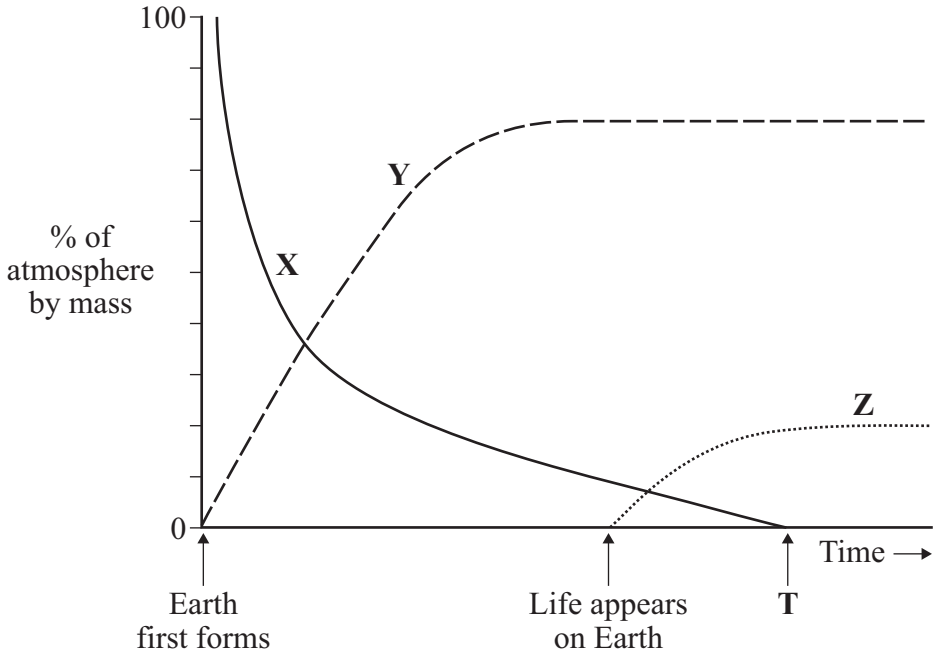
4.9.1.4 How carbon dioxide decreased

Question 10

March 2008 | CHY1BP | Original Q7 | Legacy

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

4.9.1.4 How carbon dioxide decreased

Question 10 · continued

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.

4.9.1.4 How carbon dioxide decreased

Question 11

June 2008 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

Scientists are researching new catalysts to convert compounds in coal into small hydrocarbon molecules.

These small molecules can be used to make liquid fuels such as petrol.

4A Scientists are trying to develop processes that convert coal into liquid fuels, such as petrol, because . . .

1 they have found new supplies of catalysts.

2 oil reserves are running out quickly.

3 there is no alternative to using coal.

4 catalysts are being used up.

4B Petrol is made from small molecules and **not** large molecules because hydrocarbons with small molecules . . .

1 have a higher boiling point.

2 are more viscous.

3 are darker in colour.

4 ignite more easily.

4C Both petrol and coal produce carbon dioxide when burned.

To compare the volume of the gas produced by a sample of coal with the volume of gas produced by a sample of petrol, a control variable would be . . .

1 how much carbon dioxide is produced.

2 the amount of coal and petrol used.

3 the speed at which each fuel is set alight.

4 the time taken to burn all the fuel.

4.9.1.4 How carbon dioxide decreased

Question 11 · continued June 2008 | CHY1AP | Original Q4 | Legacy

4D Ethanol, made from plant material, is another liquid fuel used in cars.

Ethanol and petrol produce similar amounts of carbon dioxide when they burn.

Burning ethanol made from plant material, in cars, is thought to be less of an environmental problem than burning petrol.

This is because . . .

1 ethanol does **not** produce water when it burns.

2 using ethanol made from plants as a fuel does **not** change the amount of carbon dioxide in the atmosphere.

3 ethanol will burn without using oxygen.

4 in the car engine, only partial combustion of the ethanol occurs.

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

Question 12

June 2008 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about unsaturated hydrocarbons.

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

A catalysis

B polymerisation

C combustion

D thermal decomposition

Heating large hydrocarbon molecules so that they break down into smaller molecules, such as ethene, is an example of . . . **1** . . . .

Ethanol is formed when ethene reacts with steam. The reaction is speeded up using phosphoric acid. This reaction is an example of . . . **2** . . . .

Individual ethene molecules can be made to link together to form very long chains in a process called . . . **3** . . . .

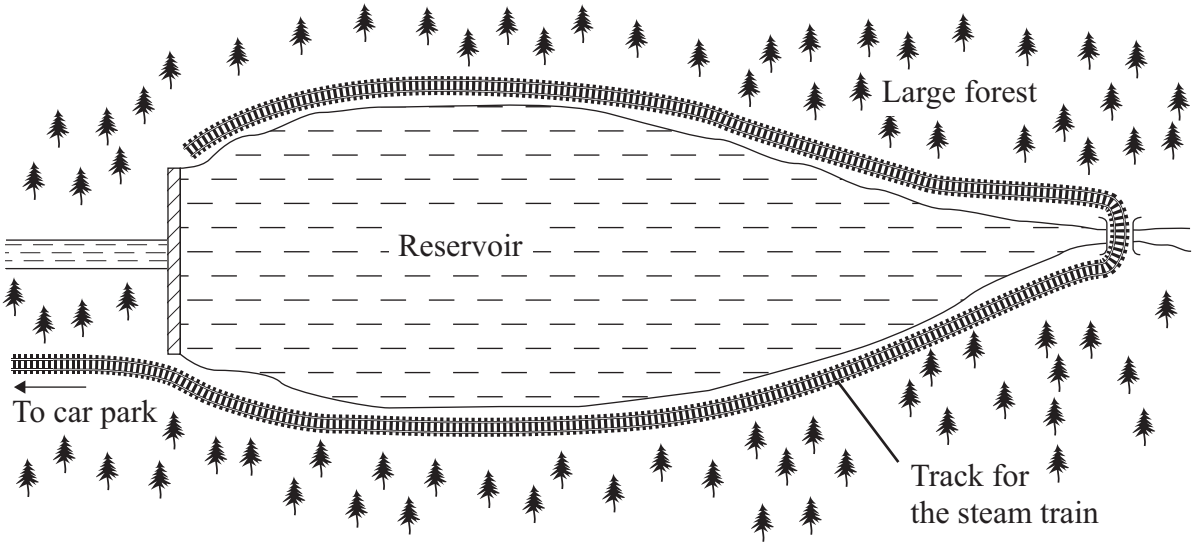
Ethene reacts with oxygen to produce carbon dioxide and water. This reaction is an example of . . . **4** . . . .

4.9.1.4 How carbon dioxide decreased

Question 13

June 2008 | CHY1H | Original Q6 | Legacy

6 A large reservoir is surrounded by trees. Planners need to protect the environment. The distance around the reservoir is many kilometres. There will be only one road access to a car park a few kilometres from the reservoir. From the car park people would be transported to accommodation, activities or places of interest by steam train.



6 (a) Coal contains carbon and small amounts of sulfur. The steam train would cause environmental problems if coal were used as the fuel.

Explain why.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

4.9.1.4 How carbon dioxide decreased

Question 13 · continued

for mark

6 (b) The planners have stated that, as a result of using the steam train, there must be no overall increase of carbon dioxide added to the atmosphere. The steam train would be considered as 'carbon neutral' if wood, from the surrounding forest, were used as the fuel.

Suggest why.

.....

.....

.....

.....

.....

.....

(3 marks)

7

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

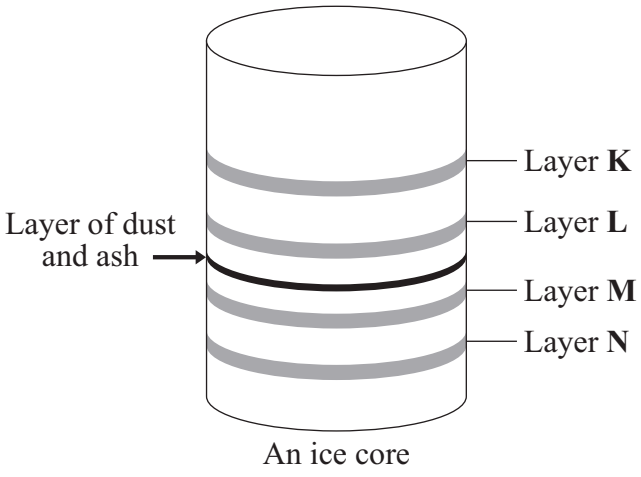
Question 14

November 2008 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

The North Pole is situated on a thick sheet of ice, floating on sea water. There has never been vegetation here. The ice took a very long time to form.
Substances trapped in the ice can provide evidence about the atmosphere in the past.
Cores of ice are drilled out of the ice sheet and analysed.

One of the cores of ice is shown in the diagram.



Layer	Approximate age of the ice in years	Carbon dioxide gas content in ppm
K	100	850
L	300	525
M	500	520
N	700	518

4A There was a large amount of carbon dioxide gas in the atmosphere 100 years ago.

An explanation for this is . . .

1 an increase in global warming.

2 that carbon dioxide was lost from the ice over time.

3 the increased burning of fossil fuels.

4 that plants started to release more carbon dioxide as the Earth warmed up.

4.9.1.4 How carbon dioxide decreased

Question 14 · continued

4B Which statement best describes the variation of carbon dioxide gas in the four layers?

1 There is a slow steady rise from **N** to **K**.

2 There is no overall pattern.

3 It is constant from **N** to **L** followed by a sharp rise in **K**.

4 There is a very slow rise from **N** to **L** followed by a sharp rise in **K**.

4C What is the most likely reason why a layer of dust and ash is found between layers **L** and **M**?

1 Explorers spilled dust and ash in the area.

2 The dust and ash were blown here from elsewhere.

3 There was a forest fire here.

4 There was volcanic activity 300 years ago.

4D The age of the ice could be estimated by . . .

1 chemical analysis of the dust and ash layer and linking it with a known historical event about 400 years ago.

2 finding fossil plants and relating them to samples found elsewhere.

3 comparing the ice core with others taken from near the North Pole.

4 comparing the ice core with others from around the world.

4.9.1.4 How carbon dioxide decreased

Question 15

November 2008 | CHY1BP | Original Q6 | Legacy

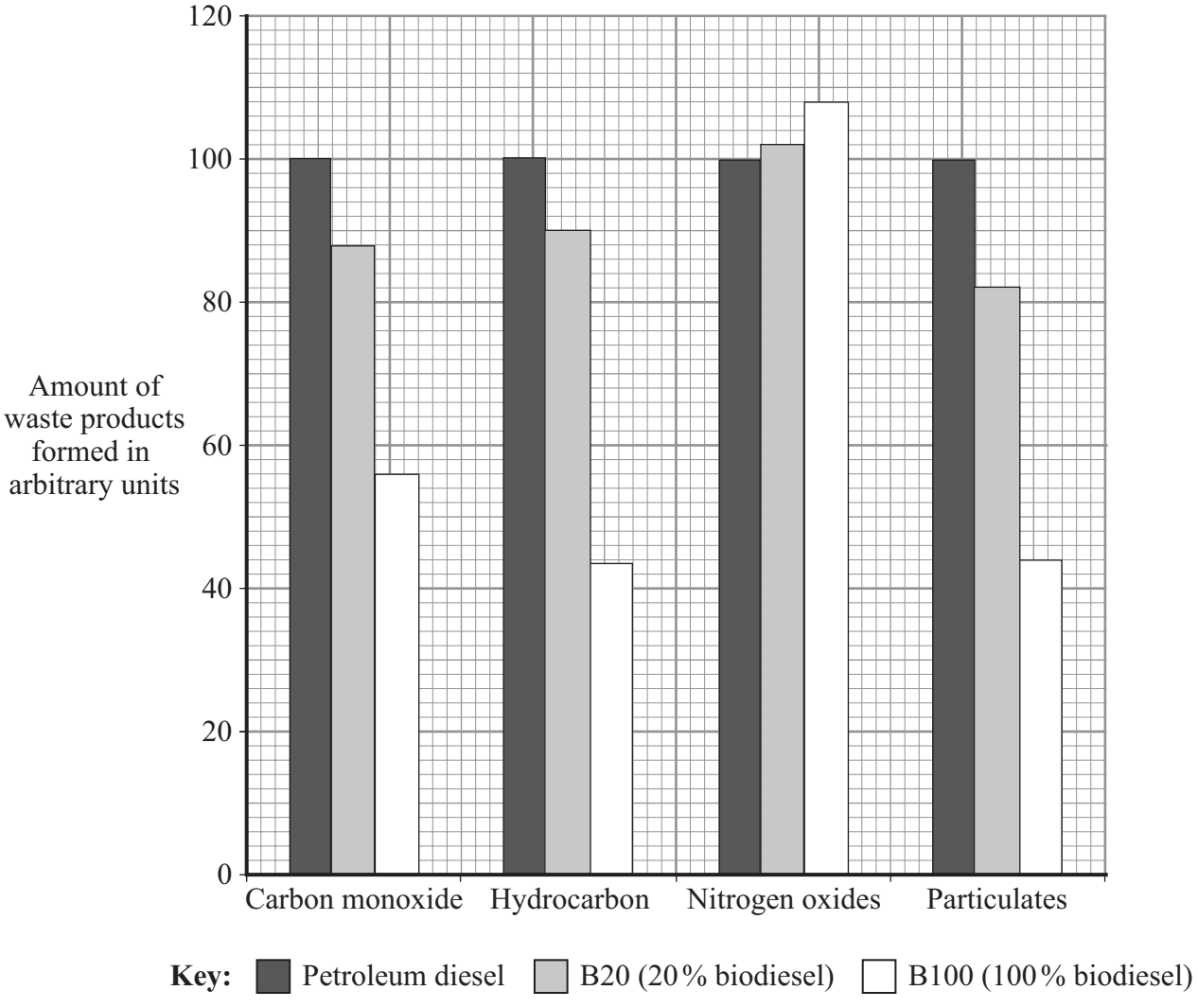
QUESTION SIX

Biodiesel is a fuel made from vegetable oils. It can be mixed with or it can entirely replace petroleum diesel fuel in vehicles.
B20 is petroleum diesel with 20% biodiesel.
B100 is 100% biodiesel.

Petroleum diesel is made from crude oil.

In a car engine, the fuel ignites and burns in air. The waste products formed leave the engine through the exhaust system.

The bar graph compares the quantities of four different waste products formed by burning B20 and B100 with the quantities formed by burning petroleum diesel.



4.9.1.4 How carbon dioxide decreased

Question 15 · continued

6A From the information on the chart, the use of B100 instead of B20 will reduce particulates by about . . .

1 5 times.

2 half.

3 20%

4 35%

6B Which of the following is a correct statement about the waste products formed by burning these fuels?

1 They are all oxides.

2 They are all reduced when B20 is used instead of petroleum diesel.

3 Water vapour is also produced.

4 No carbon dioxide is produced with B100.

6C The main advantage of B100 over petroleum diesel is that B100 . . .

1 is non-biodegradable.

2 is renewable.

3 is unsaturated.

4 is hydrogenated.

6D 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.

4.9.1.4 How carbon dioxide decreased

Question 16

March 2009 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide.

$$CaCO_3 \rightarrow CaO + CO_2$$

100 g of calcium carbonate, on complete decomposition, produces 56 g of calcium oxide.

If the carbon dioxide is not allowed to escape, it will recombine with the calcium oxide. This can happen at any temperature.

The carbon dioxide formed could be:

- used by oil companies
- used by ice-cream companies
- reacted with sodium hydroxide to make sodium carbonate for glass-making.

7A Calculate the mass of carbon dioxide that would be released by completely decomposing 400 tonnes of calcium carbonate.

(1 tonne = 1 000 000 g)

1 17.6 tonnes

2 22.4 tonnes

3 176.0 tonnes

4 224.0 tonnes

7B If calcium oxide is left exposed to the air, it will increase in mass.

Which of the following could **not** be the reason for this?

1 The calcium oxide is recombining with carbon dioxide from the air.

2 The calcium oxide is reacting with water from the air.

3 The calcium oxide is still thermally decomposing.

4 The calcium oxide is reverting back to calcium carbonate.

4.9.1.4 How carbon dioxide decreased

Question 16 · continued March 2009 | CHY1AP | Original Q7 | Legacy

7C A company makes calcium oxide from calcium carbonate.

The best way for this company to benefit economically, and at the same time reduce environmental damage, is to . . .

1 store the carbon dioxide in holes in the ground made by oil companies.

2 offer the carbon dioxide to oil companies so that they can use it to flush oil out of the ground.

3 sell solid carbon dioxide to ice-cream companies for keeping ice-cream cold.

4 sell the carbon dioxide to glass-making companies for conversion into sodium carbonate.

7D Graphs of global temperatures compared with the amount of carbon dioxide in the atmosphere over the past 50 years follow each other very closely.

The best conclusion that can be drawn from this is that . . .

1 burning fossil fuels causes global warming.

2 decomposing limestone causes global warming.

3 the heat from processing limestone causes global warming.

4 rising levels of carbon dioxide probably add to global warming.

4.9.1.4 How carbon dioxide decreased

Question 17

June 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Two problems caused by the gases released when fossil fuels are burned are:

- acid rain, caused by sulfur dioxide and oxides of nitrogen
- global warming, caused by carbon dioxide.

Fuel manufacturers have introduced low-sulfur fuels to try to reduce the sulfur dioxide emissions.

6A Low-sulfur fuels were introduced in the UK in 2000. The amount of acid rain gases from transport increased from 2000 to 2004.

This increase could be due to . . .

1 the partial combustion of low-sulfur fuels.

2 an increasing number of vehicles on the UK's roads.

3 increasing emissions of carbon monoxide.

4 some sulfur dioxide not dissolving in rain water.

6B Carbon monoxide and oxides of nitrogen can be removed by a catalytic converter in the exhaust system of vehicles. The two gases, carbon monoxide (CO) and nitrogen dioxide (NO_2), react to produce carbon dioxide (CO_2) and nitrogen (N_2).

The balanced equation that correctly describes this reaction is . . .

1 $CO + NO_2 \rightarrow CO_2 + N_2$

2 $2CO + NO_2 \rightarrow 2CO_2 + N_2$

3 $3CO + 2NO_2 \rightarrow 3CO_2 + N_2$

4 $4CO + 2NO_2 \rightarrow 4CO_2 + N_2$

6C The conversion of carbon monoxide and nitrogen dioxide to carbon dioxide and nitrogen will . . .

1 decrease acid rain and decrease global warming.

2 decrease acid rain and increase global warming.

3 increase acid rain and increase global warming.

4 increase acid rain and decrease global warming.

4.9.1.4 How carbon dioxide decreased

Question 17 · continued June 2009 | CHY1AP | Original Q6 | Legacy

6D Environmentalists have encouraged the use of hydrogen as a fuel instead of petrol because . . .

1 hydrogen is a renewable fuel obtained from sugar.

2 carbon monoxide is the main product of combustion.

3 no carbon dioxide is produced when hydrogen is burned.

4 hydrogen produces only low levels of sulfur dioxide when burned.

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

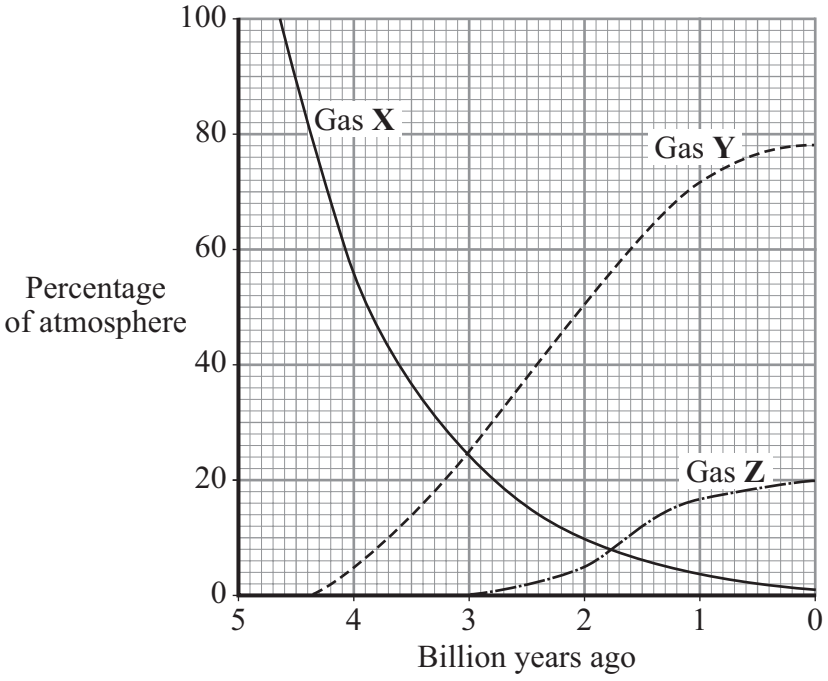
Question 18

June 2009 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

Gases **X**, **Y** and **Z** are found in the Earth's atmosphere today.

The graph shows how the percentages of these gases in the atmosphere have changed over the last five billion years.



8A Which row in the table correctly describes the gases **X**, **Y** and **Z**?

	Gas X	Gas Y	Gas Z
1	Carbon dioxide	Nitrogen	Oxygen
2	Oxygen	Nitrogen	Carbon dioxide
3	Nitrogen	Carbon dioxide	Oxygen
4	Carbon dioxide	Oxygen	Nitrogen

4.9.1.4 How carbon dioxide decreased

Question 18 · continued June 2009 | CHY1BP | Original Q8 | Legacy

8B The Earth's atmosphere today contains the noble gas argon, which is by far the most abundant noble gas.

Argon is used in filament light bulbs because . . .

1 it has a low density.

2 it glows red when hot.

3 it can be obtained from the air by filtration.

4 it is chemically unreactive.

The table below shows the amounts of carbon dioxide in the Earth's atmosphere since 1750.

Year	1750	1800	1850	1900	1950	2000
Percentage (%) of carbon dioxide by volume	0.0270	0.0282	0.0288	0.0297	0.0310	0.0368

8C A graph of percentage (%) of carbon dioxide on the *y*-axis against time on the *x*-axis from 1750 to 2000 would show . . .

1 direct proportionality after 1800.

2 many anomalous values.

3 random scatter.

4 stronger positive correlation after 1850 than before.

8D The values given in the table show . . .

1 sensitivity because the values are close together.

2 reliability because the values are calculated by modern techniques.

3 precision because the values are given to 4 decimal places.

4 accuracy because famous scientists have calculated the values.

4.9.1.4 How carbon dioxide decreased

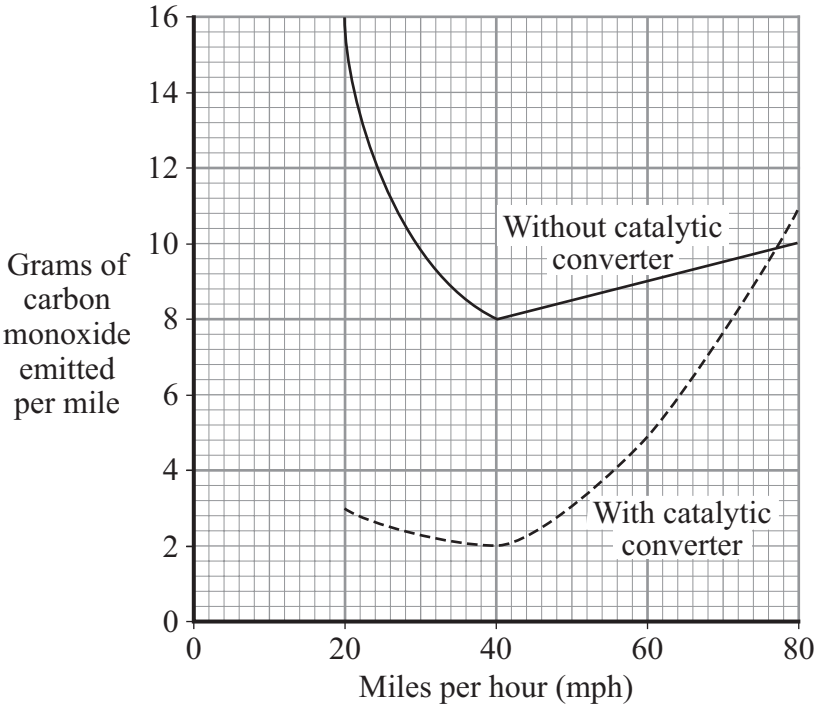
Question 19

November 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Catalytic converters are fitted to car exhausts to reduce harmful emissions from the car.
In a catalytic converter, carbon monoxide is converted into carbon dioxide. However, catalytic converters are not 100% efficient.

The graph shows the effect of a catalytic converter.



6A At 40 mph, a catalytic converter reduces carbon monoxide emissions by . . .

1 2 g per mile.

2 4 g per mile.

3 6 g per mile.

4 8 g per mile.

4.9.1.4 How carbon dioxide decreased

Question 19 · continued

6B At what speed does a car with a catalytic converter emit the same amount of carbon monoxide as a car without a catalytic converter?

1 40 mph

2 70 mph

3 77 mph

4 80 mph

6C Which statement about the graph is true?

1 Catalytic converters work best at speeds above 40 mph.

2 The higher the speed, the higher the carbon monoxide emissions.

3 There is no connection between speed and the amount of carbon monoxide emitted.

4 Catalytic converters are more effective at lower speeds.

6D All the carbon monoxide emitted into the atmosphere eventually forms carbon dioxide.

Which of the following statements is true?

1 Using catalytic converters reduces the amount of carbon dioxide put into the atmosphere by cars.

2 The effect that car emissions have on global warming is not changed by using catalytic converters.

3 Carbon dioxide levels are not affected by the use of cars.

4 A car without a catalytic converter produces more carbon dioxide than a car fitted with one.

4.9.1.4 How carbon dioxide decreased

Question 20

November 2009 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

Some scientists think that the Earth's early atmosphere was mainly carbon dioxide, water vapour and nitrogen, with no oxygen.

Some scientists think that the early atmosphere also contained carbon monoxide, hydrogen, methane and ammonia.

Other scientists think that the atmosphere has always contained some oxygen.

Evidence comes from geological records starting over 4 billion years ago, the composition of gases from volcanoes, observations of conditions on other planets, and the composition of the atmosphere today.

The table shows some information about the atmospheres of the planets, Venus, Earth and Mars today.

	Venus	**Earth**	**Mars**
Carbon dioxide, % by mass	98.0	0.036	95.0
Oxygen, % by mass	0.0	21.0	0.25
Nitrogen, % by mass	2.0	78.0	2.4
Water vapour, % by mass	0.05	0.20	0.10
Mass of atmosphere in tonnes	5.2×10^{17}	5.2×10^{15}	2.4×10^{10}

9A Scientists do **not** agree about the Earth's early atmosphere because . . .

1 there is too much evidence available.

2 the information can be interpreted in different ways.

3 the data is inaccurate.

4 geological records do not go back far enough.

9B Which of the following supports the idea that there was oxygen in the Earth's early atmosphere?

1 Calcium sulfate ($CaSO_4$) is found in rocks formed 3.5 billion years ago.

2 Many of the oldest rocks contain iron sulfide, FeS.

3 The atmosphere now contains more than 20% oxygen.

4 Some of the gases in the early atmosphere came from volcanoes.

4.9.1.4 How carbon dioxide decreased

9C Which one of these is an **incorrect** reason for the small percentage of carbon dioxide in the Earth's atmosphere today?

1 Some carbon dioxide has dissolved in the oceans.

2 Carbon dioxide has been used in chemical reactions to form sedimentary rocks.

3 Some carbon dioxide has been locked up in fossil fuels.

4 There has always been only a small amount of carbon dioxide in the atmosphere.

9D Which one of the following statements is true?

1 Venus has the smallest mass of water vapour in its atmosphere.

2 Earth has a greater mass of water vapour in its atmosphere than Venus or Mars.

3 Venus has a greater mass of nitrogen in its atmosphere than Earth or Mars.

4 Mars has a greater mass of carbon dioxide in its atmosphere than the Earth.

END OF TEST

4.9.1.4 How carbon dioxide decreased

Question 21

March 2010 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

All the gases in the Earth's atmosphere can be separated by this method:

- remove the carbon dioxide
- cool the air down to a very low temperature so that it liquefies
- allow the liquefied gases to warm up
- collect the gases as they boil off at different temperatures.

The table below gives some information about the gases in the Earth's atmosphere.

Gas	Melting point in °C	Boiling point in °C	Abundance in %
Oxygen	−223	−183	21
Nitrogen	−209	−196	78
Carbon dioxide	−57	−57	0.03
Helium	−272	−269	Less than 0.1
Neon	−248	−246	Less than 0.1
Argon	−189	−186	0.9
Krypton	−157	−153	Less than 0.1
Xenon	−112	−108	Less than 0.1

8A In this method of separation, carbon dioxide is always removed from the air before it is liquefied because . . .

1 it would react with the other gases present.

2 it would solidify during cooling and block up the pipes.

3 it is a greenhouse gas and would warm up the apparatus.

4 it is a heavy gas and would not separate properly from the mixture.

4.9.1.4 How carbon dioxide decreased

Question 21 · continued March 2010 | CHY1BP | Original Q8 | Legacy

8B How many of the gases listed in the table (excluding carbon dioxide), would be liquid at –150 °C?

1 None

2 1

3 2

4 3

8C Argon is the cheapest of the noble gases to produce because . . .

1 there is high demand for it for use in light bulbs.

2 it is the most abundant of the noble gases.

3 it is the gas that vaporises most easily and so requires the least energy to remove it.

4 it is an unreactive gas so it can easily be separated from the other gases in the air.

8D Earth's early atmosphere contained a high percentage (%) of carbon dioxide.

One reason for the reduction of the percentage of carbon dioxide is that carbon dioxide . . .

1 has dissolved in the oceans.

2 has been reduced to carbon monoxide.

3 has decomposed to form carbon and oxygen.

4 has been released by plants.

4.9.1.4 How carbon dioxide decreased

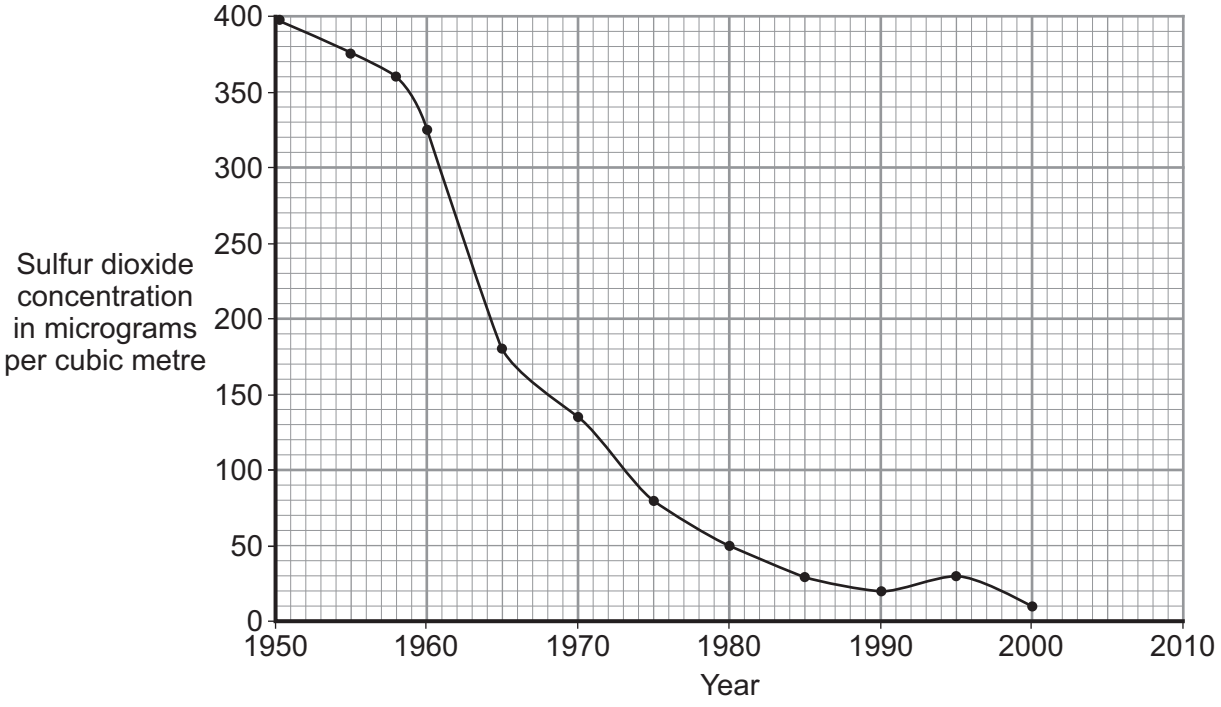
Question 22

June 2010 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The graph shows how sulfur dioxide concentrations in the atmosphere above London changed between 1950 and 2000.

The table shows the energy used in London in 1950 and in 2000.



Year	Energy used in arbitrary units							
	Petrol	Diesel	Electricity	Oil	House coal	Other solid fuels	Gas	Total
1950	10	5	20	25	100	110	60	330
2000	60	20	130	10	0	10	310	540

7A The information in the graph and table suggests that sulfur dioxide levels have decreased due to . . .

1 an increase in the use of petrol.

2 a decrease in the use of coal and other solid fuels.

3 an increase in the use of electricity that is generated at coal-burning power stations.

4 an increase in the use of diesel.

4.9.1.4 How carbon dioxide decreased

Question 22 · continued

7B Which one of the following is a reason why a prediction for sulfur dioxide concentration in 2010 might be unreliable?

1 Sulfur dioxide has a natural cycle in London of increasing and decreasing.

2 Sulfur dioxide dissolves in water to produce acid rain.

3 The concentration of sulfur dioxide has, in previous years, both increased and decreased.

4 Sulfur dioxide is very difficult to measure in such small concentrations.

7C It was found that the amount of sulfur dioxide from transport increased during years 2000 to 2004, even though many more cars were using low-sulfur fuels.

The reason for this could be . . .

1 a decrease in the use of transport.

2 the introduction of more efficient cars that burn less fuel.

3 an increase in the number of cars used in London.

4 an increase in the price of crude oil.

7D A newspaper published an article about sulfur dioxide concentrations in the atmosphere above London. It stated that in one five-year period, sulfur dioxide levels had fallen by about 44 %.

The five-year period was . . .

1 1960–1965.

2 1965–1970.

3 1985–1990.

4 1995–2000.

4.9.1.4 How carbon dioxide decreased

Question 23

June 2010 | CHY1BP | Original Q5 | Legacy

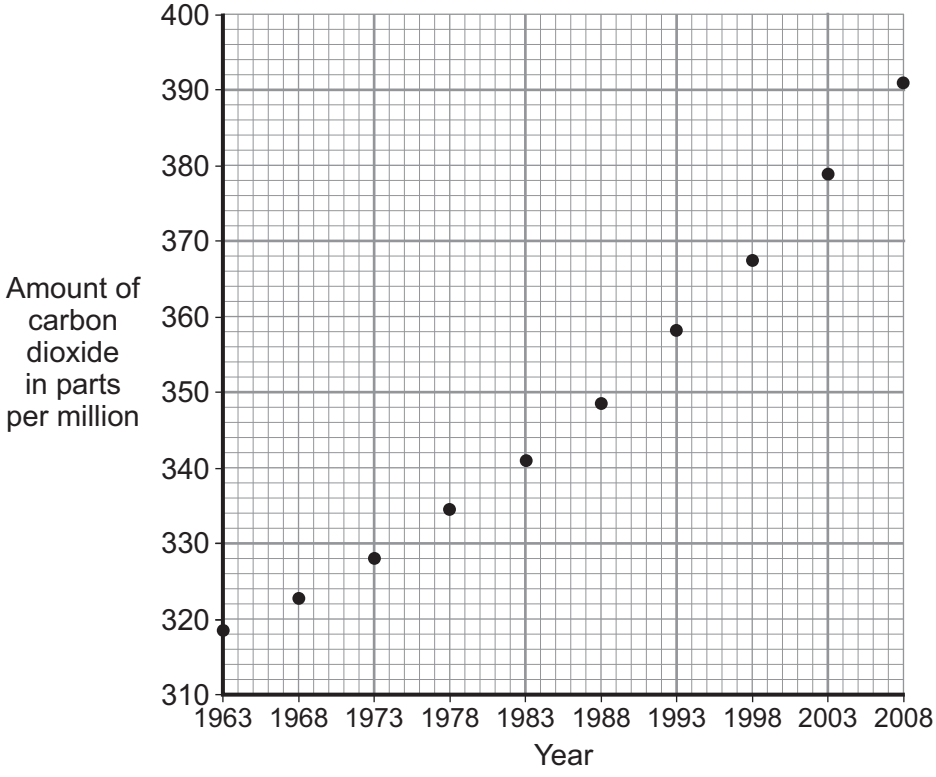
QUESTION FIVE

Scientists have been measuring the amount of carbon dioxide in the atmosphere high above a remote island in the Pacific Ocean.

The table shows some data that they collected over 45 years.

The data is plotted on the graph.

Year	1963	1968	1973	1978	1983	1988	1993	1998	2003	2008
Amount of carbon dioxide in parts per million	318.9	323.1	328.0	334.2	340.9	348.9	358.1	367.7	378.8	391.0



5A What is the best way of showing the trend in the amount of carbon dioxide on the graph?

1 Draw a series of straight lines linking one point to the next.

2 Add points between those already plotted to estimate the missing years.

3 Draw a bar chart.

4 Draw a smooth curve as close as possible to the points.

4.9.1.4 How carbon dioxide decreased

Question 23 · continued

5B What does the data show about the amounts of carbon dioxide above the island?

1 The amount of carbon dioxide has increased at an increasing rate since 1963.

2 Recent efforts to slow the increase in the amount of carbon dioxide have been successful.

3 Amounts of carbon dioxide before 1963 were lower than 300 parts per million.

4 The amount of carbon dioxide has increased because there are now more cars on the island.

5C Is there enough data to support the theory that global carbon dioxide levels have increased over the period studied?

1 No, because the scientists would need to measure the amount of carbon dioxide every year to be certain.

2 Yes, because it is obvious that the amount of carbon dioxide is the same all over the world.

3 No, because data from many different sites worldwide would be needed to make sure.

4 Yes, because the amount of carbon dioxide went up every time a measurement was made.

5D Scientists have compared the amount of carbon dioxide in the atmosphere today with the amount they estimate there was during the first billion years of the Earth's existence.

They think that . . .

1 there is more carbon dioxide today because of the burning of fossil fuels.

2 there is less carbon dioxide today because a lot became trapped in carbonate rocks.

3 the amount of carbon dioxide has remained much the same until very recently.

4 there was no carbon dioxide to begin with because there were no humans to burn fuels.

4.9.1.4 How carbon dioxide decreased

Question 24

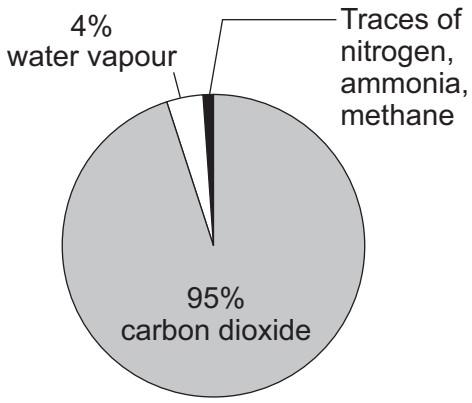
June 2010 | CHY1H | Original Q2 | Legacy

2 (a) Scientists have suggested that:

- the Earth formed as a molten ball of rock and minerals
- the rock and minerals cooled slowly
- the surface of the Earth was covered by volcanoes
- the volcanoes released gases that formed the Earth's early atmosphere.

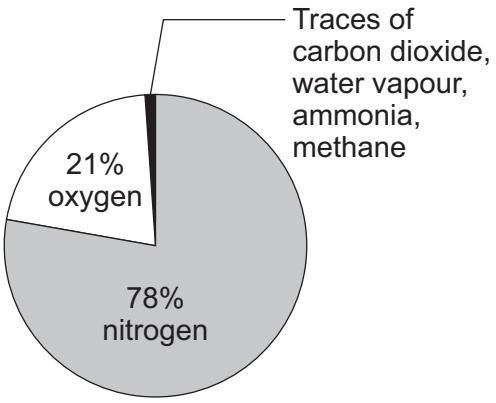
The pie charts show the approximate percentages of gases in the Earth's early atmosphere and in the Earth's atmosphere today.

Earth's early atmosphere



Average surface temperature above 400 °C

Earth's atmosphere today



Average surface temperature 20 °C

2 (a) (i) Explain what has happened to most of the water vapour in the Earth's early atmosphere.

.....

.....

.....

.....

(2 marks)

2 (a) (ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's early atmosphere decreased.

1 .....

.....

2 .....

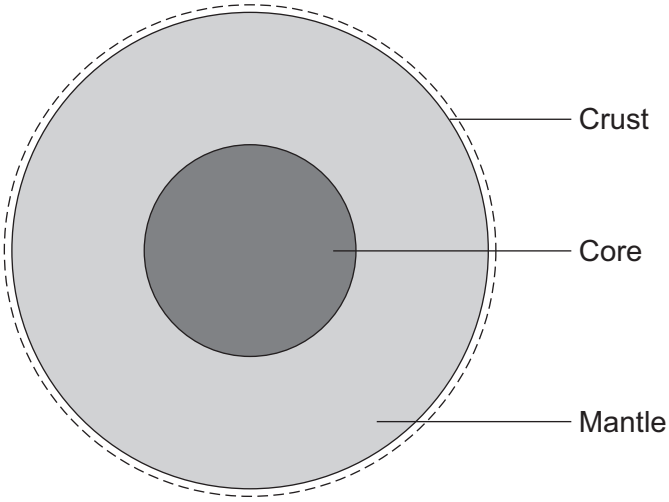
.....

(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 24 · continued

2 (b) Scientists have suggested that the Earth consists of a core, mantle and crust.



A 'traditional' theory is that the core is made of iron and nickel.

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

2 (b) (i) Why can scientists **not** prove which theory about the core is correct?

.....

.....

(1 mark)

2 (b) (ii) How can the 'controversial' theory be used to explain why the Earth's tectonic plates move?

.....

.....

.....

.....

.....

.....

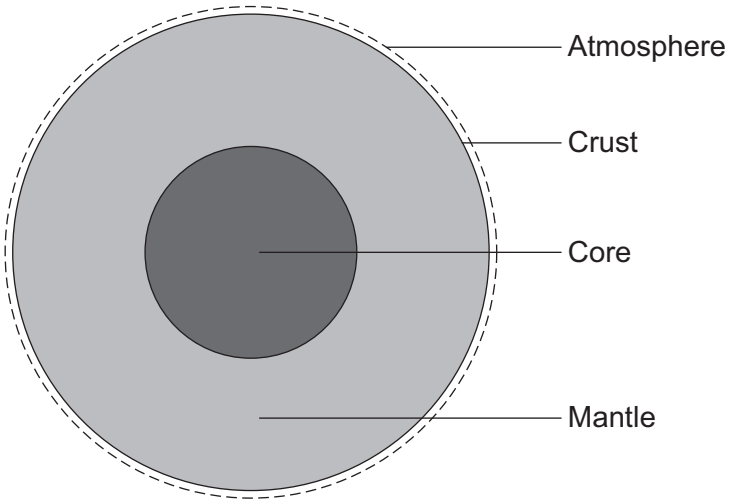
(3 marks)

8

4.9.1.4 How carbon dioxide decreased

Question 25

3 The Earth has a layered structure and is surrounded by an atmosphere.



3 (a) Scientists believe that the Earth's atmosphere was formed by volcanoes releasing gases.
This early atmosphere was about 95 % carbon dioxide.
The composition of the Earth's atmosphere is always changing.

3 (a) (i) The Earth's atmosphere today contains about 0.035 % carbon dioxide.

What happened to most of the carbon dioxide that was in the Earth's early atmosphere?

.....

.....

.....

.....

(2 marks)

3 (a) (ii) About 60 million years ago a large meteorite hit the Earth.
This meteorite heated limestone in the Earth's crust causing the release of large amounts of carbon dioxide.

Explain how carbon dioxide is released from limestone.

.....

.....

.....

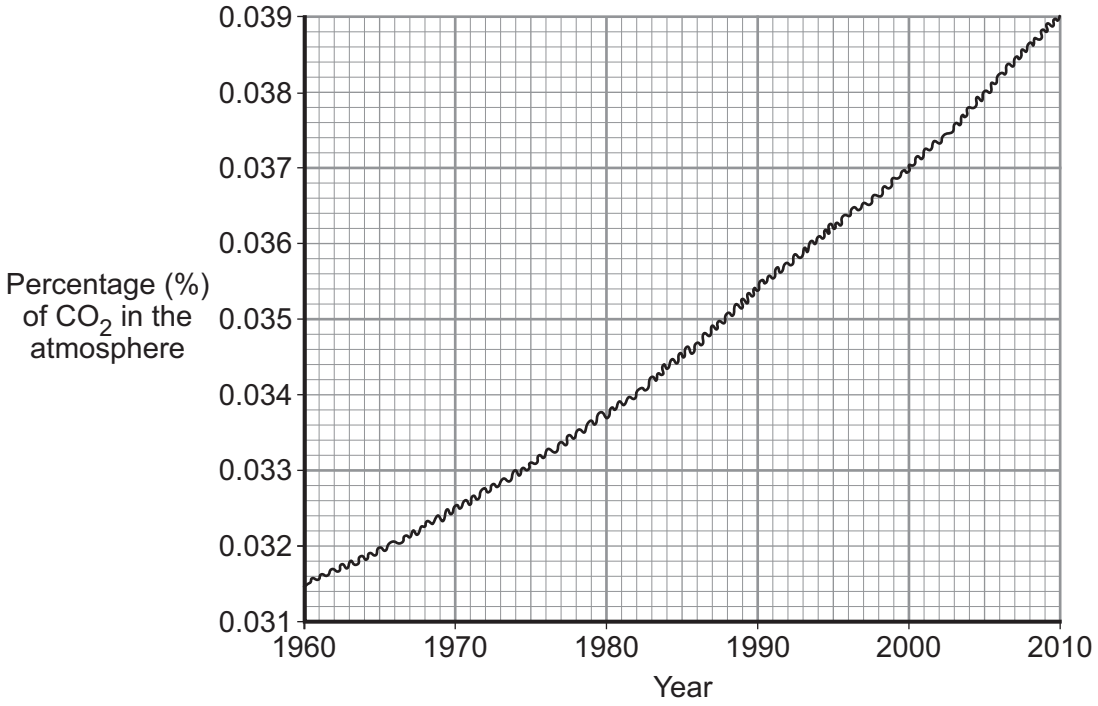
.....

(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 25 · continued

3 (b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



Explain, as fully as you can, why we should be concerned about the information displayed on this graph.

.....

.....

.....

.....

.....

.....

.....

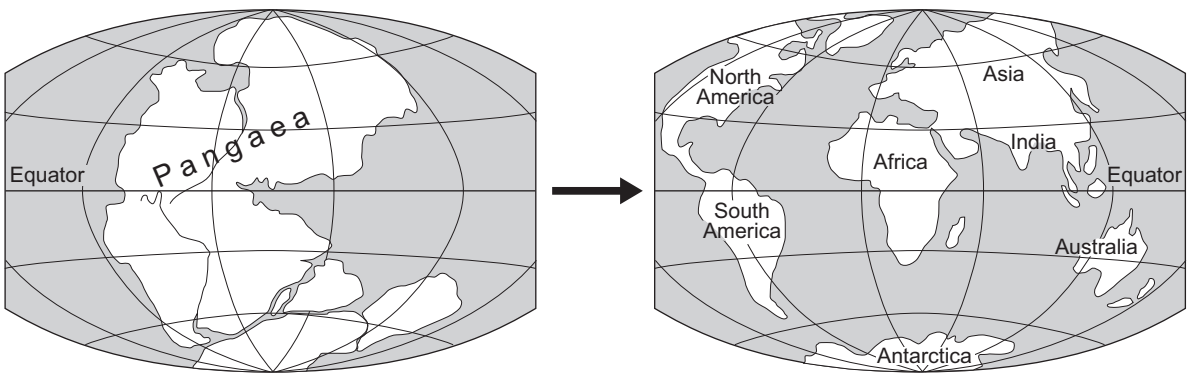
(3 marks)

Question 3 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 25 · continued

3 (c) Scientists believe that all the continents of the Earth were once joined together. The huge 'supercontinent' was called Pangaea.



200 million years ago **Today**

In 1915, Alfred Wegener had an idea that the change shown in the diagram was caused by *continental drift*. Most scientists could not accept his idea.

3 (c) (i) Suggest why most scientists in 1915 could not accept Wegener's idea of *continental drift*.

.....

.....

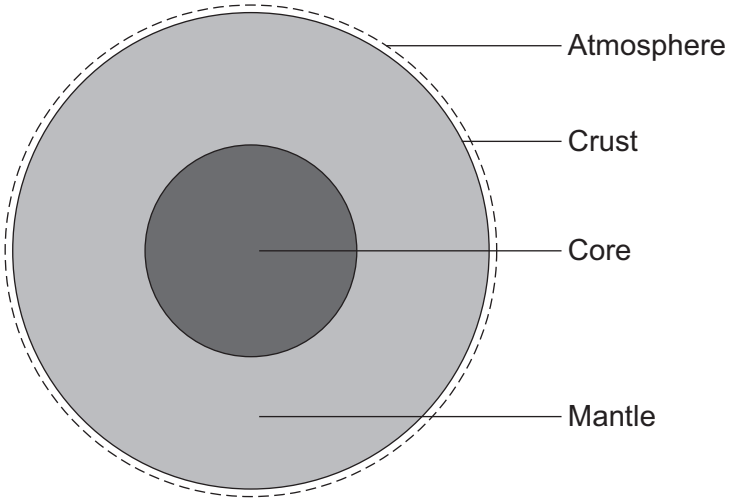
(1 mark)

4.9.1.4 How carbon dioxide decreased

Question 25 · continued

To help you with this question, the information and diagram from the beginning of the question are reprinted here.

The Earth has a layered structure and is surrounded by an atmosphere.



3 (c) (ii) Use this information and your knowledge and understanding to explain how continents move.

.....

.....

.....

.....

.....

.....

(3 marks)

11

4.9.1.4 How carbon dioxide decreased

Question 26

March 2011 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

Some vehicles which normally use petroleum diesel fuel can also use a mixture of biodiesel and petroleum diesel.

Petroleum diesel is made from crude oil.
Biodiesel is made from a variety of vegetable oils: for example, soybean, palm and rapeseed.
This means that large areas of land are needed to grow crops from which to extract the vegetable oils for the production of biodiesel.

8A Research into the production and use of biodiesel continues.

The main reason for this is that . . .

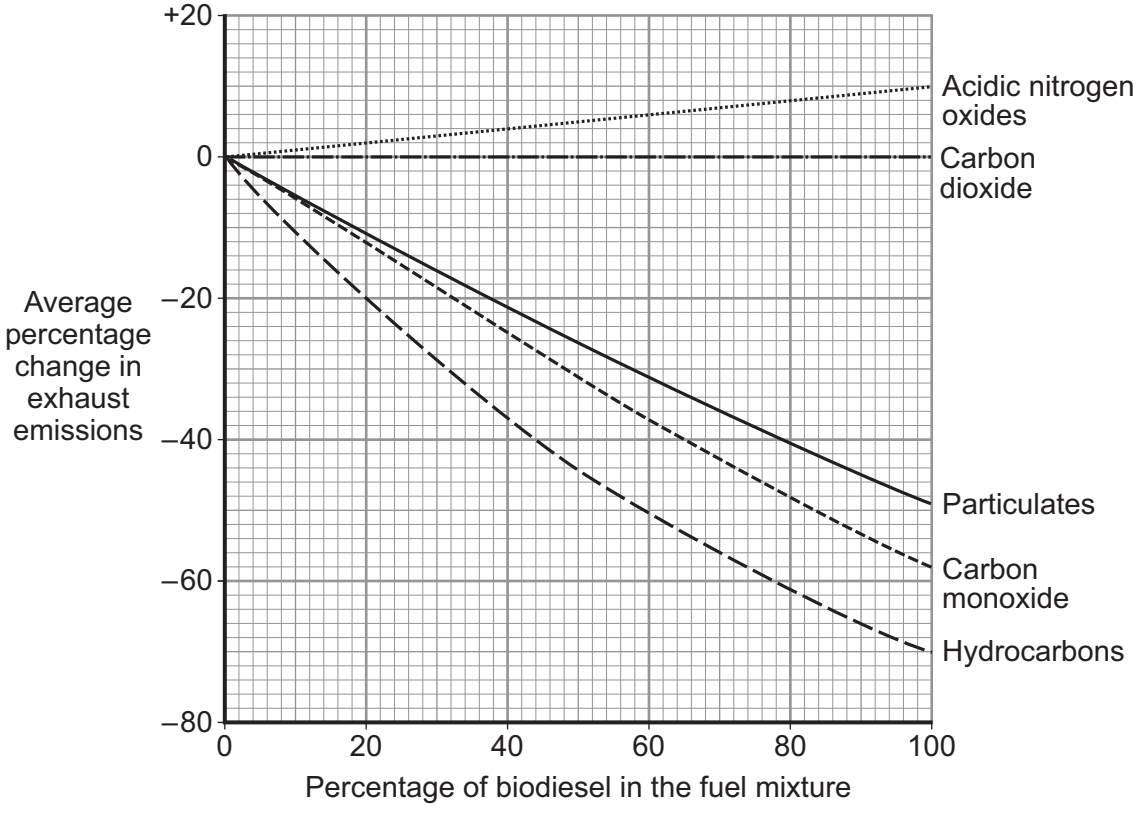
1 unused food crops are being wasted in some developing countries.

2 large, new oilfields have been discovered in Europe.

3 crude oil is a non-renewable energy source.

4 car manufacturers are making cars that run only on biodiesel.

The graph shows the average percentage change in exhaust emissions from vehicles using different mixtures of petroleum diesel and biodiesel.



4.9.1.4 How carbon dioxide decreased

Question 26 · continued March 2011 | CHY1BP | Original Q8 | Legacy

8B Some scientists claim that net carbon dioxide emissions are lower for biodiesel than for petroleum diesel.

What is the basis for this argument?

1 Biodiesel produces less carbon dioxide when it burns.

2 Plants take up carbon dioxide as they grow.

3 Biodiesel is not a carbon compound.

4 Plants release carbon dioxide in respiration.

8C The graph indicates that when compared with 100 % petroleum diesel, a fuel mixture of equal volumes of petroleum diesel and biodiesel will . . .

1 reduce nitrogen oxides by about 5 %.

2 increase both particulates and carbon monoxide by about 25 %.

3 reduce hydrocarbons by about 45 %.

4 reduce carbon dioxide by about 5 %.

8D One possible disadvantage of using fuel with a high percentage of biodiesel is that . . .

1 it is non-biodegradable.

2 it could increase the amount of acid rain.

3 it is non-renewable.

4 it could increase global dimming.

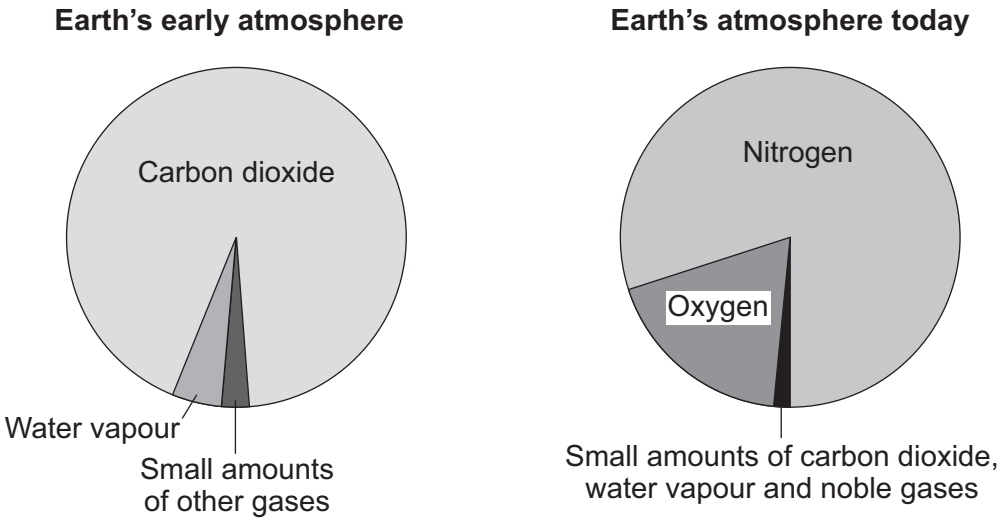
4.9.1.4 How carbon dioxide decreased

Question 27

June 2011 | CHY1BP | Original Q3 | Legacy

QUESTION THREE

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



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

This gas is . . .

1 ammonia, NH_3

2 helium, He

3 methane, CH_4

4 oxygen, O_2

4.9.1.4 How carbon dioxide decreased

Question 27 · continued

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

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

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

3C Why was there no oxygen in the Earth's early atmosphere?

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

2 Living organisms had used up the oxygen.

3 There were no plants on Earth.

4 Oxygen is a very reactive gas.

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

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

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

2 it is locked up as carbon in fossil fuels.

3 most homes use fossil fuels for central heating.

4 plants produce carbon dioxide by photosynthesis.

4.9.1.4 How carbon dioxide decreased

Question 28

June 2011 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

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

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

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

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

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

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

1 1

2 2

3 4

4 6

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

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

7B How is the ethene for this process obtained?

1 by fractional distillation of crude oil

2 by cracking fractions from crude oil

3 by polymerisation of crude oil

4 by vaporisation of crude oil

4.9.1.4 How carbon dioxide decreased

Question 28 · continued June 2011 | CHY1BP | Original Q7 | Legacy

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

1 higher temperatures are required.

2 catalysts are used.

3 the ethanol is purer.

4 the reaction is slower.

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

One reason for this is that . . .

1 ethene can be produced in unlimited quantities.

2 crude oil is a non-renewable resource.

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

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

4.9.1.4 How carbon dioxide decreased

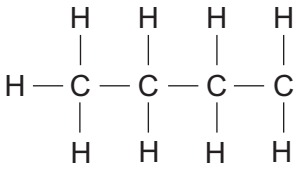
Question 29

June 2011 | CHY1H | Original Q5 | Legacy

5 Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

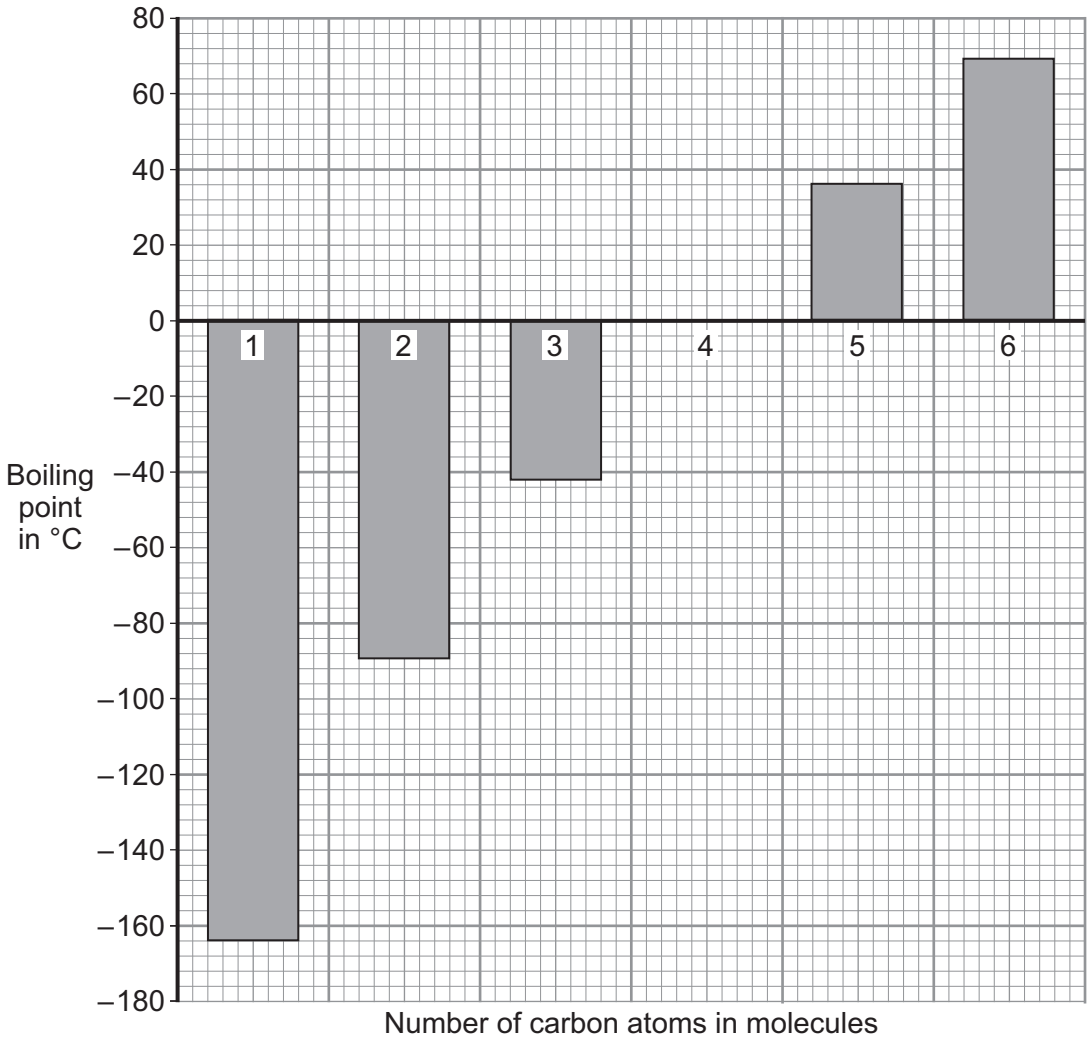
5 (a) The general formula of an alkane is C_nH_{2n+2}

Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1 mark)

5 (b) The boiling points of alkanes are linked to the number of carbon atoms in their molecules.



5 (b) (i) Describe the link between the number of carbon atoms in an alkane molecule and its boiling point.

.....

.....

(1 mark)

4.9.1.4 How carbon dioxide decreased

Question 29 · continued June 2011 | CHY1H | Original Q5 | Legacy

5 (b) (ii) Suggest **two** reasons why all of the alkanes in the bar chart are better fuels than the alkane with the formula $C_{30}H_{62}$

1 .....

.....

2 .....

.....

(2 marks)

5 (c) During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %.
Over the last 100 years the percentage of carbon dioxide in the atmosphere has increased to about 0.04 %.
Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport.
Fossil fuels contain carbon that has been locked up for millions of years.

5 (c) (i) Burning fossil fuels, such as petrol, releases this locked up carbon. Balance the chemical equation for the combustion of one of the alkanes in petrol.

$$2\,C_8H_{18} + 25\,O_2 \longrightarrow \text{.....}\ CO_2 + \text{.....}\ H_2O$$

(1 mark)

5 (c) (ii) Where did the carbon that is locked up in fossil fuels come from?

.....

.....

(1 mark)

5 (c) (iii) The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %.
Explain why.

.....

.....

.....

.....

.....

.....

(2 marks)

8

4.9.1.4 How carbon dioxide decreased

Question 30

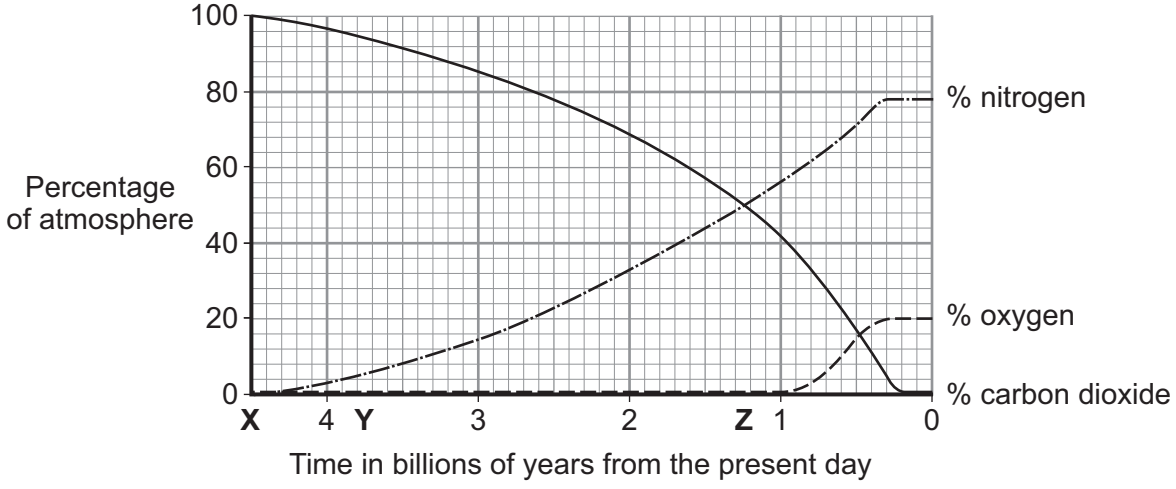
November 2011 | CHY1BP | Original Q7 | Legacy

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

4.9.1.4 How carbon dioxide decreased

Question 30 · continued

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.

4.9.1.4 How carbon dioxide decreased

Question 31

January 2012 | CH1HP | Original Q2 | Legacy

2 A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

2 (a) Use the information above to answer these questions.

2 (a) (i) Give the formula for heptane.

.....

(1 mark)

2 (a) (ii) Complete the general formula of alkanes.
n = number of carbon atoms

$$C_nH$$

(1 mark)

2 (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1**.

2 (b) (i) Name the carbon compound produced in **Reaction 2**.

.....

(1 mark)

2 (b) (ii) Give a reason why the carbon compounds produced are different.

.....

.....

(1 mark)

Question 2 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 31 · continued

2 (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

2 (c) (i) What is the percentage of the other gases in the table?

.....

(1 mark)

2 (c) (ii) What is the name of the compound that makes up most of the other gases?

.....

(1 mark)

2 (c) (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

.....

.....

(1 mark)

2 (c) (iv) State how nitrogen oxides are produced in a petrol engine.

.....

.....

.....

.....

(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 31 · continued

2 (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

.....

.....

.....

.....

(2 marks)

11

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

Question 32

June 2012 | CH1HP | Original Q4 | Legacy

4 Venus is often compared to the Earth. The Earth's early atmosphere was mainly carbon dioxide like the atmosphere of Venus today.

Atmosphere of Earth today		Atmosphere of Venus today	
Gas	**Percentage (%)**	**Gas**	**Percentage (%)**
Nitrogen	78	Nitrogen	3.5
Oxygen	21	Oxygen	A trace
Carbon dioxide	0.04	Carbon dioxide	96

4 (a) Give **two** reasons why the percentage of carbon dioxide decreased in the Earth's early atmosphere.

.....

.....

.....

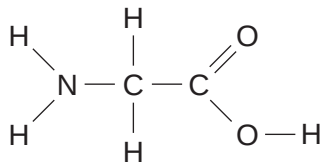
.....

(2 marks)

4 (b) In the 1950s two scientists, Miller and Urey, investigated the origin of life on Earth.
Miller and Urey used the gases that they believed were in the Earth's early atmosphere and used water to represent the oceans.
The gases they used were methane (CH_4), ammonia (NH_3) and hydrogen (H_2).
A continuous electrical spark was used to simulate lightning storms.

After one week the Miller-Urey experiment had produced amino acids.
Amino acids are essential to life.

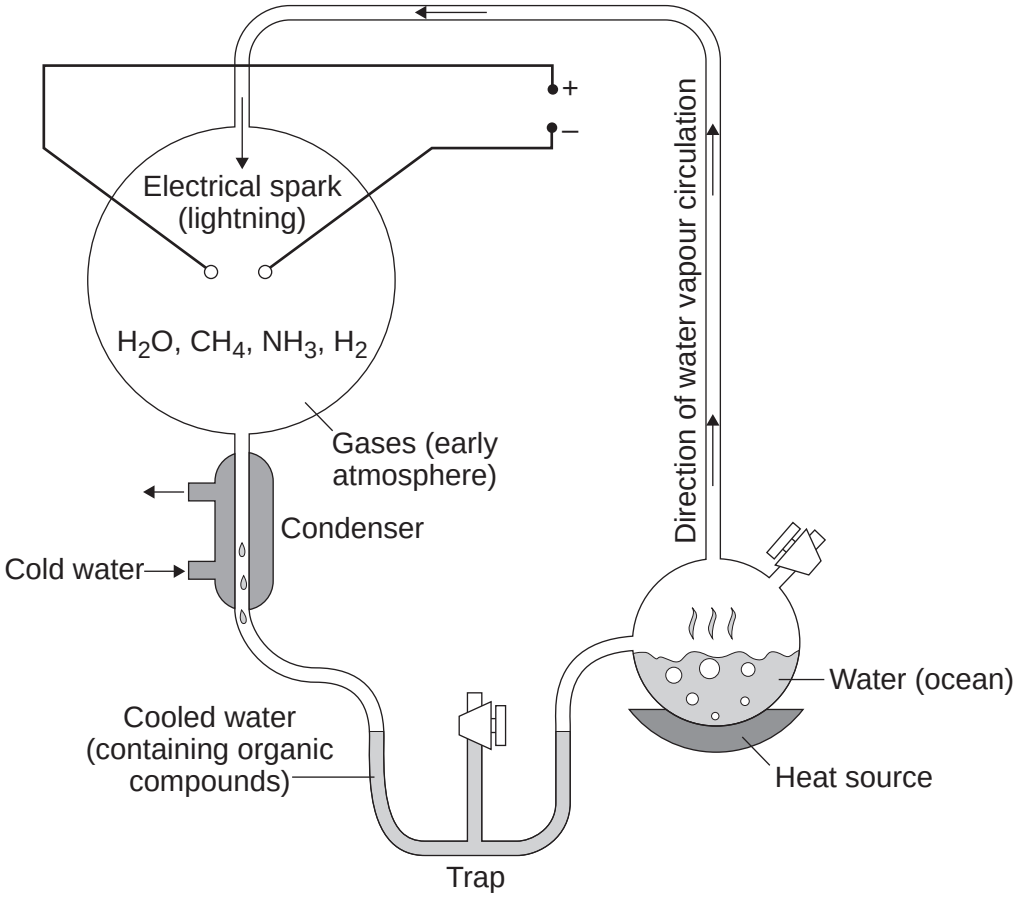
The simplest amino acid is glycine (aminoethanoic acid).



4.9.1.4 How carbon dioxide decreased

Question 32 · continued

The apparatus used in the Miller-Urey experiment is shown in the diagram.



Use the information in the diagram and on page 10 to answer these questions.

4 (b) (i) Miller and Urey used methane, ammonia and hydrogen for the Earth's early atmosphere.

Suggest why.

.....

.....

(1 mark)

4 (b) (ii) The experiment provides only weak evidence of how amino acids formed on Earth.

Suggest **two** reasons why.

.....

.....

.....

.....

(2 marks)

5

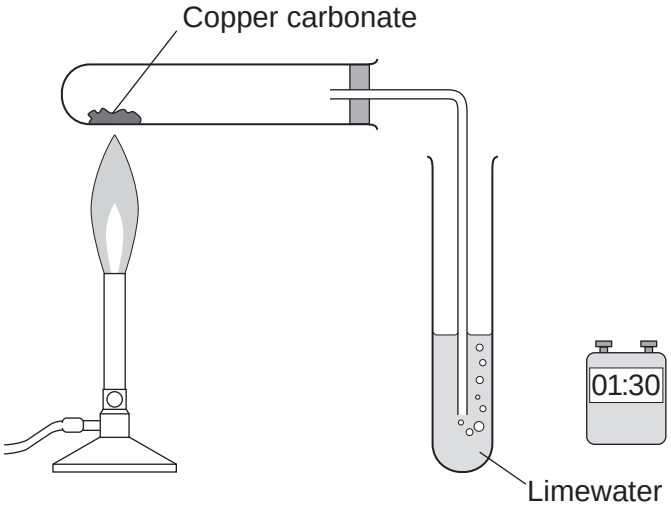
4.9.1.4 How carbon dioxide decreased

Question 33

January 2013 | CH1HP | Original Q2 | Legacy

2 Carbon dioxide is produced when copper carbonate is heated.

A student investigated heating copper carbonate.
The student used the apparatus to measure how long it took for carbon dioxide to be produced.
The student also noted what happened during each minute for three minutes.



2 (a) The student used changes to the limewater to measure how long it took for carbon dioxide to be produced.

Describe how.

.....

.....

.....

.....

(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 33 · continued

2 (b) The student wrote down her observations.

Time interval in minutes	Observations
Between 0 and 1	A slow release of gas bubbles. The limewater did not change. The solid in the test tube was green.
Between 1 and 2	A fast release of gas bubbles. The limewater changed at 1 minute 10 seconds.
Between 2 and 3	No release of gas bubbles. The solid in the test tube was black.

2 (b) (i) Suggest the reason for the student's observations between 0 and 1 minute.

.....

.....

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.....

(2 marks)

2 (b) (ii) Explain the student's observations between 1 and 2 minutes.

.....

.....

.....

.....

(2 marks)

2 (b) (iii) Explain the student's observations between 2 and 3 minutes.

.....

.....

.....

.....

(2 marks)

8

4.9.1.4 How carbon dioxide decreased

Question 34

June 2013 | CH1HP | Original Q5 | Legacy

5 The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was formed.
The amount of carbon dioxide continues to change because of human activities.

5 (a) Cement is produced when a mixture of calcium carbonate and clay is heated in a rotary kiln. The fuel mixture is a hydrocarbon and air.

Hydrocarbons react with oxygen to produce carbon dioxide.
Calcium carbonate decomposes to produce carbon dioxide.

5 (a) (i) Complete each chemical equation by writing the formula of the other product.

$$CH_4 + 2O_2 \longrightarrow 2 \text{ .....} + CO_2$$

$$CaCO_3 \longrightarrow \text{.....} + CO_2$$

(2 marks)

5 (a) (ii) Hydrocarbons and calcium carbonate contain *locked up* carbon dioxide.

What is *locked up* carbon dioxide?

.....

.....

.....

.....

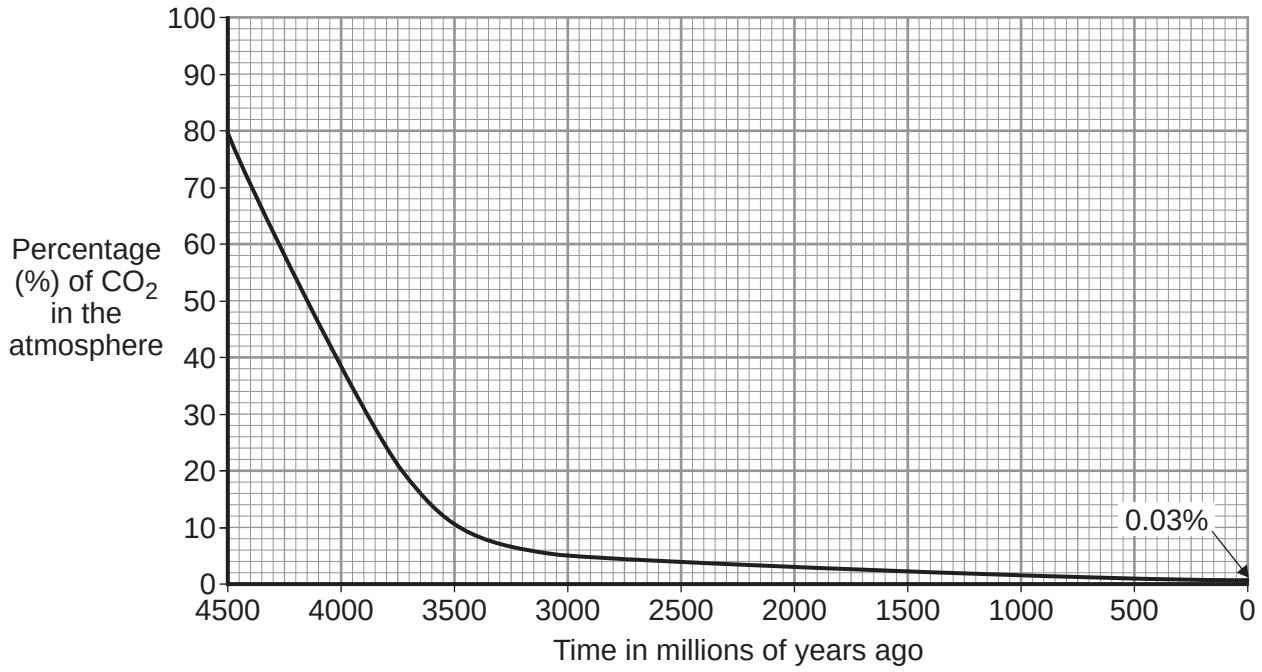
(2 marks)

4.9.1.4 How carbon dioxide decreased

Question 34 · continued

5 (b) **Graph 1** shows how the percentage of carbon dioxide in the atmosphere changed in the last 4500 million years.

Graph 1



Use information from **Graph 1** to answer these questions.

5 (b) (i) Describe how the percentage of carbon dioxide has changed in the last 4500 million years.

.....

.....

.....

.....

(2 marks)

5 (b) (ii) Give **two** reasons why the percentage of carbon dioxide has changed.

.....

.....

.....

.....

(2 marks)

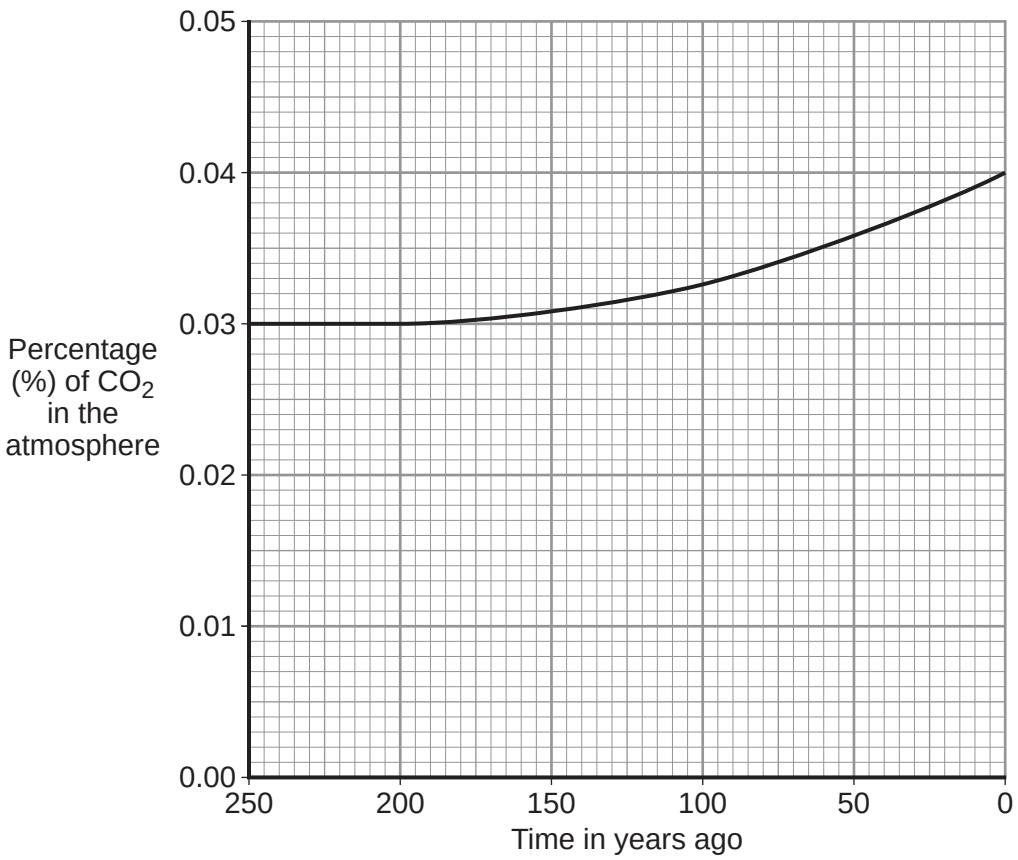
Question 5 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 34 · continued

5 (c) **Graph 2** shows how the percentage of carbon dioxide in the atmosphere changed in the last 250 years.

Graph 2



Should we be concerned about this change in the percentage of carbon dioxide?

Explain your answer.

.....

.....

.....

.....

(2 marks)

10

4.9.1.4 How carbon dioxide decreased

Question 35

June 2014 | CH1HP | Original Q1 | Legacy

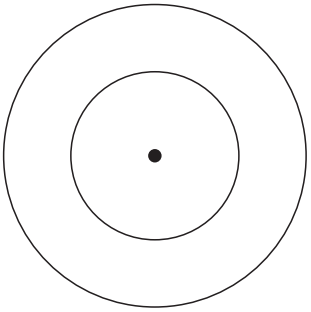
1 Fossil fuels contain carbon and hydrogen.

1 (a) (i) Use the Chemistry Data Sheet to help you to answer this question.

Complete **Figure 1** to show the electronic structure of a carbon atom.

[1 mark]

Figure 1



1 (a) (ii) Complete the word equation for the oxidation of hydrogen.

[1 mark]

hydrogen + oxygen ⟶ .....

1 (b) Coal is a fossil fuel.

Coal contains the elements hydrogen, sulfur, oxygen and carbon.

Name **two** products of burning coal that have an impact on the environment.

What impact does each of the products you named have on the environment?

[4 marks]

.....

.....

.....

.....

.....

.....

.....

.....

6

4.9.1.4 How carbon dioxide decreased

Question 36

June 2015 | CH1HP | Original Q3 | Legacy

3 This question is about life, the Earth and its atmosphere.

3 (a) There are many theories about how life was formed on Earth.

Suggest **one** reason why there are many theories.

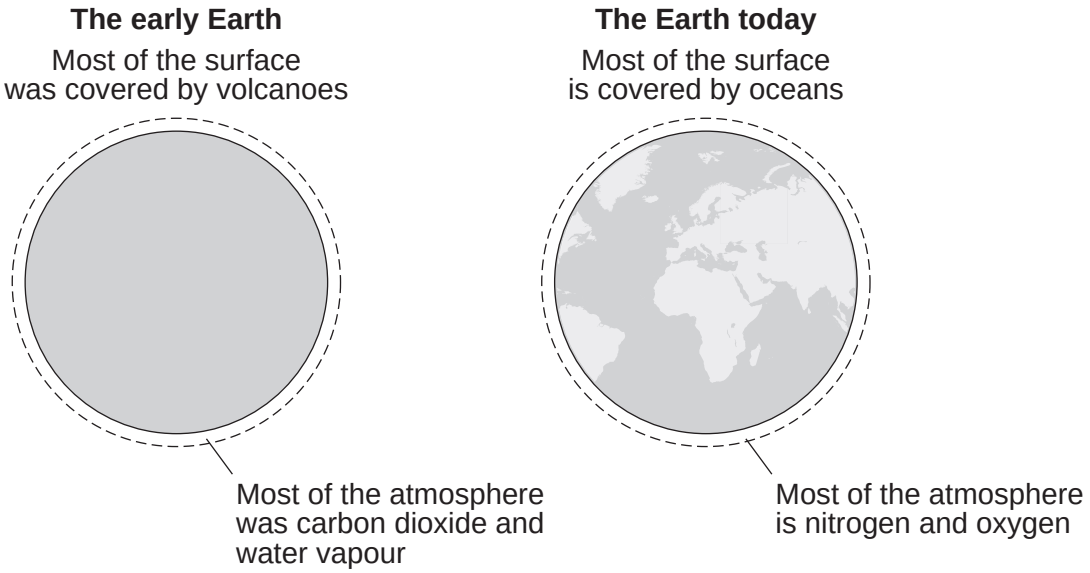
[1 mark]

.....

.....

3 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

This Earth and its atmosphere today are not like the early Earth and its atmosphere.



Describe and explain how the surface of the early Earth and its atmosphere have changed to form the surface of the Earth and its atmosphere today.

[6 marks]

.....

.....

.....

.....

.....

.....

4.9.1.4 How carbon dioxide decreased

Question 37

June 2017 | CH1HP | Original Q5 | Legacy

5 This question is about the Earth's atmosphere.

5 (a) The Earth's early atmosphere was a mixture of gases.

One theory is that the Earth's early atmosphere had the composition shown in **Table 4**.

Table 4

Gas	Percentage in Earth's early atmosphere (%)
Carbon dioxide	96
Nitrogen	3.5
Oxygen	a trace
Other gases including methane, ammonia, hydrogen and water vapour	0.5

5 (a) (i) Amino acids are at the basis of all life processes.
The simplest amino acid is glycine, NH_2CH_2COOH

Two scientists, Miller and Urey, showed that they could produce glycine from a mixture of methane, ammonia, hydrogen and water.
Miller and Urey concluded that this is how life was formed on Earth.

Suggest **one** reason why this conclusion may **not** be correct.

[1 mark]

5 (a) (ii) Give **three** reasons why the percentage of carbon dioxide in the Earth's atmosphere today is less than the percentage of carbon dioxide in the Earth's early atmosphere.

[3 marks]

4.9.1.4 How carbon dioxide decreased

Question 37 · continued

5 (b) **Table 5** shows the boiling points of some gases in the air.

Table 5

Gas	Boiling point in °C
Nitrogen	–196
Oxygen	–183
Carbon dioxide	–79*
Helium	–269
Neon	–246
Argon	–186

*freezes at this temperature

Oxygen from the air is separated by fractional distillation. To do this separation the air is cooled to –200 °C. Most of the gases condense.

5 (b) (i) Name the two gases that would **not** condense at –200 °C.

[1 mark]

_____ and _____

5 (b) (ii) Suggest why carbon dioxide is removed before the air is cooled.

[1 mark]

_____

_____

5 (b) (iii) The liquid at –200 °C is passed into a fractionating column.

Explain why one of the fractions is a mixture of oxygen and one other gas.

[2 marks]

_____

_____

_____

_____

4.9.1.4 How carbon dioxide decreased

Question 37 · continued

5 (c) Oxygen is used in the production of steel.

Cast iron from a blast furnace contains 96% iron and 4% carbon.

The stages for the production of steel from cast iron are:

Stage 1 pass oxygen into molten cast iron

Stage 2 add small amounts of other metals.

Explain why each stage is needed in the production of steel.

[4 marks]

12

4.9.1.4 How carbon dioxide decreased

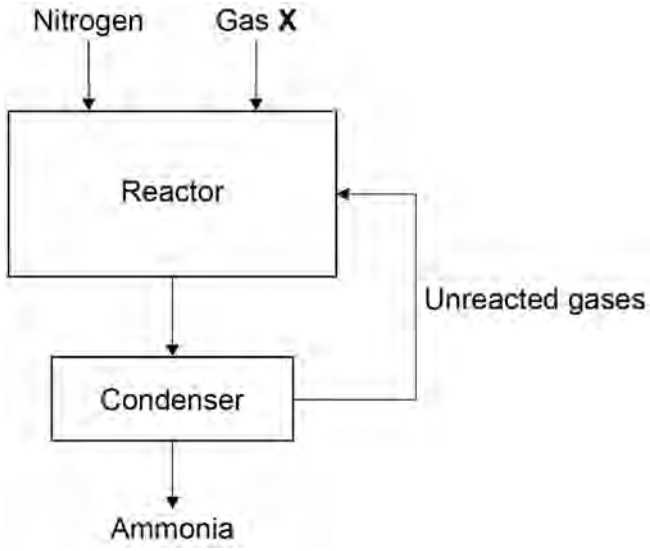
Question 38

June 2018 | 8462/2H | Original Q3

0 3 This question is about gases.

Figure 3 shows how nitrogen is used in the Haber Process to produce ammonia.

Figure 3



0 3 . 1 Gas **X** in **Figure 3** is obtained from methane.

Name gas **X**.

[1 mark]

_____

0 3 . 2 Give the approximate temperature and pressure used in the reactor.

[2 marks]

Temperature _____

Pressure _____

0 3 . 3 The mixture of gases from the reactor cools in the condenser.

Suggest why ammonia condenses but the other gases do not.

[1 mark]

_____

_____

4.9.1.4 How carbon dioxide decreased

Question 38 · continued

The Earth's early atmosphere was different to Earth's atmosphere today.

Scientists think that the Earth's early atmosphere was like the atmosphere found on Venus today.

Table 2 shows the amounts of carbon dioxide and oxygen in the atmospheres of Venus and Earth today.

Table 2

Gas	Percentage (%) in Venus' atmosphere today	Percentage (%) in Earth's atmosphere today
Carbon dioxide	96.50	0.04
Oxygen	0.00	20.95

0 3 . 4 The percentages of carbon dioxide and oxygen have changed from Earth's early atmosphere to Earth's atmosphere today.

Explain the processes that led to these changes.

[6 marks]

4.9.1.4 How carbon dioxide decreased

Question 38 · continued

0 3 . 5 Why are scientists **not** certain about the percentage of each gas in the Earth's early atmosphere?

[1 mark]

11

Turn over for the next question

4.9.1.4 How carbon dioxide decreased

Question 39

June 2023 | 8462/2H | Original Q4

0 4 This question is about greenhouse gases and climate change.

Carbon dioxide and methane are greenhouse gases.

0 4 . 1 Which of the following is also a greenhouse gas?

[1 mark]

Tick (✓) **one** box.

- Chlorine ☐
- Nitrogen ☐
- Oxygen ☐
- Water vapour ☐

In the past 50 years, there has been an increase in:

- the world population
- the concentration of carbon dioxide in the atmosphere
- the concentration of methane in the atmosphere
- the mean temperature of the atmosphere at the Earth's surface.

Most scientists think this information can be used to explain climate change.

0 4 . 2 Explain why the increase in world population may have caused the increase in the concentration of carbon dioxide in the atmosphere.

[2 marks]

4.9.1.4 How carbon dioxide decreased

Question 39 · continued

0 4 . 3 Explain why the increase in world population may have caused the increase in the concentration of methane in the atmosphere.

[2 marks]

0 4 . 4 Describe **two** potential effects of the increase in the mean temperature of the atmosphere at the Earth's surface.

[2 marks]

1

2

0 4 . 5 The mean temperature of the atmosphere at the Earth's surface has increased.

Most scientists think that this has been caused by an increase in the concentration of greenhouse gases in the atmosphere.

Give **one** reason why some scientists do **not** accept this theory.

[1 mark]

8

4.9.1.4 How carbon dioxide decreased

Question 40

June 2024 | 8462/2H | Original Q5

0 5 This question is about burning fuels in central heating boilers.

In the future, gas central heating boilers may burn hydrogen rather than natural gas.

Table 2 shows information about these fuels when 1 dm^3 of the fuel is burned in a central heating boiler.

Table 2

	Fuel	
	Hydrogen	**Natural gas**
Energy released in kJ	11.9	37.1
Mass of carbon dioxide produced in grams	0.00	1.83
Mass of water vapour produced in grams	0.75	1.50
Mass of oxides of nitrogen produced in grams	6.6×10^{-4}	4.9×10^{-4}

0 5 . 1 Explain how oxides of nitrogen are produced when burning fuels.

[2 marks]

4.9.1.4 How carbon dioxide decreased

Question 40 · continued

0 5 . 2 Explain **one** positive impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use **Table 2**.

[2 marks]

0 5 . 3 Explain **one** negative impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use **Table 2**.

[2 marks]

Question 5 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 40 · continued

0 5 . 4 Air is 20% oxygen.

Calculate the volume of air needed to provide enough oxygen to react with 3.50 dm^3 of hydrogen gas.

The equation for the reaction is

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

[3 marks]

Volume of air = _____ dm^3

0 5 . 5 Central heating boilers can also burn kerosene.

Kerosene is produced from crude oil in a fractionating column using fractional distillation.

In the first step, crude oil is heated and hydrocarbon vapours are formed.

Explain how kerosene is produced from these hydrocarbon vapours.

[3 marks]

12

4.9.1.4 How carbon dioxide decreased

Question 41

June 2025 | 8462/2H | Original Q4

0 4 The Earth's atmosphere has changed over time.

0 4 . 1 Explain how the percentage of nitrogen changed in the Earth's early atmosphere.

[2 marks]

0 4 . 2 **Table 4** shows the percentage (%) of carbon dioxide present in the Earth's early atmosphere.

Table 4

Time in billions of years ago	Percentage (%) of carbon dioxide in the Earth's early atmosphere
4.5	98
4.0	54
3.5	30
3.0	21

The percentage of carbon dioxide in the Earth's **early** atmosphere changed between 4.5 billion and 3.0 billion years ago.

Give **two** reasons why.

[2 marks]

1

2

4.9.1.4 How carbon dioxide decreased

Question 41 · continued

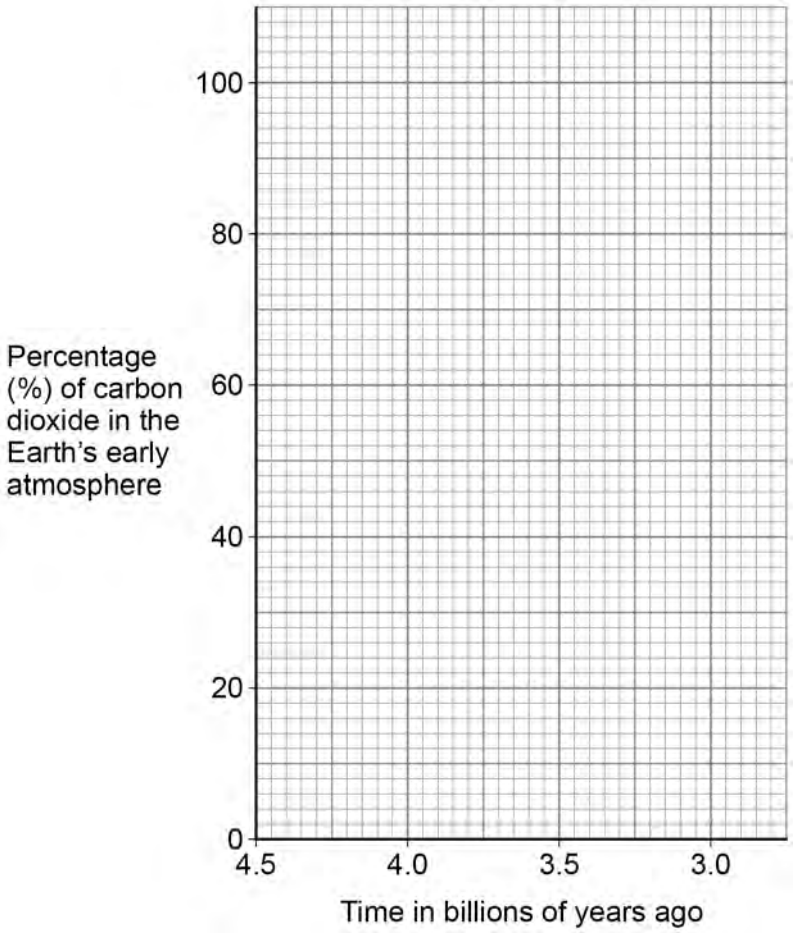
0 4 . 3 Complete **Figure 3**.

You should:

- plot the data in **Table 4**
- draw a line of best fit.

[2 marks]

Figure 3



Question 4 continues on the next page

4.9.1.4 How carbon dioxide decreased

Question 41 · continued

0 4 . 4 **Table 5** shows information about the percentage (%) of carbon dioxide and of oxygen present in the Earth's atmosphere over time.

Table 5

Time in billions of years ago	Percentage (%) of gas in the Earth's atmosphere	
	Carbon dioxide	Oxygen
2.5	18	1
2.0	15	2
1.5	10	8
1.0	3	17
0.5	1	19

The percentages of carbon dioxide and of oxygen in the Earth's atmosphere changed between 2.5 billion and 0.5 billion years ago.

Explain how.

[3 marks]

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