AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.3.1

Atmospheric pollutants from fuels

Past-paper questions

Tier	**Foundation**
Question groups	**69**
Available paper years	**2007–2024**

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:** _____

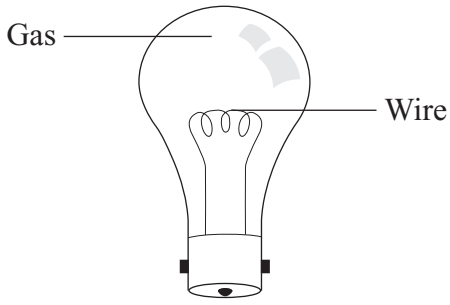
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.9.3.1 Atmospheric pollutants from fuels

Question 01

3 When electricity passes through a thin wire, the wire gets hot. If the wire gets very hot, it may glow. This idea is used in filament lamps.

Filament lamp



(a) The table shows some metals and their melting points.

Metal	Melting point in °C
Aluminium	660
Copper	1084
Iron	1540
Tungsten	3410

Which metal in the table should be used to make the wire in a filament lamp?

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

4.9.3.1 Atmospheric pollutants from fuels

Question 01 · continued

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(b) The table shows some gases.

Gas
Argon
Carbon dioxide
Oxygen
Sulfur dioxide

Which gas in the table should be used in a filament lamp?

Give a reason for your answer.

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(2 marks)

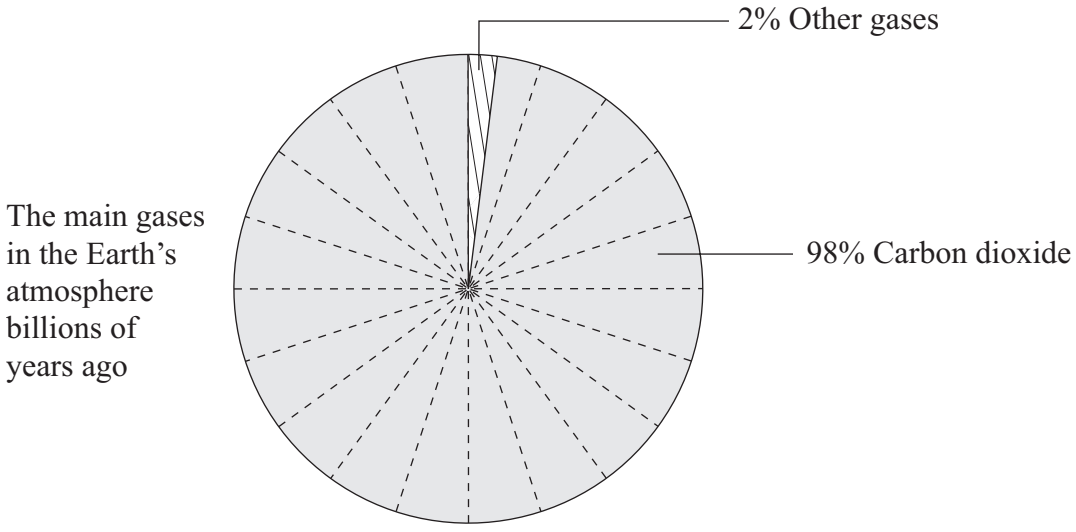
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4.9.3.1 Atmospheric pollutants from fuels

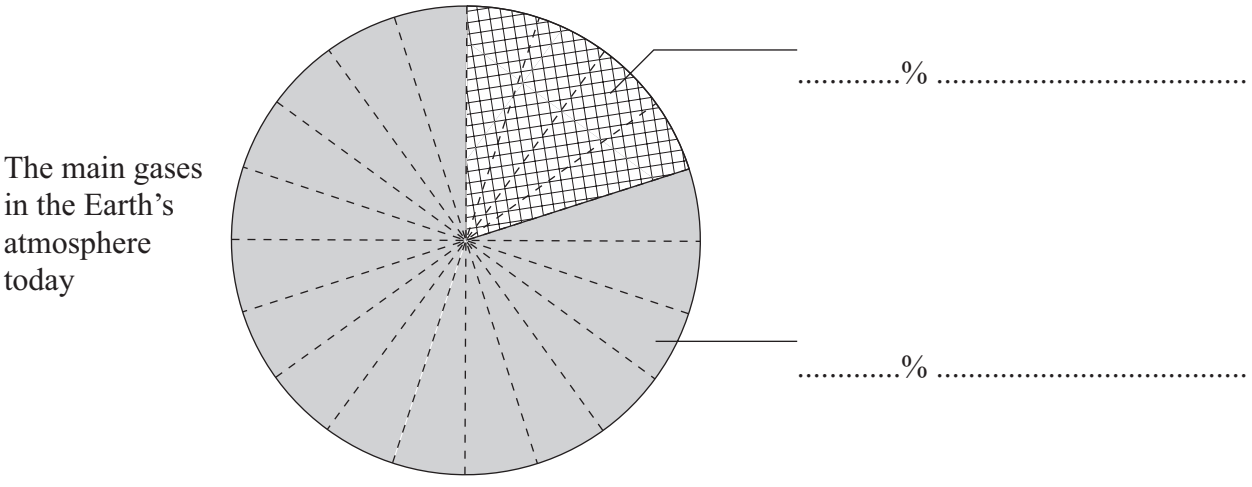
Question 02

January 2007 | CHY1F | Original Q7 | Legacy

7 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)

4.9.3.1 Atmospheric pollutants from fuels

Question 02 · 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)

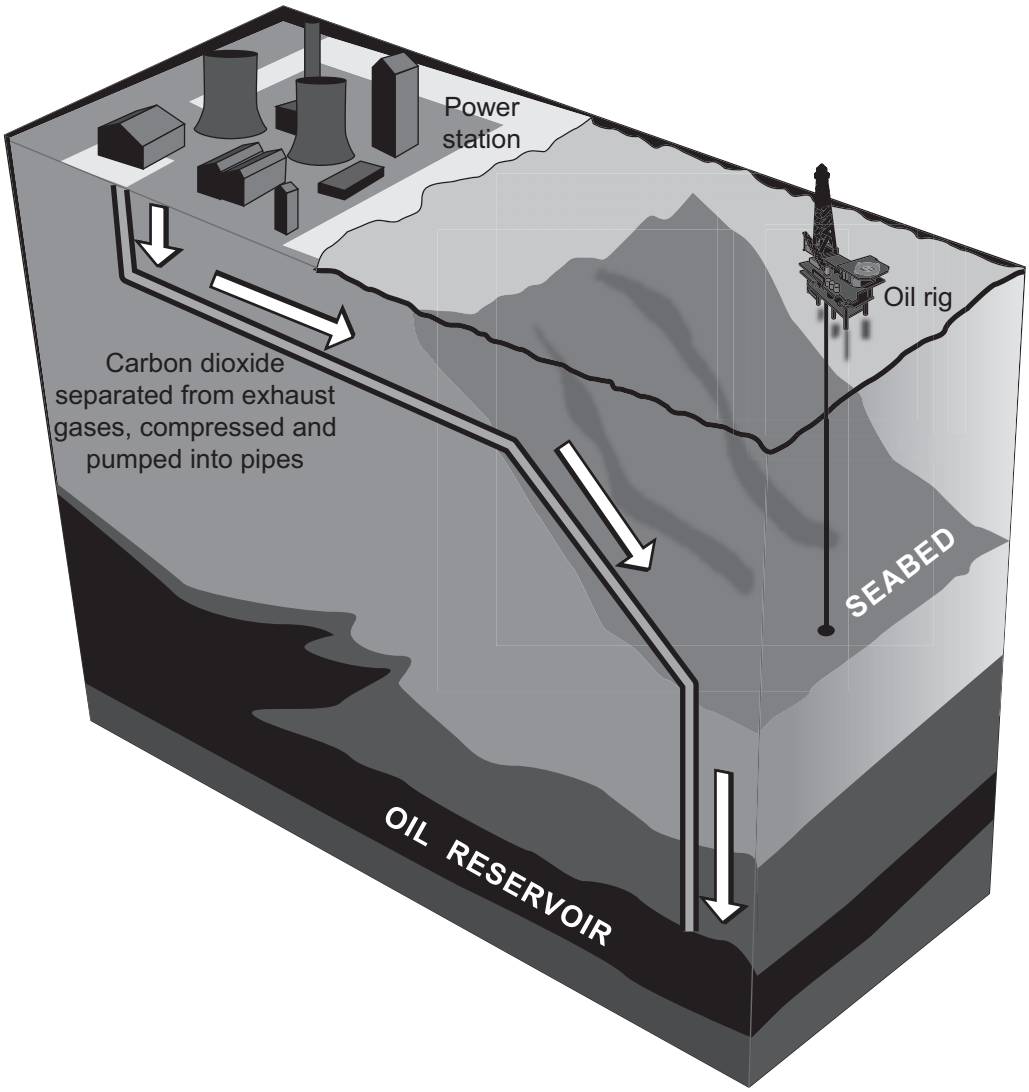
Question 7 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 02 · 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

4.9.3.1 Atmospheric pollutants from fuels

Question 03

March 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

This question is about crude oil.

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

A an alkane

B carbon

C crude oil

D sulfur dioxide

An example of a mixture is . . . **1** . . . .

An example of an element is . . . **2** . . . .

An example of a hydrocarbon is . . . **3** . . . .

An example of an acidic gas often made when a fuel burns is . . . **4** . . . .

4.9.3.1 Atmospheric pollutants from fuels

Question 04

March 2007 | CHY1A | Original Q8 | Legacy

QUESTION EIGHT

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

8A 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

8B 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

4.9.3.1 Atmospheric pollutants from fuels

Question 04 · continued

8C 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.

8D 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.

4.9.3.1 Atmospheric pollutants from fuels

Question 05

June 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

The balanced, symbol equation shows the atoms involved in a chemical reaction.

$Fe_2O_3(s)$	+	$3CO(g)$	→	$2Fe(s)$	+	$3CO_2(g)$
iron oxide		carbon monoxide		iron		carbon dioxide

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

A atom

B compound

C element

D symbol

O is the . . . **1** . . . for oxygen.

Fe_2O_3 is the formula for the . . . **2** . . . , iron oxide.

Fe represents one . . . **3** . . . of iron.

Carbon is a soft, black, non-metal . . . **4** . . . .

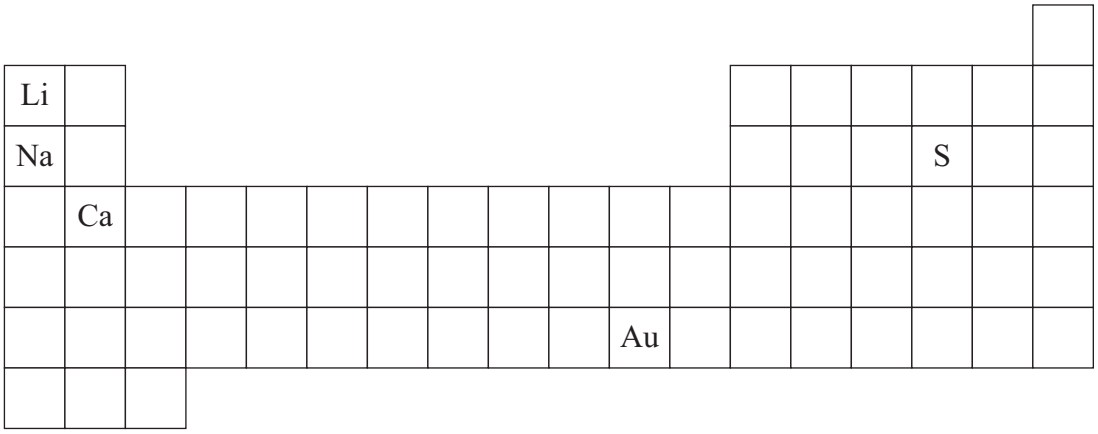
4.9.3.1 Atmospheric pollutants from fuels

Question 06

June 2007 | CHY1A | Original Q2 | Legacy

QUESTION TWO

The diagram shows the position of some elements in the periodic table.



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

A gold (Au)

B lithium (Li)

C calcium (Ca)

D sulfur (S)

	What we can say about the element
1	It is combined with the element oxygen in quicklime.
2	It is in a compound that produces acid rain.
3	It is an unreactive transition metal.
4	It has similar chemical properties to sodium.

4.9.3.1 Atmospheric pollutants from fuels

Question 07

3 Crude oil is a natural resource from which useful fuels can be separated.

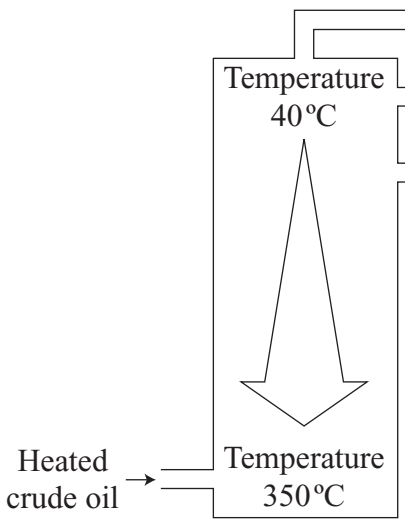
(a) Crude oil is a mixture of hydrocarbons.

Complete the sentence about a hydrocarbon molecule.

A hydrocarbon molecule is made up of ..... and carbon atoms only.

(1 mark)

(b) Many fuels come from crude oil. Some of these fuels are shown in the diagram.



Fraction	Number of carbon atoms in each molecule
gases	1–4
petrol	5–12
diesel	15–25

Suggest **two** properties of these fuels that allow them to be separated from crude oil.

.....

.....

.....

.....

(2 marks)

4.9.3.1 Atmospheric pollutants from fuels

Question 07 · continued

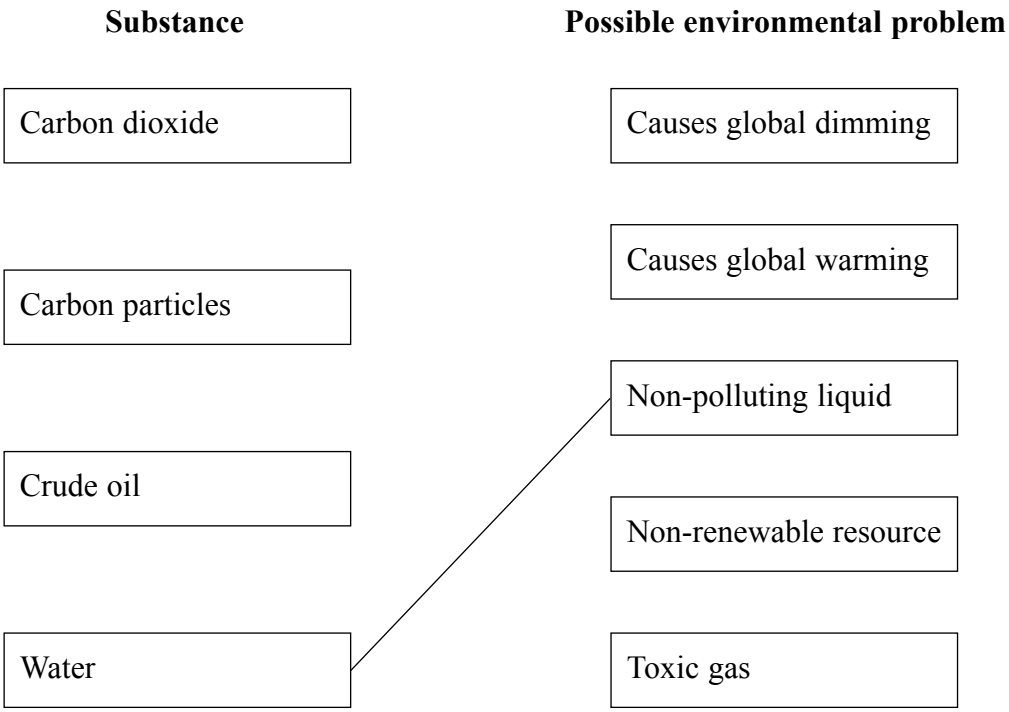
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(c) Fuels from crude oil burn to provide heat energy.

When a fuel burns, it combines with oxygen in the air and produces carbon dioxide and water. When there is not enough oxygen, the fuel burns and also produces carbon monoxide and carbon particles.

Draw a straight line from each substance that links it to a possible environmental problem.

One has been done for you.



(3 marks)

6

4.9.3.1 Atmospheric pollutants from fuels

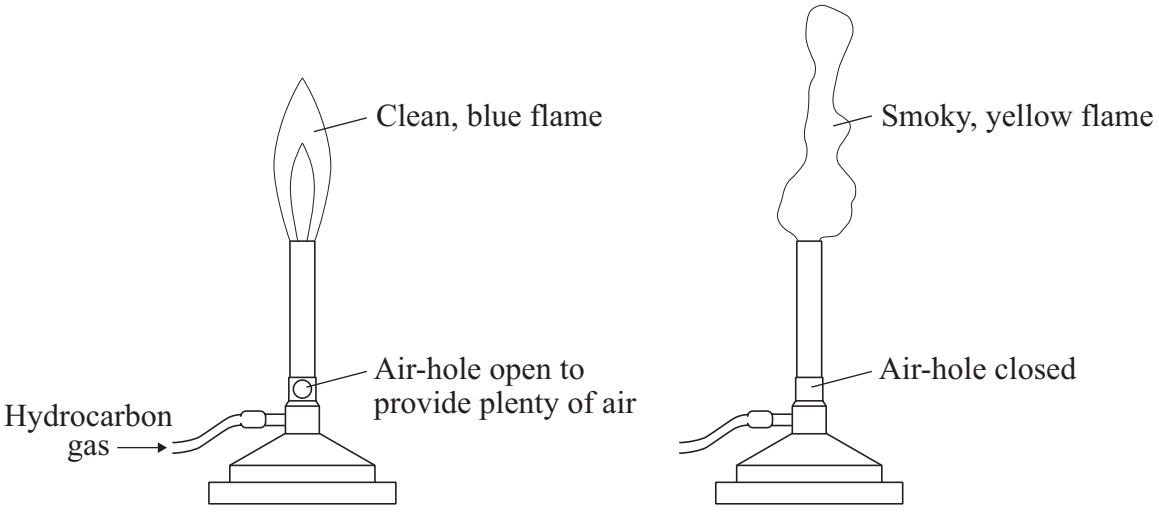
Question 08

November 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The diagram shows a hydrocarbon gas burning in a Bunsen burner.

The flame is different when the air-hole is open compared with when it is closed.



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

A carbon

B carbon monoxide

C carbon dioxide

D oxygen

With the air-hole open, the two main products of combustion are water and . . . **1** . . . .

Water is formed when hydrogen in the hydrocarbon gas reacts with . . . **2** . . . .

With the air-hole closed, another gas that is produced during combustion is . . . **3** . . . .

The yellow flame contains black specks of . . . **4** . . . .

4.9.3.1 Atmospheric pollutants from fuels

Question 09

November 2007 | CHY1A | Original Q8 | Legacy

QUESTION EIGHT

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.

8A 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

4.9.3.1 Atmospheric pollutants from fuels

Question 09 · continued November 2007 | CHY1A | Original Q8 | Legacy

8B 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.

8C 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.

8D 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.

4.9.3.1 Atmospheric pollutants from fuels

Question 10

November 2007 | CHY1B | Original Q4 | Legacy

QUESTION FOUR

This question is about gases in the Earth's atmosphere.

In the Earth's early atmosphere	In the Earth's atmosphere today
Carbon dioxide	Nitrogen
Small amounts of: ammonia, NH_3 methane, CH_4	Oxygen
	Small amounts of: carbon dioxide noble gases
Water vapour	Water vapour

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

A ammonia

B helium

C methane

D oxygen

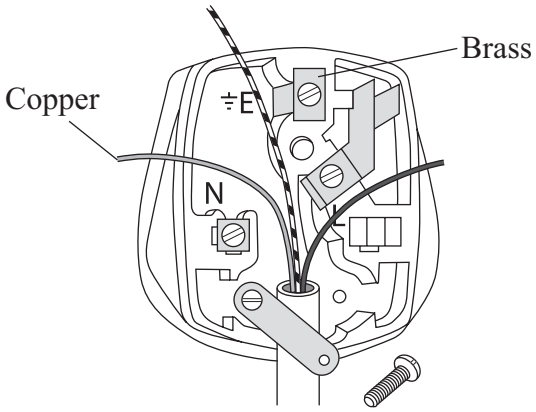
	What we can say about the gas
1	It is a hydrocarbon.
2	It is a noble gas.
3	It is a compound of nitrogen and hydrogen.
4	It is produced in the atmosphere by the activity of plants.

4.9.3.1 Atmospheric pollutants from fuels

Question 11

January 2008 | CHY1F | Original Q6 | Legacy

6 Copper metal is used for electric wires.
An alloy of copper, called brass, is used for pins and terminals of electric plugs.



(a) Copper metal is relatively soft and flexible.

Give another reason why copper is used for electric wires.

.....

.....

(1 mark)

(b) Brass is an *alloy*.

What is an *alloy*?

.....

.....

(1 mark)

Question 6 continues on the next page

Question 11 · continued

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(c) Open-cast mining of copper ore makes a very large hole.



Source: Photograph © Melvyn P. Lawes; *Papilio/CORBIS*

(i) Suggest **one** environmental problem that is caused by open-cast mining of copper ore.

.....

.....

(1 mark)

(ii) Some copper ores contain copper sulfide, CuS.
Copper sulfide is heated in air to produce copper and sulfur dioxide.

$$CuS + O_2 \rightarrow Cu + SO_2$$

Suggest **one** environmental problem caused by heating copper sulfide in air.

.....

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 11 · continued

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(d) The amount of copper-rich ores is estimated to last only a few more years.
New houses need several kilometres of copper wire.

(i) Explain why the need to use so much copper will cause a problem in the future.

.....

.....

(1 mark)

(ii) Suggest **two** ways in which society could overcome this problem.

1 .....

.....

2 .....

.....

(2 marks)

7

4.9.3.1 Atmospheric pollutants from fuels

Question 12

March 2008 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about substances that are released into the air when fuels burn.

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

A sulfur dioxide

B carbon dioxide

C carbon monoxide

D particles

	What we can say about the substance
1	It is a cause of global warming.
2	It is the main cause of acid rain.
3	It is a gas formed by incomplete combustion.
4	It is a cause of global dimming.

4.9.3.1 Atmospheric pollutants from fuels

Question 13

March 2008 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Scientists have been concerned for some time about the effects of releasing large amounts of sulfur dioxide into the atmosphere. Much of the sulfur dioxide is formed from burning fuels that contain sulfur. The equation for this reaction is:

$$S + O_2 \rightarrow SO_2$$

9A The equation given above for the burning of sulfur is balanced because . . .

1 there are the same number of atoms on each side of the equation.

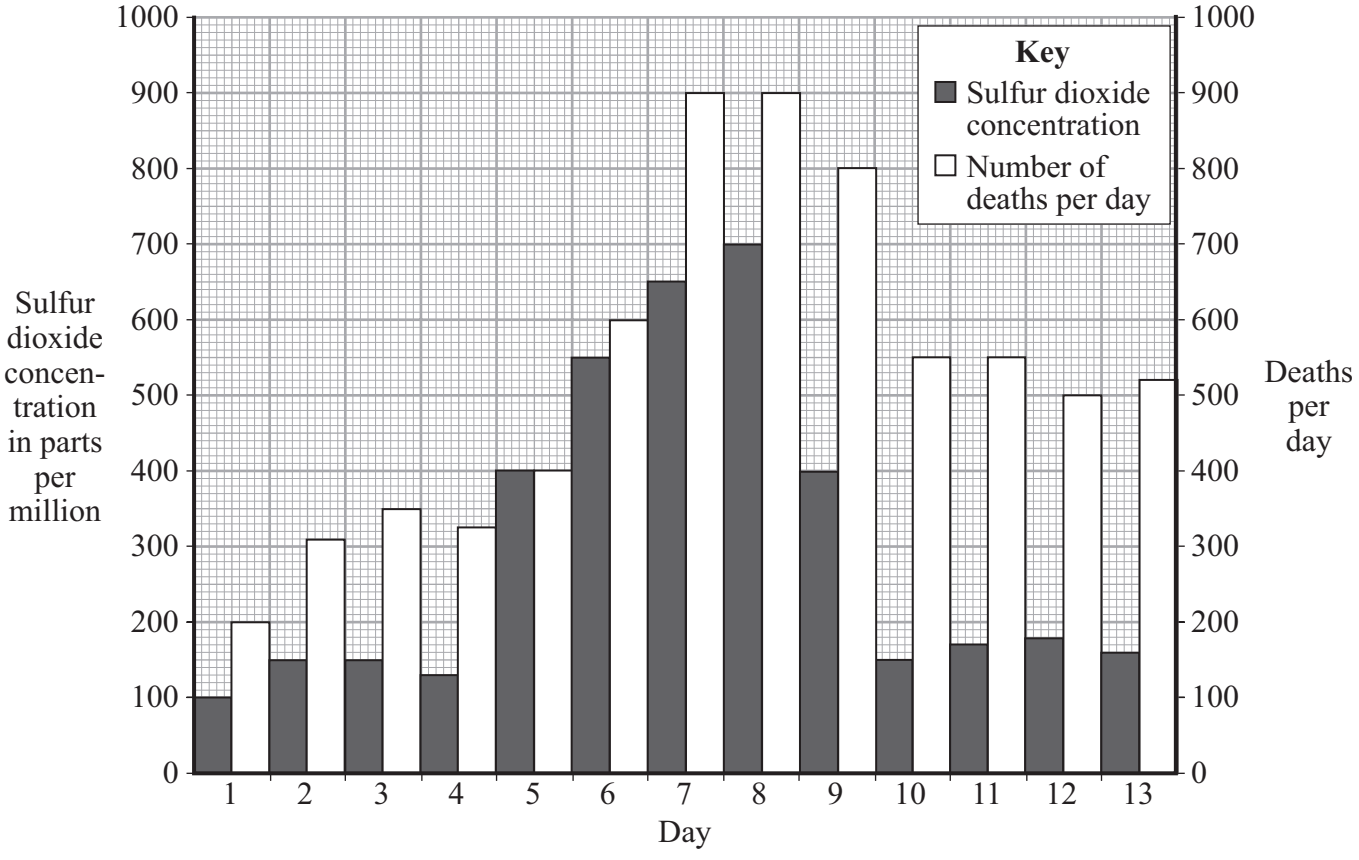
2 there are the same number of each type of atom on each side of the equation.

3 the amount of sulfur dioxide in the air stays about the same.

4 only two elements are involved in the equation.

Some scientists believe that sulfur dioxide is responsible for human deaths. To support this idea, they looked at the death rates during the smogs that occurred in London in the 1950s. The smogs contained sulfur dioxide and smoke particles.

The data the scientists used is shown below.



4.9.3.1 Atmospheric pollutants from fuels

Question 13 · continued March 2008 | CHY1AP | Original Q9 | Legacy

9B The average number of deaths per day from day 5 to day 8 was . . .

1 475

2 700

3 900

4 2800

9C The suggestion that sulfur dioxide in the smog was responsible for human deaths was . . .

1 a conclusion.

2 a hypothesis.

3 a piece of research.

4 a piece of evidence.

9D Which one of the following is a valid statement from the graph?

1 Sulfur dioxide was responsible for the deaths.

2 Smog was responsible for the deaths.

3 Sulfur dioxide could **not** be responsible for the deaths since the graphs do **not** match exactly.

4 Sulfur dioxide was probably responsible for the deaths but other factors may have been responsible.

END OF TEST

4.9.3.1 Atmospheric pollutants from fuels

Question 14

March 2008 | CHY1BP | Original Q1 | Legacy

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.

4.9.3.1 Atmospheric pollutants from fuels

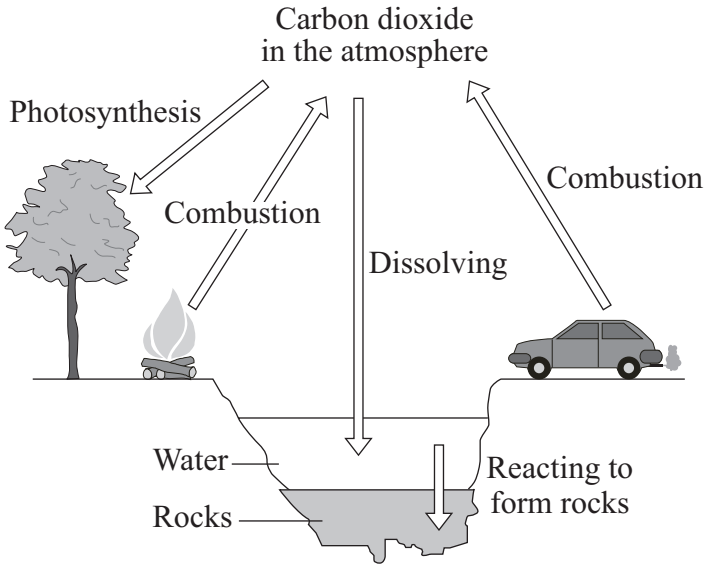
Question 15

March 2008 | CHY1BP | Original Q9 | Legacy

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.
Reproduced under the terms of the Click-Use Licence.

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.

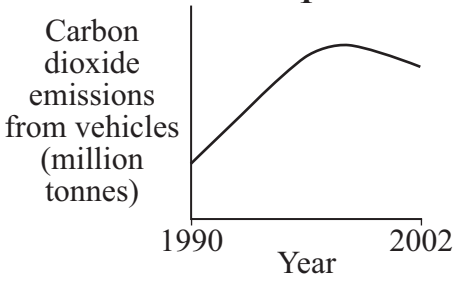
3 counting the number of vehicles on the road.

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

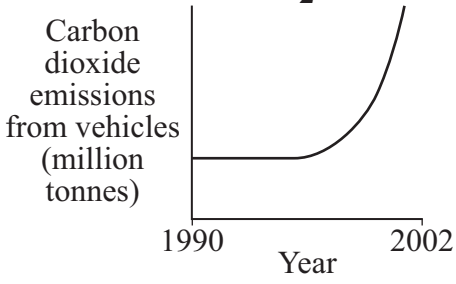
Question 15 · continued

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?

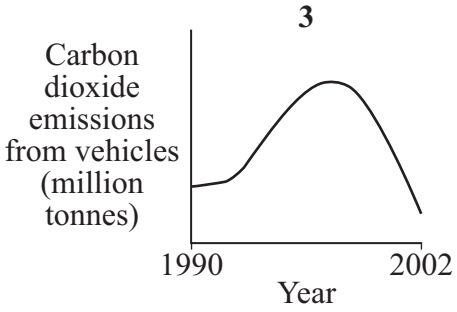
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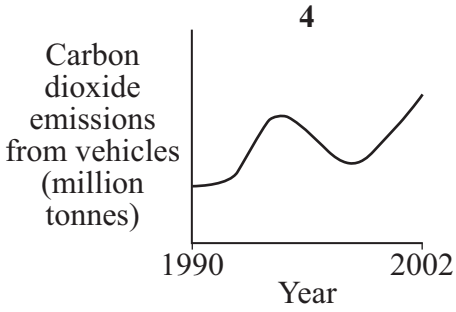
2



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

4.9.3.1 Atmospheric pollutants from fuels

Question 16

June 2008 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about environmental problems caused by burning fuels.

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

A carbon dioxide

B smoke particles

C sulfur dioxide

D water vapour

	Environmental problem
1	acid rain
2	global dimming
3	global warming
4	no problems

4.9.3.1 Atmospheric pollutants from fuels

Question 17

June 2008 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

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.

9A 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.

9B 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.

9C 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.

4.9.3.1 Atmospheric pollutants from fuels

Question 17 · continued

9D 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.

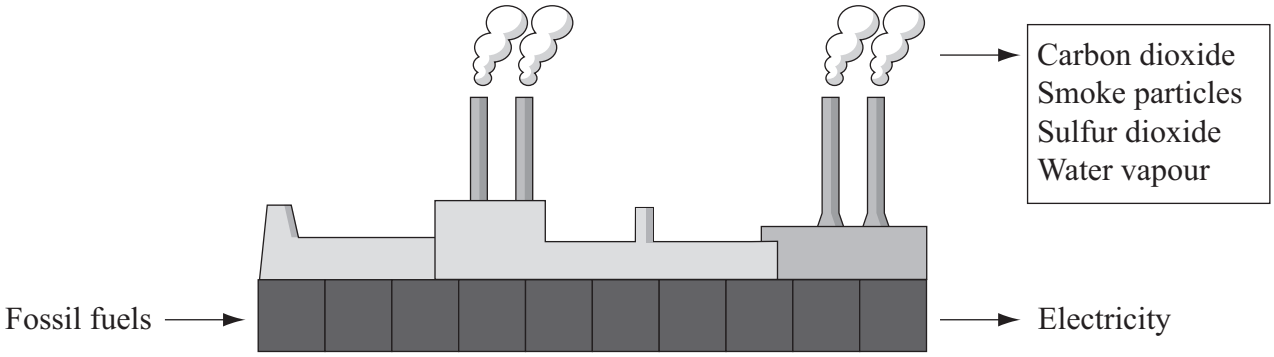
END OF TEST

4.9.3.1 Atmospheric pollutants from fuels

Question 18

June 2008 | CHY1F | Original Q2 | Legacy

2 Most electricity in the UK is generated in power stations that burn fossil fuels.
The diagram lists some of the substances released into the air when fossil fuels are burned.



Power station

2 (a) (i) Which **one** of the substances released into the air causes acid rain?

.....

(1 mark)

2 (a) (ii) In the sentence below, draw a ring around the correct answer.

The type of environmental pollution caused by

smoke particles is

global dimming
global warming
rising sea levels

.

(1 mark)

2 (a) (iii) Suggest how the burning of fossil fuels may cause climate change.

.....

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.....

.....

(2 marks)

4.9.3.1 Atmospheric pollutants from fuels

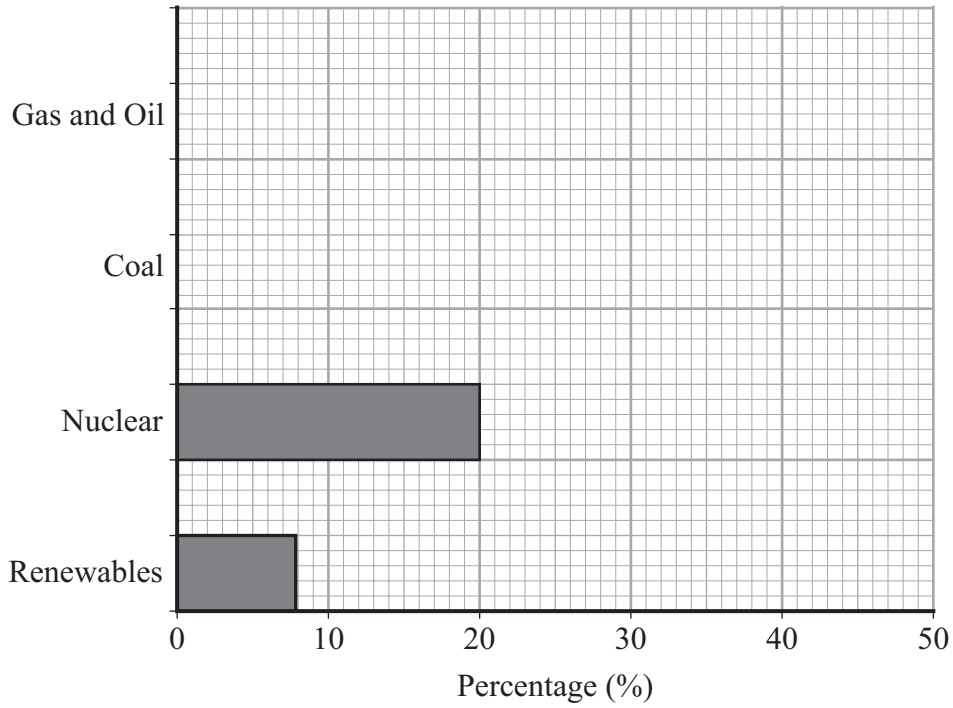
Question 18 · continued

for mark

2 (b) The table shows the percentage of electricity generated by different energy sources.

Energy sources	Renewables	Nuclear	Coal	Gas and Oil
Percentage (%)	8	20	32	40

Complete the bar chart to show the percentage of electricity generated by coal and by gas and oil.



(2 marks)

6

4.9.3.1 Atmospheric pollutants from fuels

Question 19

November 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about four of the gases given off when coal is heated in the absence of air.

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

A hydrogen, H_2

B ammonia, NH_3

C methane, CH_4

D carbon monoxide, CO

The gas that is an element is . . . **1** . . . .

The gas that is an alkane is . . . **2** . . . .

The gas that burns to form only carbon dioxide, CO_2, is . . . **3** . . . .

The gas that has four atoms in its formula is . . . **4** . . . .

4.9.3.1 Atmospheric pollutants from fuels

Question 20

November 2008 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

Hydrocarbon fuels, **K**, **L**, **M** and **N**, were burned and the products were collected and identified.

The results are shown in the table below.

	Hydrocarbon fuels			
Products of burning	**K**	**L**	**M**	**N**
Carbon monoxide	✓	✓	✓	✗
Carbon dioxide	✓	✓	✓	✓
Water vapour	✓	✓	✓	✓
Soot	✓	✓	✗	✗
Sulfur dioxide	✗	✗	✓	✓

Key:
✓ indicates that the substance is one of the products
✗ indicates that the substance is **not** one of the products.

8A The results show that combustion was **only** complete for . . .

1 hydrocarbon fuel **K**.

2 hydrocarbon fuel **L**.

3 hydrocarbon fuel **M**.

4 hydrocarbon fuel **N**.

8B The table of results shows that the hydrocarbon fuels that do **not** contain sulfur are . . .

1 **M** and **N**.

2 **K** and **L**.

3 **L** and **M**.

4 **K** and **M**.

4.9.3.1 Atmospheric pollutants from fuels

Question 20 · continued

8C When hydrocarbon fuels are burned, some of the products cause problems.

Which one of the following statements correctly describes a problem that is caused by the products of burning?

1 Sulfur dioxide in the air causes heavier rainfall.

2 Releasing large amounts of carbon dioxide into the atmosphere produces ‘acid rain’.

3 A build-up of particles in the air causes ‘global dimming’.

4 Releasing large amounts of carbon dioxide into the atmosphere causes ‘global dimming’.

8D Ethanol is a compound of carbon, hydrogen and oxygen.
Ethanol can be used as a fuel in vehicles together with, or in place of, hydrocarbon fuels.

An advantage of ethanol as a fuel is that when it burns . . .

1 no carbon dioxide is produced.

2 carbon dioxide and water are produced.

3 no sulfur dioxide is produced.

4 only water is produced.

4.9.3.1 Atmospheric pollutants from fuels

Question 21

November 2008 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about some gases found in the Earth's atmosphere.

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

A carbon dioxide

B helium

C nitrogen

D oxygen

1	It is in Group 0 of the periodic table.
2	It makes up about 80% of the atmosphere.
3	It is found in today's atmosphere in much smaller amounts than in Earth's early atmosphere.
4	It is used when fossil fuels burn.

4.9.3.1 Atmospheric pollutants from fuels

Question 22

March 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Fuels burn in air to form oxides of the elements they contain.
When fuel molecules contain a large number of carbon atoms, combustion is not always complete.
With incomplete combustion, carbon particles may be produced.

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

A H_2

B CO

C C_4H_{10}

D $C_{14}H_{28}$

1	It will burn to form carbon dioxide only.
2	It will burn to form water only.
3	It is an alkane.
4	It will probably contribute to global dimming when burned.

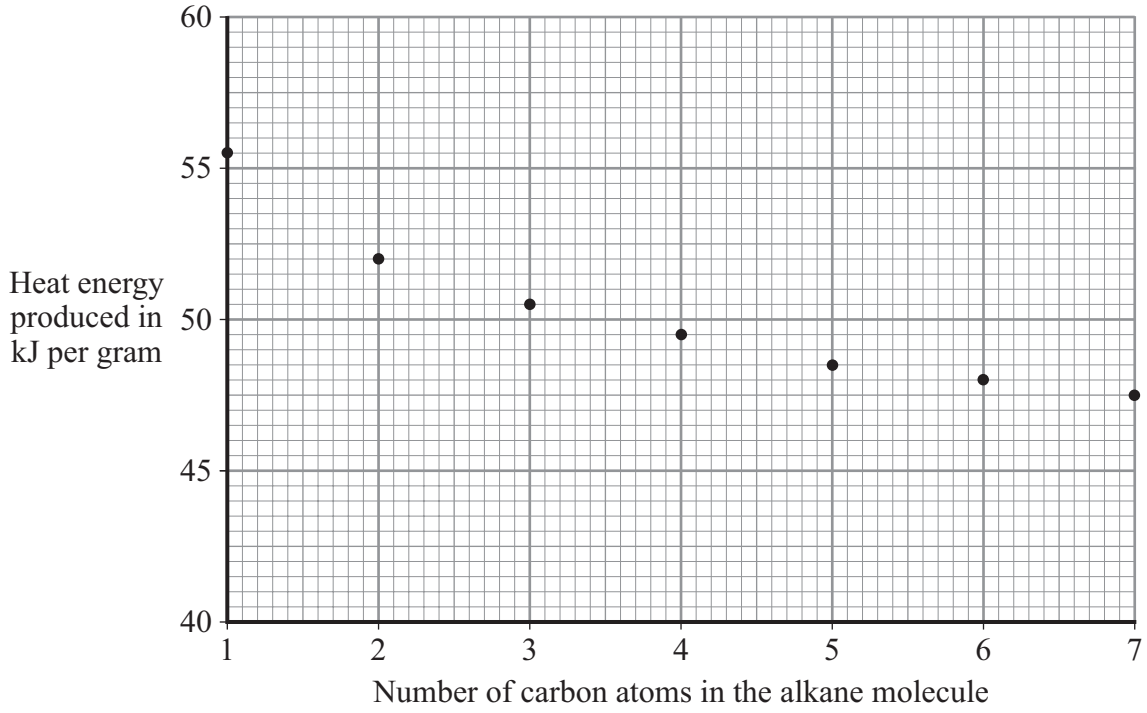
4.9.3.1 Atmospheric pollutants from fuels

Question 23

March 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

The graph shows how much heat energy is produced when one gram of each of seven alkanes is burned.



6A How much heat energy is produced by burning one gram of the alkane with two carbon atoms in its molecule?

1 51 kJ

2 52 kJ

3 53 kJ

4 54 kJ

4.9.3.1 Atmospheric pollutants from fuels

Question 23 · continued March 2009 | CHY1AP | Original Q6 | Legacy

6B The alkane that produces the most heat energy per gram, when burned, is the alkane with . . .

1 one carbon atom in its molecule.

2 three carbon atoms in its molecule.

3 five carbon atoms in its molecule.

4 seven carbon atoms in its molecule.

6C Carbon dioxide is produced when hydrocarbon fuels burn.

This is a problem because carbon dioxide . . .

1 dissolves in rainwater.

2 reacts with oxygen to form carbon monoxide.

3 may cause global warming.

4 may cause global dimming.

6D Petrol companies have reduced the amount of sulfur in petrol and diesel fuels.

The main reason is . . .

1 to reduce their production costs.

2 to reduce the amount of carbon dioxide released into the atmosphere.

3 to reduce the acidity of rain.

4 to reduce the amount of fuel used in vehicles.

4.9.3.1 Atmospheric pollutants from fuels

Question 24

June 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about substances that can be burned in air.

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

A C_2H_5SH

B C_2H_6

C C_2H_2

D C

1	It would contribute to the formation of acid rain when burned.
2	It is an alkane.
3	It corresponds to the general formula C_nH_{2n-2}
4	It forms only carbon dioxide when burned in air.

4.9.3.1 Atmospheric pollutants from fuels

Question 25

June 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Hybrid cars have both battery-powered motors and petrol engines. Hybrid cars have been developed so they have reduced carbon dioxide emissions when compared with petrol and diesel cars.

Some figures from manufacturers' tests are shown in the table.

Hybrid car	Price	Fuel economy in km per litre of petrol	Carbon dioxide emissions in g per km
K	£18 000	21.6	109
L	£20 000	23.1	104
M	£11 000	26.1	99
N	£16 000	27.1	94

6A The best way to obtain accurate figures for the amount of carbon dioxide emitted by the cars is to drive each car . . .

1 100 m.

2 1 km.

3 1 km five times, and take the highest value.

4 1 km five times, and take an average value.

6B For these cars, as the fuel economy in km per litre of petrol increases, . . .

1 the carbon dioxide emitted by the cars increases.

2 the carbon dioxide emitted by the cars decreases.

3 the cost of the cars increases.

4 the cars use more petrol per km.

4.9.3.1 Atmospheric pollutants from fuels

Question 25 · continued June 2009 | CHY1AP | Original Q6 | Legacy

6C An independent motoring organisation tested the same cars. The values obtained for carbon dioxide emissions were a lot higher than those quoted by the manufacturers.

These values could be considered to be more reliable because the independent motoring organisation . . .

1 is **not** involved in selling cars.

2 is more concerned about environmental issues.

3 used equipment with a greater range.

4 is more likely to be biased.

6D One environmental advantage that a petrol hybrid car has over a conventional petrol car is that . . .

1 when the battery is working, no energy is being used.

2 the addition of a battery makes it lighter.

3 when only the battery is working, no carbon dioxide is being emitted.

4 the car will produce more sulfur dioxide.

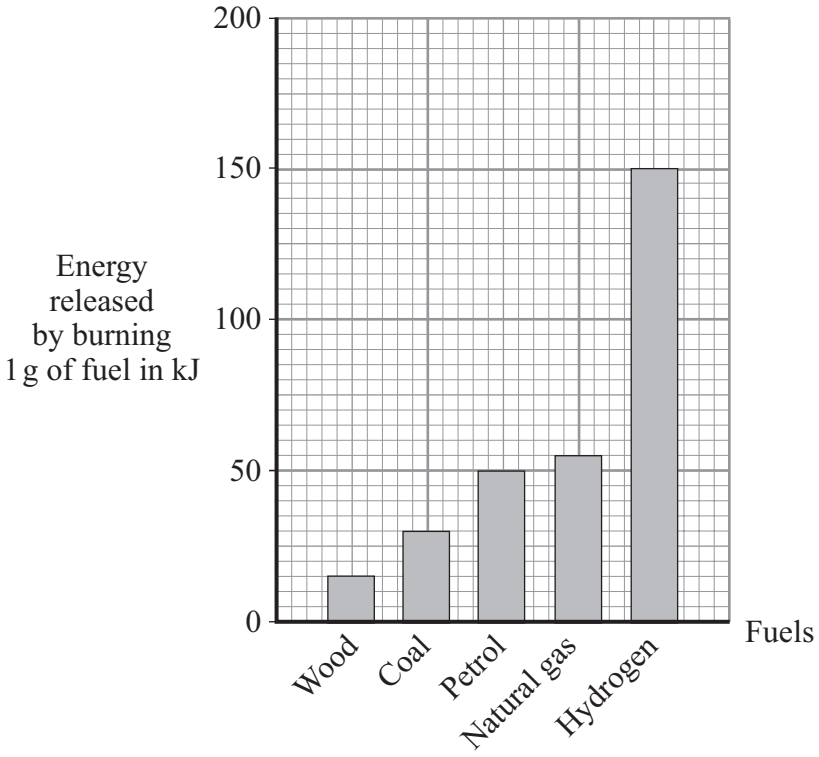
4.9.3.1 Atmospheric pollutants from fuels

Question 26

June 2009 | CHY1F | Original Q2 | Legacy

2 Energy is released by burning fuels.

2 (a) The bar chart shows the energy in kilojoules, kJ, released by burning 1 g of five different fuels.



2 (a) (i) Which fuel releases the least energy from 1 g?

.....

(1 mark)

2 (a) (ii) How much energy is released by burning 1 g of coal?

Energy = ... kJ

(1 mark)

2 (a) (iii) Coal burns in oxygen and produces the gases shown in the table.

Name	Formula
Carbon dioxide	CO_2
Water vapour	H_2O
Sulfur dioxide	SO_2

Use information from the table to name **one** element that is in coal.

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 26 · continued

for mark

2 (a) (iv) Use information from the bar chart to calculate the mass of petrol that will release the same amount of energy as 1 g of hydrogen.

.....

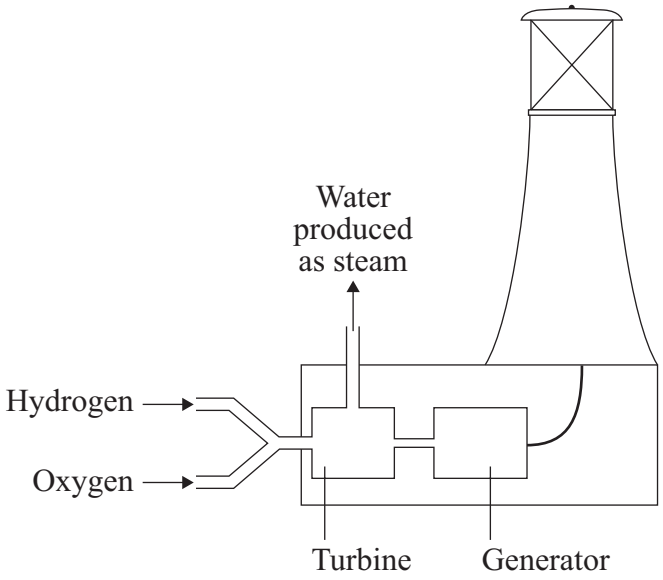
.....

Mass = ... g

(1 mark)

2 (b) Hydrogen can be made from fossil fuels.
Hydrogen burns rapidly in oxygen to produce water only.

A lighthouse uses electricity generated by burning hydrogen.



2 (b) (i) Use information from the bar chart and the diagram above to suggest **two** advantages of using hydrogen as a fuel.

1 .....

.....

2 .....

.....

(2 marks)

2 (b) (ii) Suggest **one** disadvantage of using hydrogen.

.....

(1 mark)

7

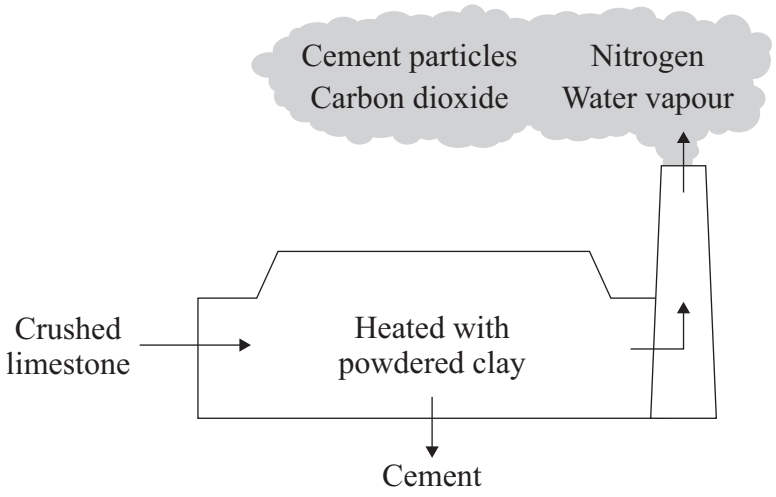
4.9.3.1 Atmospheric pollutants from fuels

Question 27

June 2009 | CHY1F | Original Q6 | Legacy

6 A limestone quarry is in an area of natural beauty and near several villages.
The company operating the quarry wants planning permission to build a new cement works in the quarry.

The diagram shows some of the substances used and produced at a cement works.



6 (a) Limestone is mainly calcium carbonate, $CaCO_3$.
Write the correct number in the box to complete each sentence.

6 (a) (i) The formula shows that calcium carbonate, $CaCO_3$,

contains ☐ different elements.

(1 mark)

6 (a) (ii) Calcium carbonate, $CaCO_3$, contains a total number of ☐ atoms.

(1 mark)

6 (b) The company wants the new cement works because the nearest cement works is 100 km from the quarry. The company argues that a new cement works sited inside the quarry would reduce carbon dioxide emissions.

Suggest why the new cement works might reduce carbon dioxide emissions.

.....

.....

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 27 · continued

for mark

6 (c) Residents from the villages near the quarry are concerned that there will be atmospheric pollution from the new cement works.

6 (c) (i) Name and explain how **one** of the emissions from the chimney causes atmospheric pollution.

Name of emission: .....

Explanation: .....

.....

(2 marks)

6 (c) (ii) Suggest what the company could do to reduce this atmospheric pollution.

.....

.....

(1 mark)

6

4.9.3.1 Atmospheric pollutants from fuels

Question 28

November 2009 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

Exhaust gases from petrol and diesel vehicles were measured under different driving conditions.

The table shows the results in parts per million (ppm).

	Driving conditions					
	Accelerating		Steady speed		Slowing down	
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
Hydrocarbons in ppm	2000	200	1000	100	10 000	300
Carbon monoxide in ppm	25 000	1000	18 000	15	20 000	46
Nitrogen oxides in ppm	1020	856	650	240	20	30

Match the type of fuel and the driving conditions, **A**, **B**, **C** and **D**, with the exhaust gas descriptions **1–4** in the table below.

A diesel, steady speed

B diesel, slowing down

C petrol, accelerating

D petrol, slowing down

	Exhaust gas description
1	a total of 76 ppm of carbon monoxide and nitrogen oxides
2	the smallest amount of hydrocarbons
3	the highest total of carbon monoxide and nitrogen oxides
4	the most unburnt fuel

4.9.3.1 Atmospheric pollutants from fuels

Question 29

November 2009 | CHY1BP | Original Q2 | Legacy

QUESTION TWO

This question is about some of the gases in the Earth's atmosphere.

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

A oxygen

B nitrogen

C carbon dioxide

D helium

The most abundant gas in the Earth's atmosphere is . . . **1** . . . .

The gas used to fill party balloons because it is less dense than air is . . . **2** . . . .

The burning of fossil fuels uses . . . **3** . . . gas from the air, and releases . . . **4** . . . gas into the air.

Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

Question 30

January 2019 | CHY1F | Original Q3 | Legacy

3 In 1980 Mount St Helens suddenly exploded. This volcanic eruption was so violent that it blew off the top of the mountain. Ash particles and volcanic gases spread throughout the Earth's atmosphere.



3 (a) Mount St Helens is on a boundary between two of the Earth's tectonic plates.

Draw a ring around the correct word to complete the sentences.

3 (a) (i) The Earth's tectonic plates are made up of the upper part of the mantle

and the

atmosphere.
core.
crust.

(1 mark)

3 (a) (ii) The movement of the Earth's tectonic plates is caused by convection currents within the mantle. These convection currents are driven by heat released by

natural

combustion
radioactive
shrinking

processes.

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

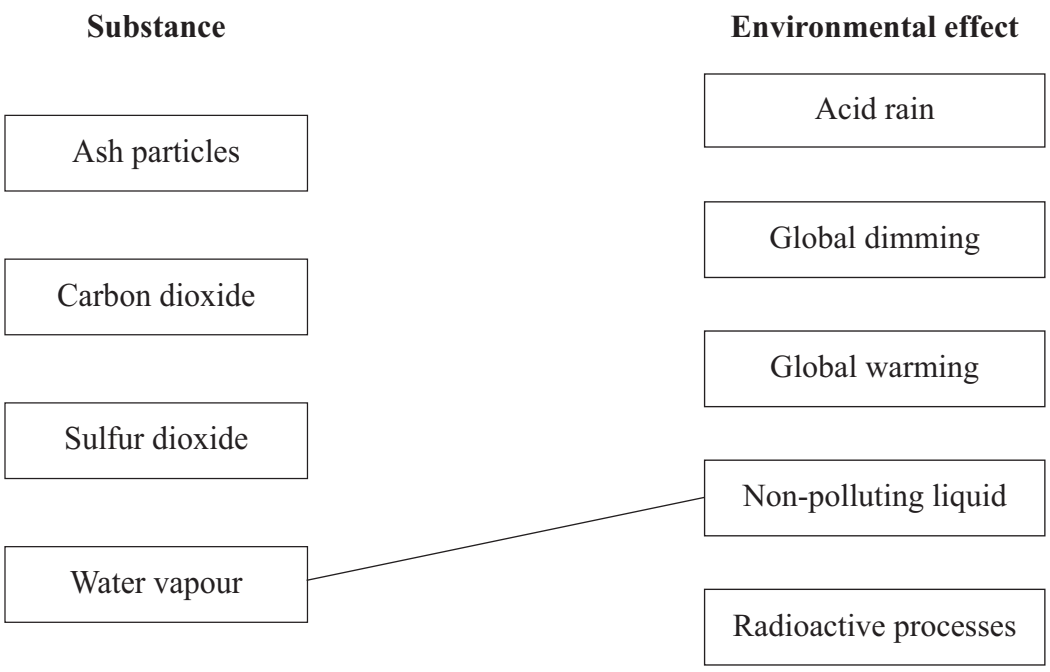
Question 30 · continued

for mark

3 (b) The volcano released large amounts of ash particles, carbon dioxide, sulfur dioxide and water vapour.

Draw **one** straight line from each substance to an environmental effect that it causes.

One has been done for you.



(3 marks)

3 (c) Why do volcanic eruptions and earthquakes happen?

.....

.....

(1 mark)

6

4.9.3.1 Atmospheric pollutants from fuels

Question 31

January 2010 | CHY1F | Original Q4 | Legacy

4 Natural gas is mainly a hydrocarbon called methane.

4 (a) Use **one** word from the box to complete the sentence.

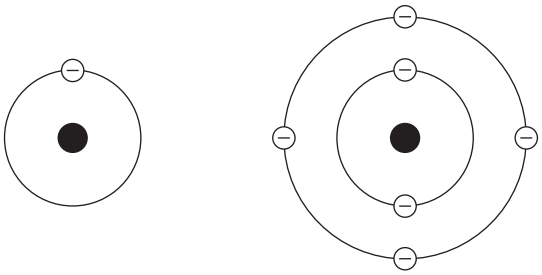
compounds	**elements**	**molecules**

Hydrocarbons contain hydrogen and carbon only.

Hydrogen and carbon are ..... .

(1 mark)

4 (b) The diagrams represent atoms of hydrogen and carbon.



Hydrogen Carbon

Draw a ring around the correct answer to complete the sentences.

4 (b) (i) The centre of each atom is called the

bond.
nucleus.
symbol.

(1 mark)

4 (b) (ii) The hydrogen atom has one electron and the carbon atom has

three
four
six

electrons.

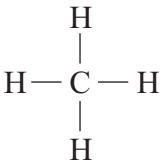
(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 31 · continued

for mark

4 (c) A molecule of methane can be represented as



Draw a ring around the correct answer to complete the sentences.

4 (c) (i) The formula of methane is

CH

CH_4

C_4H_4

(1 mark)

4 (c) (ii) The line between C—H is called a

bond.

molecule.

nucleus.

(1 mark)

4 (d) Methane burns to produce carbon dioxide (CO_2) and water (H_2O).

4 (d) (i) Draw a ring around the correct answer to complete the sentence.

When methane burns it reacts with

carbon.

nitrogen.

oxygen.

(1 mark)

4 (d) (ii) Hydrogen (H_2) can be used as a fuel.

Suggest why burning hydrogen would be less harmful to the environment than burning methane.

.....

.....

(1 mark)

7

4.9.3.1 Atmospheric pollutants from fuels

Question 32

2 Ammonium salts are used to help farmers grow crops.



2 (a) Use the correct word from the box to complete the sentence.

fertilisers	**insecticides**	**pesticides**

Ammonium salts contain nitrogen and are used by farmers as ..... to replace the nitrogen lost from the soil.

(1 mark)

2 (b) Ammonia is made by reacting nitrogen with hydrogen.

Draw a ring around the name of the raw material that provides the nitrogen.

air **crude oil** **water**

(1 mark)

2 (c) Methane and water react together to form the hydrogen.

methane and water → reactor containing a catalyst → hydrogen and carbon monoxide

2 (c) (i) Complete the word equation for this reaction.

methane + ... → hydrogen + ...

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 32 · continued

for mark

2 (c) (ii) How does the catalyst help this reaction?

.....

.....

(1 mark)

2 (d) The reaction between nitrogen and hydrogen to make ammonia can be represented by this equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Draw a ring around the meaning of the symbol, $\rightleftharpoons$

endothermic reaction **precipitation reaction** **reversible reaction**

(1 mark)

2 (e) A solution of ammonia in water is alkaline.

2 (e) (i) Which **one** of these values could be the pH of this ammonia solution?

Draw a ring around your answer.

4 **7** **10**

(1 mark)

2 (e) (ii) The ammonium salt called ammonium sulfate can be made by reacting ammonia solution with an acid.

Use the correct words from the box to complete the sentences.

hydrochloric	**hydrogen**	**sulfuric**	**water**

Ammonia solution is reacted with ..... acid to make ammonium sulfate.

During the reaction the hydrogen ions from the acid react with hydroxide

ions from the alkali to make..... .

(2 marks)

8

4.9.3.1 Atmospheric pollutants from fuels

Question 33

January 2010 | CHY3F | Original Q3 | Legacy

3 During a thunderstorm lightning strikes the Eiffel Tower.



In lightning the temperature can reach 30 000 °C. This causes nitrogen and oxygen in the air to react, producing nitrogen oxide. This reaction has a high *activation energy* and is *endothermic*.

3 (a) Nitrogen and oxygen in the air do not react easily.

What makes nitrogen and oxygen react during thunderstorms?

.....

(1 mark)

3 (b) Complete the word equation for the reaction of nitrogen with oxygen.

nitrogen + ... → .....

(1 mark)

3 (c) In an *endothermic* reaction, energy is taken in from the surroundings.

Draw a ring around the correct answer to complete the sentence.

In an *endothermic* reaction, the energy needed to break existing bonds is

less than
more than
the same as

the energy released from forming new bonds.

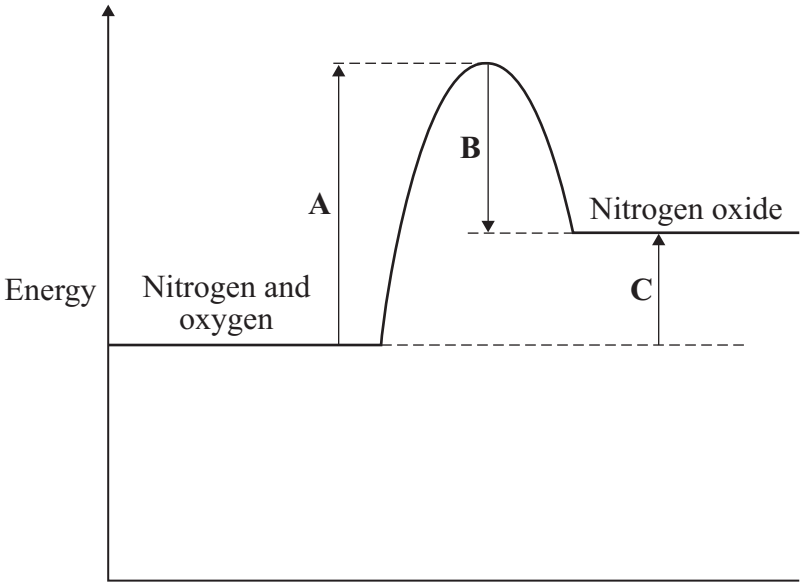
(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 33 · continued

for mark

3 (d) The energy level diagram for this reaction is shown.



Use the energy level diagram to help you to answer these questions.

3 (d) (i) Which energy change, **A**, **B** or **C**, represents the *activation energy*?

(1 mark)

3 (d) (ii) Which energy change, **A**, **B** or **C**, shows that this reaction is *endothermic*?

(1 mark)

5

4.9.3.1 Atmospheric pollutants from fuels

Question 34

March 2010 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

New substances are formed when fuels are burned. Some of these substances affect the environment.

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

A carbon dioxide

B particles

C sulfur dioxide

D water vapour

	Environmental effect
1	acid rain
2	global dimming
3	global warming
4	non-polluting

4.9.3.1 Atmospheric pollutants from fuels

Question 35

June 2010 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Petrol is a hydrocarbon fuel that burns in air. Air is mainly nitrogen.

In a car engine:

- not all of the petrol burns completely
- after burning, the products pass into the exhaust pipe.

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

A nitrogen dioxide

B carbon monoxide

C carbon dioxide

D soot (carbon)

The black solid seen inside the exhaust pipe is . . . **1** . . . .

The gas in the exhaust fumes formed by the complete combustion of petrol is . . . **2** . . . .

The poisonous gas in the exhaust fumes formed by incomplete combustion of petrol is . . . **3** . . . .

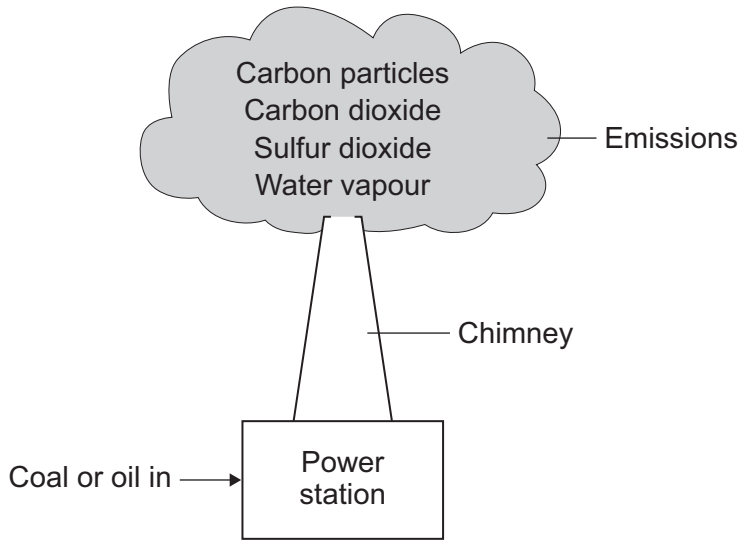
The gas in the exhaust fumes formed by combining two gases from the air is . . . **4** . . . .

4.9.3.1 Atmospheric pollutants from fuels

Question 36

June 2019 | CHY1F | Original Q3 | Legacy

3 In the future more coal-fired and fewer oil-fired power stations will be used to generate electricity.
When coal and oil are burned they produce the same types of emissions which can cause environmental problems.



3 (a) Emissions from the chimney can cause acid rain, global dimming and global warming.
Draw **one** straight line from each possible environmental problem to the emission that causes it.

Possible environmental problem	Emission that causes it
acid rain	carbon particles
global warming	carbon dioxide
global dimming	sulfur dioxide
	water vapour

(3 marks)

3 (b) Draw a ring around the correct word in the box to complete each sentence.

3 (b) (i) Incomplete combustion of coal or oil is caused by too little

carbon dioxide.
nitrogen.
oxygen.

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 36 · continued

3 (b) (ii) A gas formed by the incomplete combustion of coal or oil is

carbon monoxide.

hydrogen.

oxygen.

(1 mark)

3 (c) The table shows the world production for both coal and oil in 2000.
The world production figures after 2000 are predicted.

Year	World production of coal (billions of tonnes per year)	World production of oil (billions of barrels per year)
2000	3.5	12.5
2050	4.5	5.6
2100	5.0	1.7
2150	5.5	0.5
2200	6.0	0.0

3 (c) (i) How is the world production of oil predicted to change from 2000 to 2200?

.....

.....

(1 mark)

3 (c) (ii) Suggest **two** reasons why the world production of coal is predicted to increase.

1 .....

.....

2 .....

.....

(2 marks)

8

4.9.3.1 Atmospheric pollutants from fuels

Question 37

November 2010 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Limestone is used for building. Acid rain can damage limestone buildings because limestone is mainly calcium carbonate. Calcium carbonate reacts with acid rain to produce carbon dioxide.

A scientist tests limestone with an acid rain solution to see how much damage occurs.

The scientist:

- weighed a piece of limestone
- put the limestone in the acid rain solution
- after 1 day, took the piece of limestone out of the solution and dried the surface
- reweighed the piece of limestone.

The scientist repeated this process with the same piece of limestone for 10 days.

The results are shown in the table.

Time in days	0	1	2	3	4	5	6	7	8	9	10
Mass in g	10.0	10.2	9.5	8.9	8.4	8.0	7.7	7.5	7.3	7.3	7.3

6A A gas that causes acid rain is . . .

1 carbon monoxide.

2 sulfur dioxide.

3 carbon dioxide.

4 nitrogen.

6B The mass of the piece of limestone increased during the first day because . . .

1 carbon dioxide was produced.

2 the acid was diluted with water.

3 the limestone soaked up some of the acid rain solution.

4 the substances were mixed.

4.9.3.1 Atmospheric pollutants from fuels

Question 37 · continued

6C The mass of the piece of limestone decreased during the 10 days because . . .

1 there was an error using the balance.

2 carbon dioxide was given off.

3 the acid rain had been absorbed.

4 all the calcium carbonate had reacted.

6D After 11 days, the mass of the piece of limestone would be . . .

1 10.0 g.

2 8.4 g.

3 7.3 g.

4 6.5 g.

Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

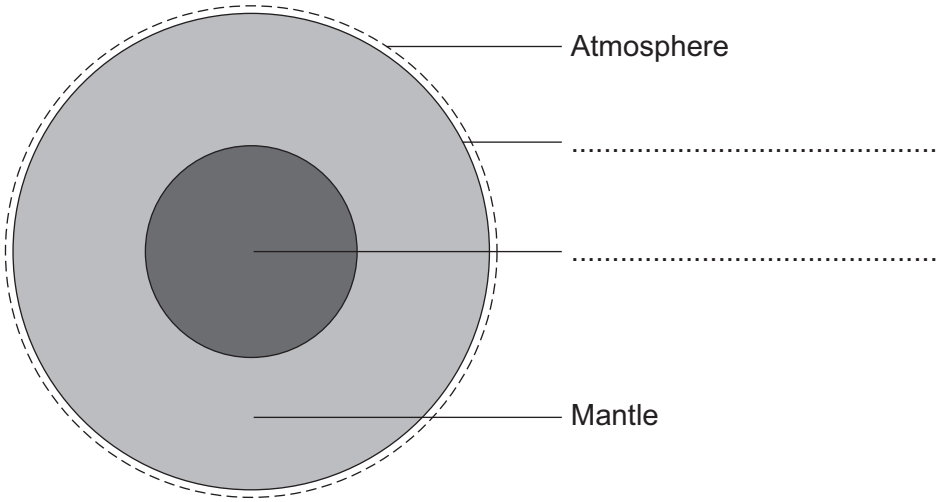
Question 38

January 2011 | CHY1F | Original Q3 | Legacy

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

3 (a) The diagram shows the layers of the Earth.

Complete the labels on the diagram.



(2 marks)

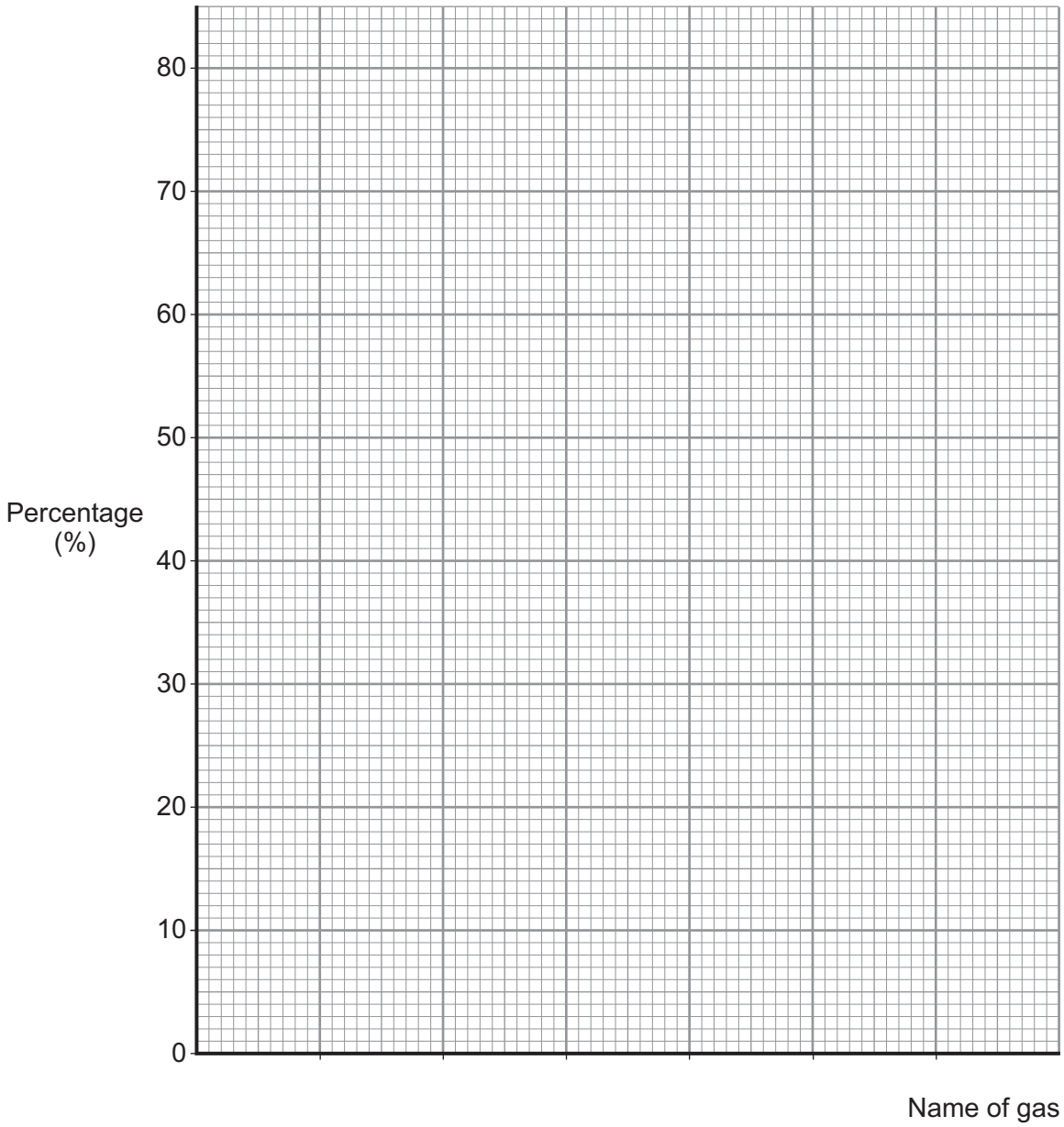
3 (b) The data in the table shows the percentages of the gases in the Earth's atmosphere.

Name of gas	Percentage (%) of gas
Nitrogen	78
Oxygen	21
Other gases	1

4.9.3.1 Atmospheric pollutants from fuels

Question 38 · continued

Present the data in the table on the grid below.



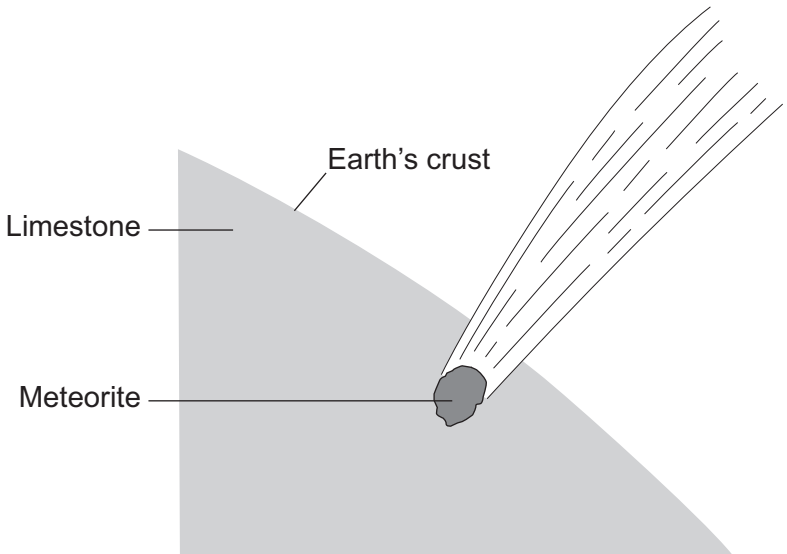
(3 marks)

Question 3 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 38 · continued

3 (c) Millions of years ago a large meteorite hit the Earth.
The meteorite heated limestone in the Earth's crust to a very high temperature.
The heat caused calcium carbonate in the limestone to release large amounts of carbon dioxide.



Draw a ring round the correct answer to complete each sentence.

3 (c) (i) Carbon dioxide was released because the calcium carbonate was

decomposed.
evaporated.
reduced.

(1 mark)

3 (c) (ii) More carbon dioxide in the Earth's atmosphere causes

acid rain.
global dimming.
global warming.

(1 mark)

7

4.9.3.1 Atmospheric pollutants from fuels

Question 39

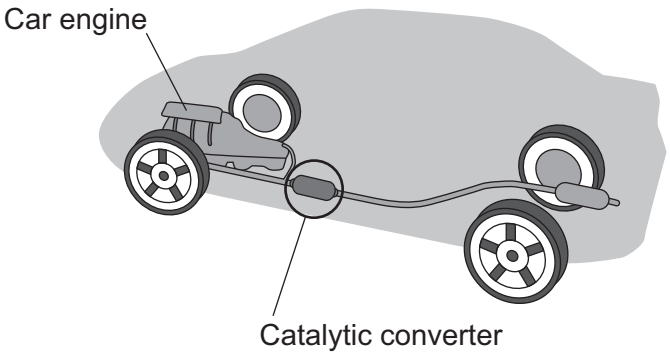
January 2011 | CHY2F | Original Q5 | Legacy

5 Read the information about car engines.

Burning petrol in air is an exothermic reaction. This reaction is used in car engines.

When petrol burns it produces harmful substances such as nitrogen oxides and carbon monoxide.

A catalytic converter stops these harmful substances being released into the air.



5 (a) Draw a ring around the correct answer to complete each sentence.

5 (a) (i) The exothermic reaction makes the temperature of the engine

decrease.

increase.

stay the same.

(1 mark)

5 (a) (ii) This is because during exothermic reactions

energy is taken in from the surroundings.

energy is given out to the surroundings.

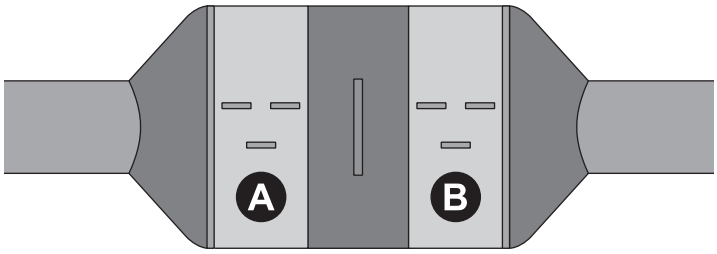
there is no energy change.

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 39 · continued

5 (b) The diagram shows a catalytic converter which removes harmful substances.
The catalytic converter has two parts, **A** and **B**, which contain different catalysts.



5 (b) (i) The equation for the reaction that takes place in part **A** is:

$$2NO \rightarrow N_2 + O_2$$

Which **one** of the substances shown in the equation is a compound?

Give the formula of this compound.

.....

(1 mark)

5 (b) (ii) The equation for the reaction that takes place in part **B** is:

$$2CO + O_2 \rightarrow 2CO_2$$

Why is it important to stop carbon monoxide (CO) from being released into the air?

.....

.....

(1 mark)

5 (c) The table lists some statements about catalysts. Only **two** statements are correct.

Tick (✓) the **two** correct statements.

Statement	Tick (✓)
A catalyst can speed up a chemical reaction.	
A catalyst is used up in a chemical reaction.	
Different reactions need different catalysts.	
A catalyst does **not** change the rate of a chemical reaction.	

(2 marks)

4.9.3.1 Atmospheric pollutants from fuels

Question 39 · continued

5 (d) Modern catalytic converters contain nanosized particles of catalyst.
Less catalyst is needed when nanosized catalyst particles are used.

5 (d) (i) Complete the sentence.

The size of nanosized particles is ..... than normal sized particles.
(1 mark)

5 (d) (ii) The catalysts contain platinum.

Suggest why a manufacturer of catalytic converters would want to use less catalyst.

.....

.....
(1 mark)

8

4.9.3.1 Atmospheric pollutants from fuels

Question 40

March 2011 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about substances that burn in air and the gases they produce.

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

A Carbon monoxide (CO)

B Hydrogen (H_2)

C Methane (CH_4)

D Hydrogen sulfide (H_2S)

	Gases produced when the substance burns in air
1	carbon dioxide (CO_2) and water vapour (H_2O)
2	water vapour (H_2O) only
3	water vapour (H_2O) and sulfur dioxide (SO_2)
4	carbon dioxide (CO_2) only

4.9.3.1 Atmospheric pollutants from fuels

Question 41

March 2011 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

During December 1952, many people died in London due to smog. Smog is a mixture of smoke and sulfur dioxide.

7A Sulfur dioxide is responsible for . . .

1 global dimming.

2 global warming.

3 the greenhouse effect.

4 acid rain.

The table shows the amount of sulfur dioxide in the air in three places in London in December 1952.

Location within London	Amount of sulfur dioxide in parts per million							
	Mean for the whole month of December 1952	Reading on each day in first week of December 1952						
		1st	2nd	3rd	4th	5th	6th	7th
Lambeth	0.22	0.16	0.24	0.34	0.75	0.86	1.34	0.47
Southwark	0.11	0.19	0.26	0.38	0.41	1.14	0.95	0.80
Westminster	0.16	0.15	–	0.24	0.48	0.63	0.99	0.89

7B Which of the following statements describes the pattern of the readings in the table?

1 The highest reading for sulfur dioxide is on the same day in each location.

2 The readings all rise and then fall in each location.

3 The sulfur dioxide readings are the same on the 6th December in each location.

4 The readings all rise and then stay the same in each location.

7C The most likely value for the missing reading on the 2nd December for Westminster is . . .

1 0.13

2 0.19

3 0.36

4 0.45

4.9.3.1 Atmospheric pollutants from fuels

7D The mean value for the whole month of December for Southwark is lower than any of the readings for the first 7 days of December for Southwark.

This is because for Southwark, . . .

1 the mean of the readings for the first 7 days in December is 0.11

2 the readings for the other days in December were all zero.

3 after 7th December, the smog became thicker.

4 most of the readings for the other days in December were lower than 0.11

Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

Question 42

June 2011 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about gases produced when a fuel burns.

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

A carbon dioxide

B carbon monoxide

C sulfur dioxide

D water vapour

1	It is the main cause of acid rain.
2	It is only produced by incomplete combustion of the fuel.
3	It is a cause of global warming.
4	It is produced from hydrogen in the fuel.

4.9.3.1 Atmospheric pollutants from fuels

Question 43

June 2011 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Copper is in high demand. Copper is extracted from ores containing copper sulfide. Most of these ores contain only low percentages of copper sulfide.

The copper sulfide is heated in a furnace. Oxygen is blown through the molten copper sulfide. Copper and sulfur dioxide are produced.

6A A company uses copper sulfide ores to produce copper.

The company will make more profit if . . .

1 the cost of the fuel to heat the furnace increases.

2 the ores contain a higher percentage of copper sulfide.

3 their workers are paid more.

4 there is a reduced demand for copper.

6B The company wants to know the amount of sulfur dioxide released into the atmosphere from the chemical works.

It would be best to measure the amount of sulfur dioxide . . .

1 in the nearest town.

2 in the area around the chemical works.

3 in the gases coming out of the chimneys at the chemical works.

4 in the country as a whole.

4.9.3.1 Atmospheric pollutants from fuels

Question 43 · continued

6C The company wants to know the total amount of sulfur dioxide given off by the chemical works in a 24-hour period.

The best way to calculate this would be from measurements taken . . .

1 at midday.

2 at 10.00 am and 10.00 pm.

3 at 9.00 am, midday and 4.00 pm.

4 every hour.

6D Ores containing very low percentages of copper sulfide are being used to produce copper.

One factor that would increase the use of these ores is . . .

1 the discovery of large deposits of high grade copper ore.

2 an increase in the use of plastics instead of copper for water pipes.

3 a large increase in the price of copper.

4 an increase in the amount of copper that is recycled.

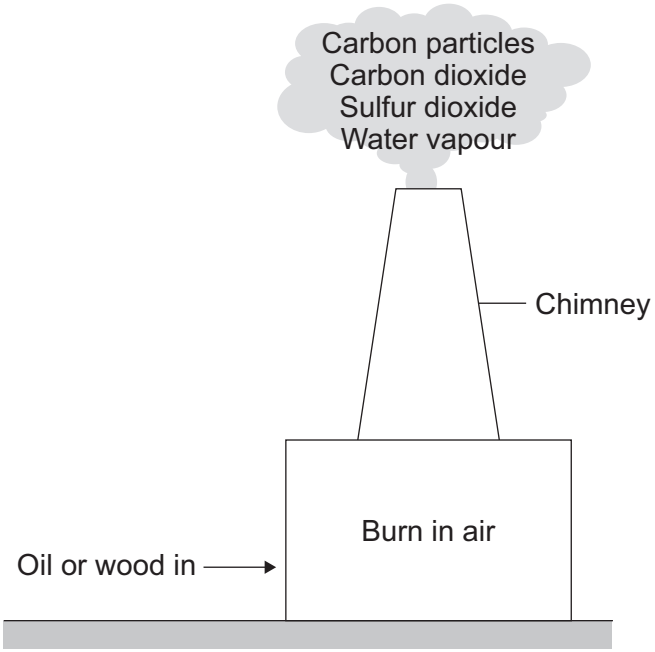
4.9.3.1 Atmospheric pollutants from fuels

Question 44

June 2011 | CHY1F | Original Q2 | Legacy

2 In the future:

- there will be fewer oil burning power stations
- there may be more wood burning power stations.



2 (a) Which **one** of the emissions from the chimney can cause acid rain?

.....

(1 mark)

2 (b) Draw a ring around the correct answer to complete the sentence.

Carbon particles in the Earth's atmosphere cause

acid rain.
global dimming.
global warming.

(1 mark)

2 (c) Which gas in the air is needed for oil or wood to burn?

.....

(1 mark)

2 (d) Suggest why there will be **fewer** power stations burning oil in the future.

.....

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 44 · continued

2 (e) Some power stations burn wood.
The wood comes from trees grown in forests.

Suggest why burning wood in power stations is said to be 'carbon-neutral'.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

Question 45

November 2011 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

National Parks are large, attractive areas where people can enjoy the countryside.

In one particular National Park, a company has a large limestone quarry and a cement factory close to it. There is a village about one kilometre from the cement factory.

7A Although the quarry is a scar on the landscape and increases pollution in the area, local people gain some benefit because . . .

1 it provides a new recreational area.

2 it creates a new habitat for wildlife.

3 it provides employment.

4 it attracts tourists to the area.

7B The main advantage to the company of having a cement factory close to the quarry rather than many kilometres away is that . . .

1 the factory can be operated 365 days a year.

2 transport costs will be less.

3 visual pollution near the village will be minimised.

4 there will be less atmospheric pollution near the village.

4.9.3.1 Atmospheric pollutants from fuels

Question 45 · continued

Local people are concerned that a different fuel being used at the cement factory is releasing sulfur dioxide when it is burned.

The table shows the sulfur dioxide concentration in the atmosphere, recorded on one day.

Distance from the cement factory in metres	Concentration of sulfur dioxide in parts per million
0	65
500	48
1000	16
1500	10
2000	5

7C The conclusion from these results is that . . .

1 as the distance in metres doubles, the concentration of the sulfur dioxide is halved.

2 the concentration of sulfur dioxide is lower further away from the cement factory.

3 children should not play within 1000 metres of the cement factory.

4 there is no sulfur dioxide 4000 metres from the cement factory.

7D On another day later in the year, the sulfur dioxide concentrations in the atmosphere were measured at the same places.

The concentrations were much lower.

Which of the following is the most likely reason for this change?

1 an increase in wind speed

2 an increase in cement production

3 the factory using a fuel with a higher sulfur content

4 less rain when measurements were taken

4.9.3.1 Atmospheric pollutants from fuels

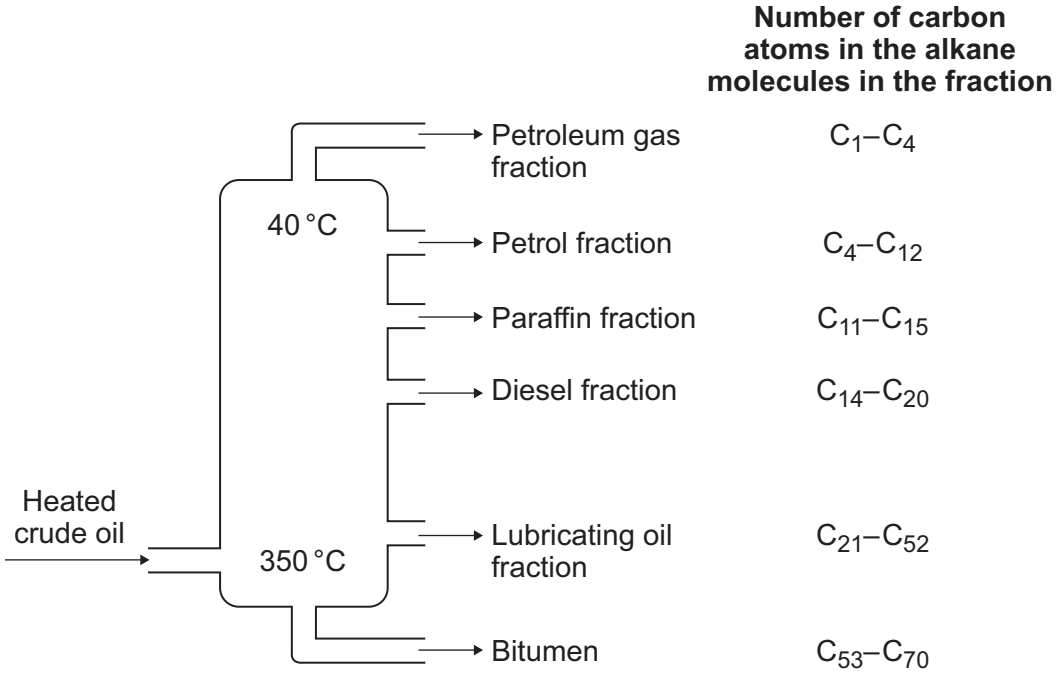
Question 46

November 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

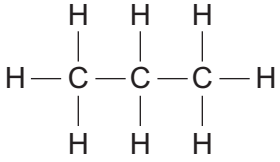
Crude oil can be separated into fractions.

Each fraction contains several alkanes.

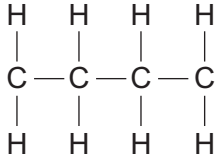


8A One of the alkanes in the petrol fraction can be represented by . . .

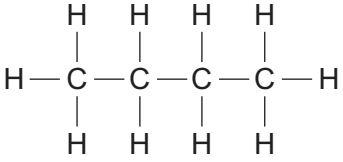
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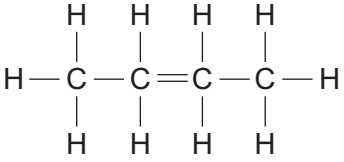
2



3



4



4.9.3.1 Atmospheric pollutants from fuels

Question 46 · continued

November 2011 | CHY1AP | Original Q8 | Legacy

8B When compared with the alkanes in the petrol fraction, the alkanes in the lubricating oil fraction . . .

1 will be more difficult to ignite.

2 will burn with a cleaner flame.

3 will have lower boiling points.

4 will have smaller molecules.

8C The alkane called nonane has 20 hydrogen atoms in each molecule.

In which fraction will it be mainly collected?

1 Petroleum gas fraction

2 Petrol fraction

3 Diesel fraction

4 Lubricating oil fraction

8D Which of these gases **cannot** be produced when a pure alkane burns?

1 carbon monoxide

2 carbon dioxide

3 sulfur dioxide

4 water vapour

4.9.3.1 Atmospheric pollutants from fuels

Question 47

January 2012 | CH1FP | Original Q6 | Legacy

6 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	

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

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

.....

(1 mark)

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

$$C_nH$$

(1 mark)

6 (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**.

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

.....

(1 mark)

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

.....

.....

(1 mark)

Question 6 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 47 · continued

6 (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	

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

.....

(1 mark)

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

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

.....

.....

.....

(2 marks)

4.9.3.1 Atmospheric pollutants from fuels

Question 47 · continued

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

Explain why.

.....

.....

.....

.....

(2 marks)

11

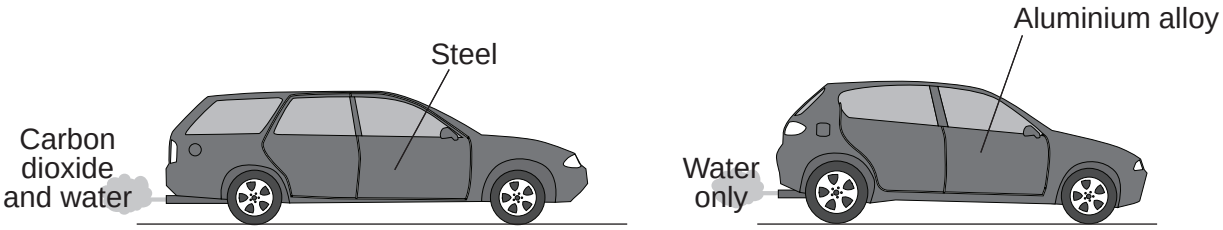
Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

Question 48

June 2012 | CH1FP | Original Q3 | Legacy

3 The picture shows two different cars.



3 (a) Some properties of aluminium are given below.

Tick (✓) **two** reasons why aluminium is better than steel for car bodies.

Reason	Tick (✓)
Aluminium is not a transition metal.	
Aluminium has a low density.	
Aluminium is expensive to extract.	
Aluminium is resistant to corrosion.	

(2 marks)

3 (b) Each car body is made from an *alloy*.

3 (b) (i) What is an *alloy*?

.....

.....

(1 mark)

3 (b) (ii) An alloy is used to make a car body. A pure metal is **not** used to make a car body.

Suggest why.

.....

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 48 · continued

3 (c) The car with a steel body uses petrol for fuel.

Draw a ring around the correct answer to complete each sentence.

3 (c) (i) Petrol is made from [air. / crude oil. / metal ores.]

(1 mark)

3 (c) (ii) Petrol is a mixture of [carbonates / hydrocarbons / polymers] including C_8H_{18}

(1 mark)

3 (c) (iii) In the car engine petrol reacts with [argon / nitrogen / oxygen] to produce carbon dioxide and water.

(1 mark)

3 (d) Look at the substances coming out of each car's exhaust.

3 (d) (i) Suggest the name of the fuel used in the car with the aluminium alloy body.

Name of fuel .....

(1 mark)

3 (d) (ii) Why is the fuel burned in the car with the aluminium alloy body better for the environment than petrol?

.....

.....

(1 mark)

9

4.9.3.1 Atmospheric pollutants from fuels

Question 49

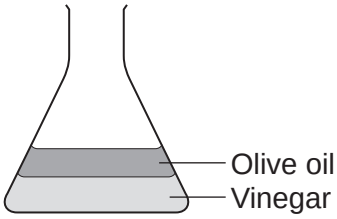
June 2012 | CH1FP | Original Q5 | Legacy

5 Olive oil is used to make salad dressings and margarine.

5 (a) Vinegar is often used in salad dressings.
Vinegar contains 95% water and 5% ethanoic acid.

5 (a) (i) To make a simple salad dressing add olive oil to vinegar and shake.
After a few minutes the mixture separates.

Simple salad dressing



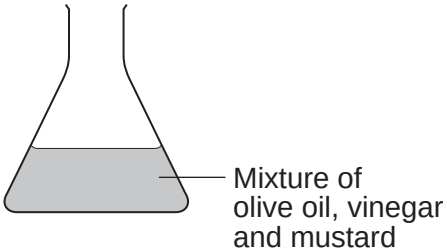
Tick (✓) **one** reason why the olive oil separates above the vinegar.

Reason	Tick (✓)
Olive oil does not dissolve in vinegar.	
Olive oil has a higher density than vinegar.	
Olive oil has a higher boiling point than vinegar.	

(1 mark)

5 (a) (ii) To make a French salad dressing add mustard to the olive oil and vinegar and shake.
After several minutes the mixture does **not** separate.

French salad dressing



The olive oil, vinegar and mustard mixture does **not** separate.
Give **one** reason why.

.....

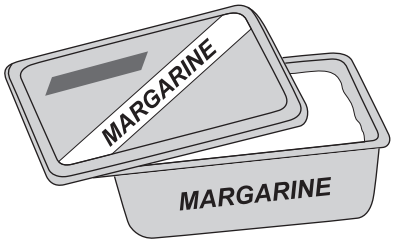
.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 49 · continued June 2012 | CH1FP | Original Q5 | Legacy

5 (b) Olive oil contains *unsaturated* compounds. Olive oil can be hardened to make margarine.



5 (b) (i) Draw a ring around the correct answer to complete the sentence.

Unsaturated compounds contain | double | ionic | metallic | carbon-carbon bonds.

(1 mark)

5 (b) (ii) Draw **one** line from the test that would detect unsaturated compounds to the result of the test.

Test	Result of test
Add bromine water	Turns cloudy
Add limewater	Turns colourless
Add water	Turns orange

(1 mark)

5 (c) Olives grow on trees.
When olive oil is burned it produces carbon dioxide.

5 (c) (i) Burning olive oil as a fuel is said to be 'carbon neutral'.
Suggest why.

.....

.....

(1 mark)

5 (c) (ii) Olive oil is too expensive to use as biodiesel fuel.
Suggest another reason why olive oil should **not** be used as a fuel.

.....

.....

(1 mark)

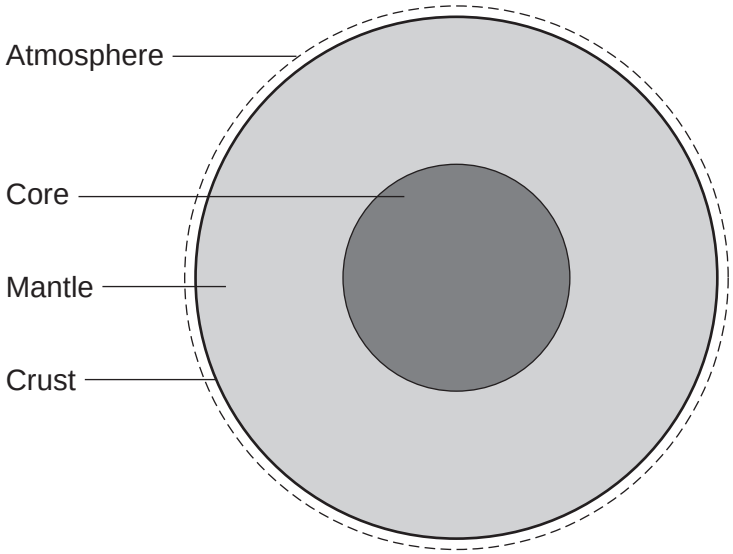
6

4.9.3.1 Atmospheric pollutants from fuels

Question 50

January 2013 | CH1FP | Original Q2 | Legacy

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



2 (a) Use the diagram above to help you to answer this question.

Draw **one** line from each statement to its correct layer.

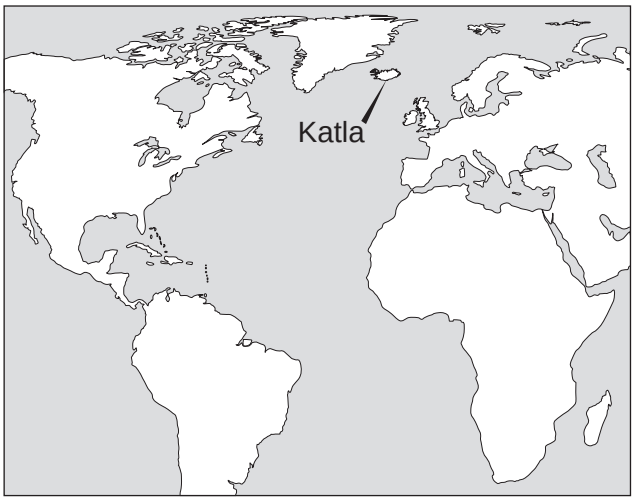
Statement	Layer
There are mountain ranges.	atmosphere
There are convection currents that cause earthquakes.	core
There is a mixture of gases.	crust
	mantle

(3 marks)

4.9.3.1 Atmospheric pollutants from fuels

Question 50 · continued

2 (b) Iceland has many volcanoes.
Scientists are monitoring a volcano in Iceland, called Katla.



There has been an increase in the number of small earthquakes (tremors) around Katla.

2 (b) (i) Draw a ring around the correct answer to complete the sentence.

Iceland has volcanoes because it

- has low temperatures.
- is an island.
- is on a tectonic plate boundary.

(1 mark)

2 (b) (ii) People do not know when Katla will next erupt.

Tick (✓) the correct reason why.

Reason	Tick (✓)
Small earthquakes (tremors) near the volcano are happening more often.	
The last two eruptions happened a long time ago in October 1918 and in May 1860.	
Scientists cannot accurately predict when volcanic eruptions will occur.	

(1 mark)

Question 2 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 50 · continued

2 (c) Previous eruptions of Katla produced large amounts of solid ash particles and sulfur dioxide.

Use the correct answer to complete each sentence.

acid rain	**earthquakes**	**global dimming**	**global warming**

An environmental impact caused by solid ash particles is ..... .

An environmental impact caused by sulfur dioxide is ..... .

(2 marks)

7

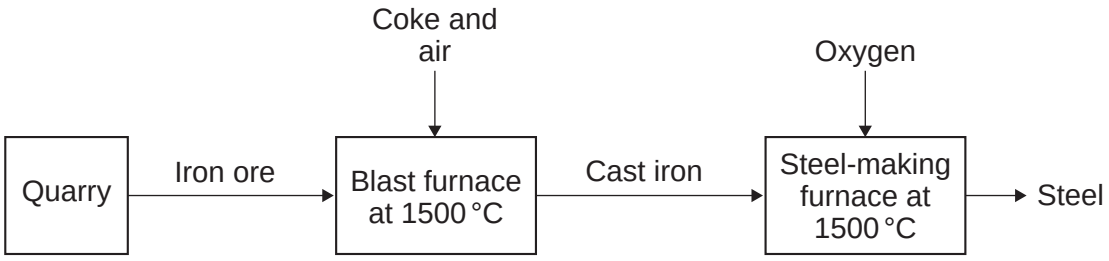
4.9.3.1 Atmospheric pollutants from fuels

Question 51

January 2013 | CH1FP | Original Q4 | Legacy

4 The iron produced from iron ore in a blast furnace is called cast iron.

Cast iron is converted into steel in a furnace.



Iron ore contains iron oxide.
Coke contains carbon.

4 (a) Quarrying iron ore will have an impact on everything near to the quarry.

4 (a) (i) Describe **one** positive impact and **one** negative impact of quarrying iron ore.

positive impact .....

.....

negative impact.....

.....

(2 marks)

4 (a) (ii) Draw a ring around the correct answer to complete the sentence.

Ores contain enough metal to make extraction of the metal

carbon neutral.

economical.

reversible.

(1 mark)

4 (b) Many chemical reactions take place in a blast furnace.
Use the flow diagram to help you to answer this question.

Suggest how the blast furnace is heated.

.....

.....

(1 mark)

4.9.3.1 Atmospheric pollutants from fuels

Question 51 · continued January 2013 | CH1FP | Original Q4 | Legacy

4 (c) A chemical reaction for the extraction of iron is:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

4 (c) (i) Complete the word equation for this chemical reaction.

..... + carbon monoxide → iron + ...

(2 marks)

4 (c) (ii) Draw a ring around the correct answer to complete the sentence.

Iron is extracted from its ore by

- decomposition.
- oxidation.
- reduction.

(1 mark)

4 (d) Cast iron contains about 4% carbon.
Cast iron is converted into low-carbon steels.

4 (d) (i) Low-carbon steel is produced by blowing oxygen into molten cast iron.

Suggest how oxygen removes most of the carbon.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) Draw a ring around the correct answer to complete the sentence.

Metals, such as nickel, are added to low-carbon steels to make the steel

- corrode easily.
- easy to shape.
- much harder.

(1 mark)

Question 4 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 51 · continued

4 (e) Recycling steel uses less energy than producing steel from iron ore.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling steel.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
Iron is the second most common metal in the Earth's crust.		
Less carbon dioxide is produced.		
More iron ore needs to be mined.		
There are different types of steel which must be sorted.		

(2 marks)

12

4.9.3.1 Atmospheric pollutants from fuels

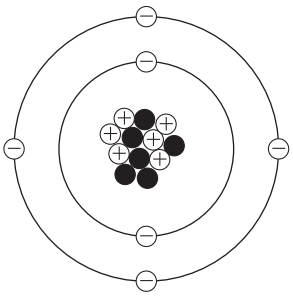
Question 52

June 2014 | CH1FP | Original Q1 | Legacy

1 Fossil fuels contain carbon.

1 (a) **Figure 1** represents a carbon atom.

Figure 1



Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The name of the particle with a positive charge is

an electron.

a neutron.

a proton.

[1 mark]

1 (a) (ii) The centre of the atom is called the

energy level.

molecule.

nucleus.

[1 mark]

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

Use the correct number from the box to complete each sentence.

[2 marks]

4	6	8	10	12

The mass number of this carbon atom is ☐

In the periodic table, carbon is in Group ☐

4.9.3.1 Atmospheric pollutants from fuels

Question 52 · continued

1 (b) Coal is a fossil fuel.

A piece of coal contains:

- 80% carbon
- 9% oxygen
- 1% sulfur
- 5% hydrogen.

The rest of the coal is other elements.

1 (b) (i) What is the percentage of other elements in this piece of coal?

[1 mark]

..... %

1 (b) (ii) Coal burns in air to produce carbon dioxide, sulfur dioxide and water.

Draw **one** line from each product to the type of pollution caused by each product.

[3 marks]

Product	Type of pollution
Carbon dioxide	Acid rain
Sulfur dioxide	Global dimming
Water	Global warming
	No pollution

8

4.9.3.1 Atmospheric pollutants from fuels

Question 53

June 2014 | CH1FP | Original Q5 | Legacy

5 Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

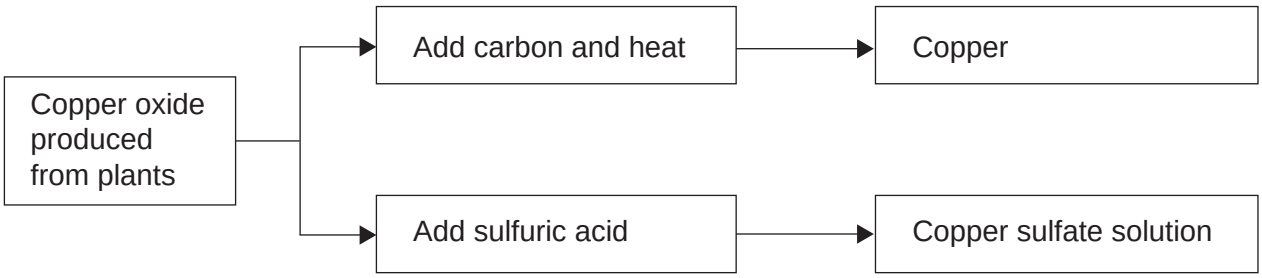
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 6**.

Figure 6



5 (a) Draw a ring around the correct answer to complete each sentence.

5 (a) (i) Copper ores contain enough copper to make extraction of the metal

carbon neutral.
economical.
reversible.

[1 mark]

5 (a) (ii) Using plants to extract metals is called

photosynthesis.
phytomining.
polymerisation.

[1 mark]

5 (a) (iii) Copper oxide reacts with carbon to produce copper and

carbon dioxide.
oxygen.
sulfur dioxide.

[1 mark]

4.9.3.1 Atmospheric pollutants from fuels

Question 53 · continued

5 (b) Copper is produced from copper sulfate solution by displacement using iron or by electrolysis.

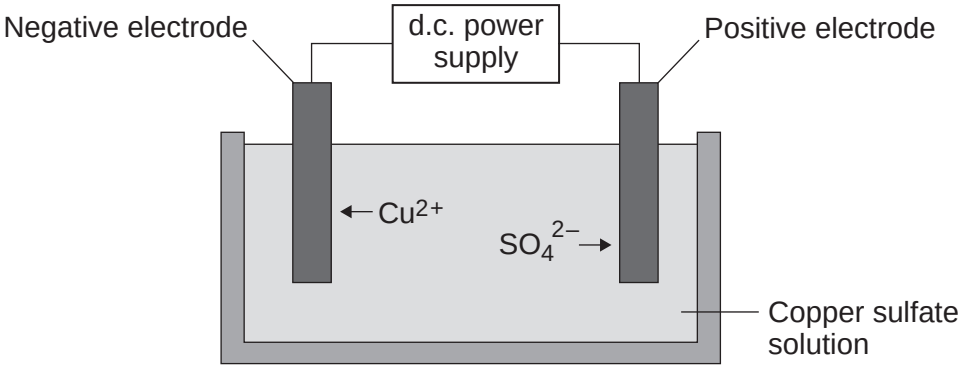
5 (b) (i) Complete the word equation.

[2 marks]

copper sulfate + iron ⟶ ..... + ...

5 (b) (ii) **Figure 7** shows the electrolysis of copper sulfate solution.

Figure 7



Why do copper ions go to the negative electrode?

[1 mark]

.....

.....

5 (c) Suggest **two** reasons why copper should **not** be disposed of in landfill sites.

[2 marks]

.....

.....

.....

.....

8

4.9.3.1 Atmospheric pollutants from fuels

Question 54

June 2014 | CH1FP | Original Q7 | Legacy

7 Ethanol and vegetable oil are used as fuels.

7 (a) There are two different ways to produce ethanol:

- using ethene from crude oil
- using sugar from plants.

7 (a) (i) Ethanol is produced from ethene by **hydration** in the presence of a catalyst.

What is **hydration**?

[1 mark]

.....

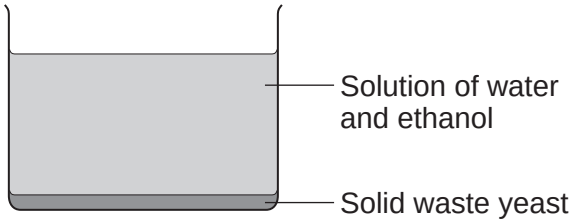
.....

7 (a) (ii) Fermentation is used to produce ethanol from sugar by:

- dissolving the sugar in water
- adding yeast to the sugar solution
- leaving the mixture for three days.

Figure 8 shows the substances after three days.

Figure 8



Suggest:

- how the solid waste yeast is removed
- how ethanol is obtained from the solution.

[2 marks]

.....

.....

.....

.....

4.9.3.1 Atmospheric pollutants from fuels

Question 54 · continued

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

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

Table 4 shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

Table 4

	Carbon dioxide in ppm	Nitrogen oxides in ppm	Sulfur dioxide in ppm	Particulates in g per m^3
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

[6 marks]

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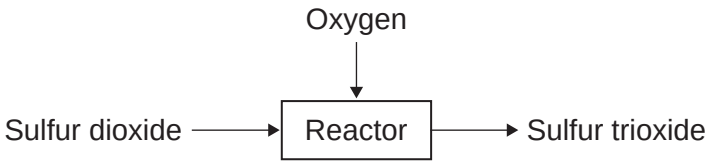
4.9.3.1 Atmospheric pollutants from fuels

Question 55

June 2014 | CH2FP | Original Q3 | Legacy

3 **Figure 4** represents the reaction of sulfur dioxide with oxygen.

Figure 4



3 (a) (i) Complete the word equation for the reaction of sulfur dioxide with oxygen.

[1 mark]

sulfur dioxide + ... → .....

3 (a) (ii) Draw a ring around the correct answer to complete the sentence.

[1 mark]

Sulfur dioxide (SO_2) is

- a compound.
- an element.
- a mixture.

3 (b) The reactants are gases.

When the pressure of the gases is increased, the reaction gets faster.

Complete the sentence.

[1 mark]

When the pressure of the gases is increased,

the frequency of the collisions ..... .

4.9.3.1 Atmospheric pollutants from fuels

Question 55 · continued

3 (c) The particles need energy to react.

Complete the sentence.

[1 mark]

The minimum amount of energy that particles need to react is called

the ..... energy.

3 (d) Give **one** way of increasing the rate of the reaction other than changing the pressure.

[1 mark]

.....

.....

5

Turn over for the next question

4.9.3.1 Atmospheric pollutants from fuels

Question 56

June 2015 | CH1FP | Original Q3 | Legacy

3 Crude oil is a fossil fuel.

3 (a) To make crude oil more useful it is separated into fractions.

Use the correct word from the box to complete each sentence.

boiling	**compound**	**decomposition**	**distillation**
filtration	**mixture**	**molecule**	

3 (a) (i) Crude oil is a ..... of different substances.

[1 mark]

3 (a) (ii) The substances in crude oil have different ..... points.

[1 mark]

3 (a) (iii) Crude oil is separated by fractional ..... .

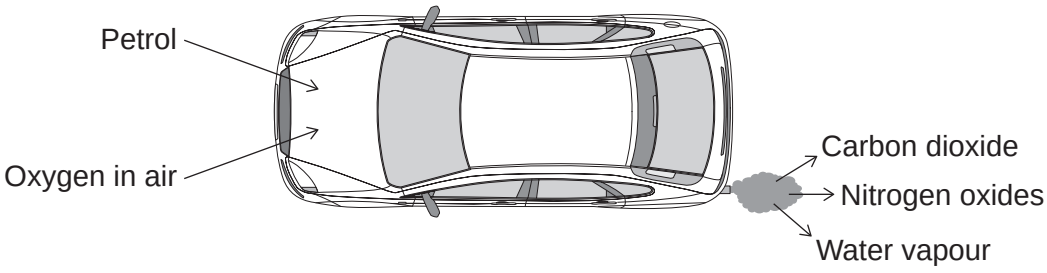
[1 mark]

3 (b) Petrol is one of the fractions produced from crude oil.

Car engines use a mixture of petrol and air.

Figure 5 shows some of the gases produced.

Figure 5



4.9.3.1 Atmospheric pollutants from fuels

Question 56 · continued

3 (b) (i) What type of reaction happens to petrol in a car engine?

[1 mark]

Tick (✓) **one** box.

combustion ☐

decomposition ☐

neutralisation ☐

3 (b) (ii) Petrol contains octane (C_8H_{18}).

Complete the word equation for the reaction of octane with oxygen.

[2 marks]

octane + ... ⟶ ..... + ...

3 (b) (iii) Cars use sulfur-free petrol as a fuel.

Describe why sulfur should be removed from petrol.

[2 marks]

.....

.....

.....

.....

Question 3 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 56 · continued

3 (c) Some fractions from crude oil contain large hydrocarbon molecules.

These molecules can be cracked to produce smaller, more useful molecules.

An equation for cracking decane is:

$$\underset{\text{decane}}{C_{10}H_{22}} \longrightarrow \underset{\text{propane}}{C_3H_8} + \underset{\text{ethene}}{C_2H_4} + \underset{\text{pentene}}{C_5H_{10}}$$

3 (c) (i) Why is propane useful?

[1 mark]

Tick (✓) **one** box.

Propane is a polymer. ☐

Propane is an alloy. ☐

Propane is a fuel. ☐

3 (c) (ii) Draw bonds to complete the displayed structure of ethene.

[1 mark]



4.9.3.1 Atmospheric pollutants from fuels

Question 56 · continued

3 (c) (iii) What is the colour change when bromine water reacts with ethene?

[1 mark]

Tick (✓) **one** box.

Orange to colourless ☐

Orange to green ☐

Orange to red ☐

3 (c) (iv) Complete the sentence.

[1 mark]

Pentene is useful because many pentene molecules can join together to form ..... .

12

4.9.3.1 Atmospheric pollutants from fuels

Question 57

June 2015 | CH2FP | Original Q1 | Legacy

1 This question is about carbon and gases in the air.

1 (a) Carbon atoms have protons, neutrons and electrons.

Complete **Table 1** by writing the relative mass of a neutron and an electron.

[2 marks]

Table 1

Name of particle	Relative mass
proton	1
neutron	
electron	

1 (b) What is the total number of protons and neutrons in an atom called?

[1 mark]

Tick (✓) **one** box.

The atomic number ☐

The mass number ☐

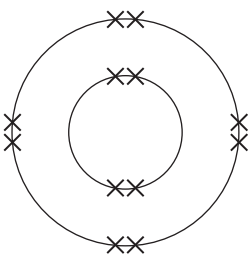
One mole of the atom ☐

1 (c) An atom of carbon has six electrons.

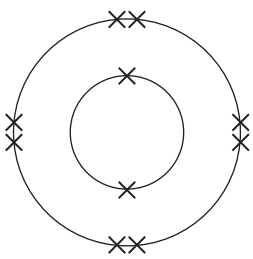
Which structure, **A**, **B** or **C**, represents the electronic structure of the carbon atom?

[1 mark]

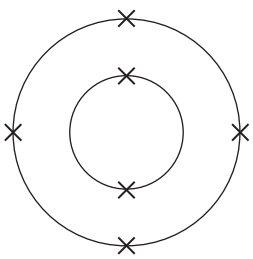
Structure A



Structure B



Structure C



The carbon atom is structure ☐.

4.9.3.1 Atmospheric pollutants from fuels

Question 57 · continued

1 (d) Carbon reacts with oxygen to produce carbon dioxide (CO_2).

1 (d) (i) How many different elements are in one molecule of carbon dioxide?

[1 mark]

.....

1 (d) (ii) What is the total number of atoms in one molecule of carbon dioxide?

[1 mark]

.....

1 (e) Sometimes carbon reacts with oxygen to produce carbon monoxide (CO).

1 (e) (i) Calculate the relative formula mass (M_r) of carbon monoxide.

Relative atomic masses (A_r): C = 12; O = 16

[1 mark]

.....

.....

M_r of carbon monoxide = ...

1 (e) (ii) Calculate the percentage by mass of carbon in carbon monoxide.

[1 mark]

.....

.....

Percentage by mass of carbon in carbon monoxide = ...%

Question 1 continues on the next page

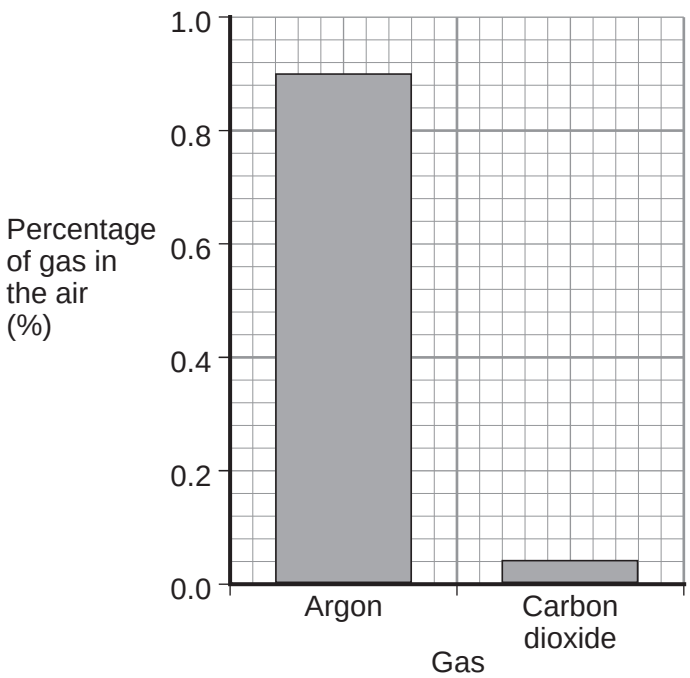
4.9.3.1 Atmospheric pollutants from fuels

Question 57 · continued

1 (f) Carbon dioxide is one of the gases in the air.

1 (f) (i) **Figure 1** shows the percentage of argon and the percentage of carbon dioxide in the air.

Figure 1



What is the percentage of argon in the air?

[1 mark]

Percentage of argon = ... %

1 (f) (ii) An instrumental method is used to measure the amount of carbon dioxide in the air.

Give **one** reason for using an instrumental method.

[1 mark]

.....

.....

10

4.9.3.1 Atmospheric pollutants from fuels

Question 58

June 2015 | CH3FP | Original Q7 | Legacy

7 Some pollutants cause acid rain.

A student tested 25.0 cm^3 samples of three types of rainwater, **P**, **Q** and **R**.
The student titrated the samples with sodium hydroxide solution (an alkali).

The student recorded the volume of sodium hydroxide solution needed to neutralise the rainwater. The student's results are shown in **Table 1**.

Table 1

	Volume of sodium hydroxide needed to neutralise the rainwater in cm^3				
Type of rainwater	**Titration 1**	**Titration 2**	**Titration 3**	**Titration 4**	**Mean value**
P	18.0	15.5	14.5	15.0	15.0
Q	13.0	10.0	11.0	10.5	10.5
R	23.0	19.5	18.5	19.0	19.0

7 (a) (i) The student calculated the mean value for rainwater **R** as 19.0 cm^3.

Show how the student calculated the mean value for rainwater **R**.

[2 marks]

.....

.....

.....

.....

7 (a) (ii) Write down **P**, **Q** and **R** in order of their acidity.

[2 marks]

Most acidic .....

.....

Least acidic .....

4.9.3.1 Atmospheric pollutants from fuels

Question 58 · continued

7 (b) A second student repeated the experiment and recorded the results in **Table 2**.

Table 2

	Volume of sodium hydroxide needed to neutralise the rainwater in cm^3	
Type of rainwater	**Titration 1**	**Titration 2**
P	17	15
Q	11	9
R	20	18

Use **Table 1** and **Table 2** to suggest **two** improvements the second student could make to obtain more accurate results.

[2 marks]

.....

.....

.....

.....

7 (c) The results of the two students show that the experiment is reproducible.

Give the reason why.

[1 mark]

.....

.....

7

4.9.3.1 Atmospheric pollutants from fuels

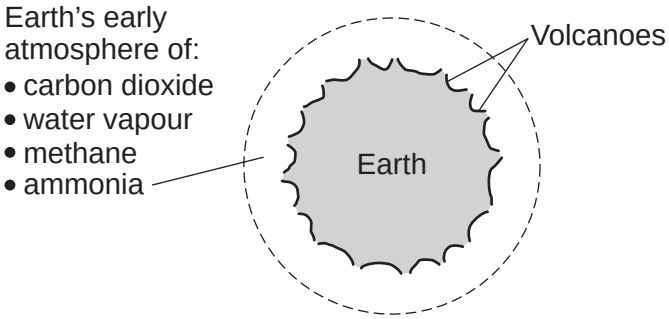
Question 59

June 2016 | CH1FP | Original Q2 | Legacy

2 This question is about the Earth and its atmosphere.

2 (a) **Figure 4** shows the Earth and its atmosphere billions of years ago.

Figure 4



2 (a) (i) The boiling point of water is 100 °C.

Suggest **one** reason why there was no liquid water on the Earth's surface billions of years ago.

[1 mark]

_____

_____

2 (a) (ii) Complete the sentence.

[1 mark]

On the Earth today, volcanic eruptions happen at the boundaries between

tectonic _____ .

Question 2 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 59 · continued

2 (b) The Earth's atmosphere today contains nitrogen, oxygen, argon, carbon dioxide and other gases.

2 (b) (i) Draw **one** line from each substance to a description of the substance.

[3 marks]

Substance	Description of the substance
air	compound
carbon dioxide	element
argon	hydrocarbon
	metal
	mixture

2 (b) (ii) Which gas in the Earth's atmosphere is used when hydrocarbons burn?

[1 mark]

Tick (✓) **one** box.

- carbon dioxide ☐
- nitrogen ☐
- oxygen ☐

2 (b) (iii) What percentage of the Earth's atmosphere is nitrogen?

[1 mark]

Tick (✓) **one** box.

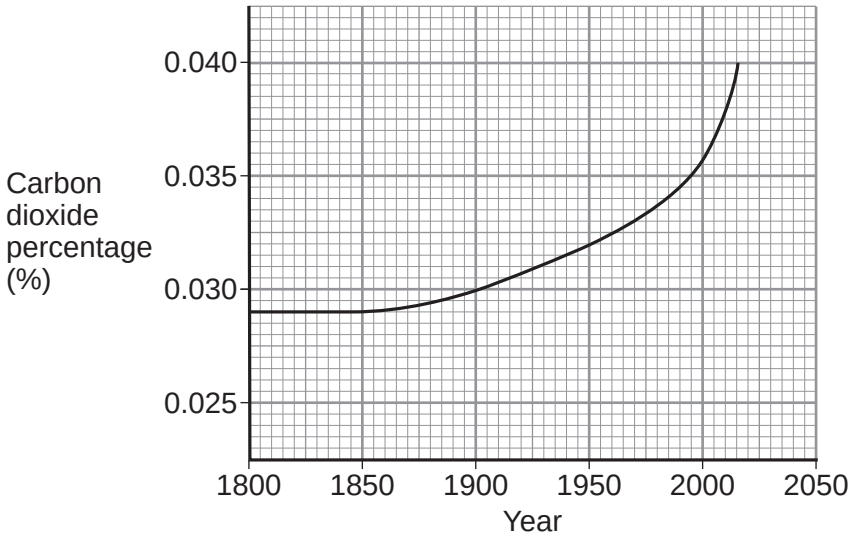
- about 40% ☐
- about 60% ☐
- about 80% ☐

4.9.3.1 Atmospheric pollutants from fuels

Question 59 · continued

2 (c) **Figure 5** shows the carbon dioxide percentage (%) in the Earth's atmosphere since the year 1800.

Figure 5



2 (c) (i) What was the carbon dioxide percentage in 1900?

[1 mark]

_____ %

2 (c) (ii) Describe, in detail, how the carbon dioxide percentage changed from 1900 to 2015.

[2 marks]

_____

_____

_____

_____

2 (c) (iii) Suggest **two** reasons for the change in the carbon dioxide percentage from 1900 to 2015.

[2 marks]

1 _____

_____

2 _____

_____

12

4.9.3.1 Atmospheric pollutants from fuels

Question 60

June 2016 | CH1FP | Original Q5 | Legacy

5 This question is about hydrocarbons.

5 (a) Most of the hydrocarbons in crude oil are alkanes.

5 (a) (i) Large alkane molecules can be cracked to produce more useful molecules.

The equation shows the cracking of dodecane.

$$\underset{\text{dodecane}}{C_{12}H_{26}} \longrightarrow \underset{\text{butane}}{C_4H_{10}} + \underset{\text{hexene}}{C_6H_{12}} + \underset{\text{ethene}}{C_2H_4}$$

Give **two** conditions used to crack large alkane molecules.

[2 marks]

1 _____

2 _____

5 (a) (ii) The products hexene and ethene are alkenes.

Complete the sentence.

[1 mark]

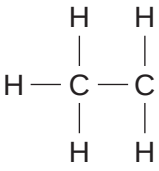
When alkenes react with bromine water the colour changes

from orange to _____ .

5 (a) (iii) Butane (C_4H_{10}) is an alkane.

Complete the displayed structure of butane.

[1 mark]



Question 5 continues on the next page

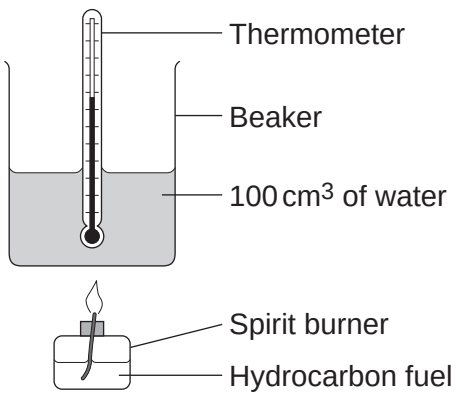
4.9.3.1 Atmospheric pollutants from fuels

Question 60 · continued

5 (b) A group of students investigated the energy released by the combustion of four hydrocarbon fuels.

Figure 12 shows the apparatus used.

Figure 12



Each hydrocarbon fuel was burned for two minutes.

Table 2 shows the students' results.

Table 2

	After two minutes				
Name and formula of hydrocarbon fuel	**Mass of fuel used in g**	**Temperature increase of water in °C**	**Energy released by fuel in kJ**	**Energy released by 1.0 g of fuel in kJ**	**Relative amount of smoke in the flame**
Hexane, C_6H_{14}	0.81	40	16.80	20.74	very little smoke
Octane, C_8H_{18}	1.10	54	22.68	20.62	some smoke
Decane, $C_{10}H_{22}$	1.20	58	24.36		smoky
Dodecane, $C_{12}H_{26}$	1.41	67	28.14	19.96	very smoky

4.9.3.1 Atmospheric pollutants from fuels

Question 60 · continued

5 (b) (i) Calculate the energy released by 1.0 g of decane in kJ.

[2 marks]

Energy released = _____ kJ

5 (b) (ii) Suggest **one** improvement to the apparatus, or the use of the apparatus, that would make the temperature increase of the water for each fuel more accurate.

Give a reason why this is an improvement.

[2 marks]

5 (b) (iii) The students noticed that the bottom of the beaker became covered in a black substance when burning these fuels.

Name this black substance.

Suggest why it is produced.

[2 marks]

5 (b) (iv) A student concluded that hexane is the best of the four fuels.

Give **two** reasons why the results in **Table 2** support this conclusion.

[2 marks]

1 _____

2 _____

Question 5 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 60 · continued

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

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

Table 3 shows information about petrol and hydrogen.

Table 3

	Petrol	**Hydrogen**
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen ⟶ carbon dioxide + water	hydrogen + oxygen ⟶ water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

[6 marks]

4.9.3.1 Atmospheric pollutants from fuels

Question 61

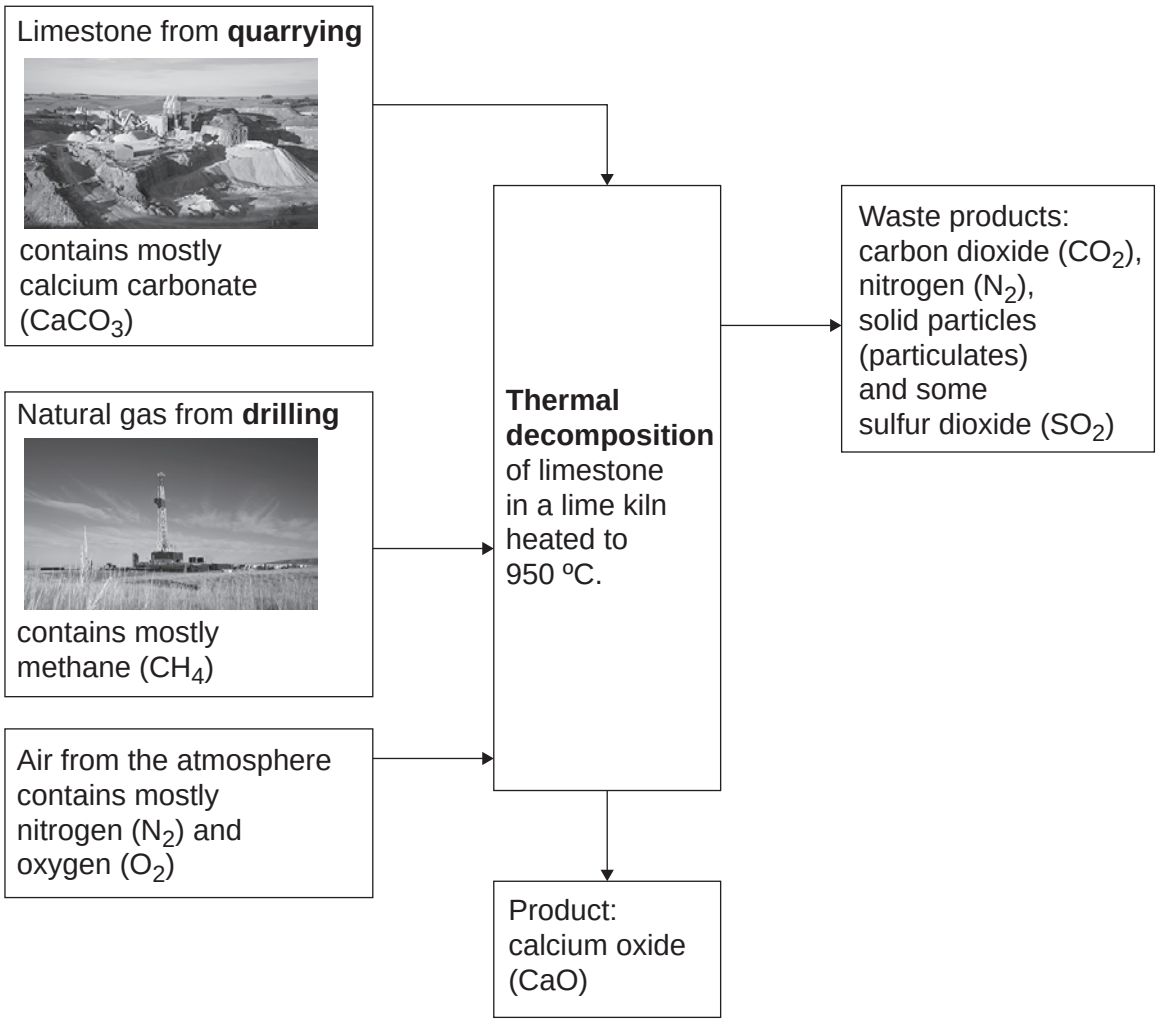
June 2017 | CH1FP | Original Q7 | Legacy

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

Limestone is heated in a lime kiln to produce calcium oxide.

Figure 9 shows the reactants used and the products made in a lime kiln.

Figure 9



Use information from **Figure 9** to explain the potential environmental impacts of quarrying, drilling and the thermal decomposition of limestone used in the production of calcium oxide.

[6 marks]

4.9.3.1 Atmospheric pollutants from fuels

Question 62

June 2018 | 8462/2F | Original Q2

0 2 This question is about fuels.

Octane (C_8H_{18}) is a hydrocarbon in petrol.

0 2 . 1 Cracking breaks down large hydrocarbon molecules into smaller hydrocarbon molecules.

Which hydrocarbon molecule can be cracked to produce octane, C_8H_{18} ?

[1 mark]

Tick **one** box.

- C_4H_8 ☐
- C_4H_{10} ☐
- C_8H_{16} ☐
- $C_{12}H_{26}$ ☐

0 2 . 2 What type of carbon compound is octane, C_8H_{18} ?

[1 mark]

Tick **one** box.

- Alcohol ☐
- Alkane ☐
- Carboxylic acid ☐
- Ester ☐

Question 2 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 62 · continued

0 2 . 3 Oxygen is needed to burn fuels.

Name the source of the oxygen needed to burn fuels.

[1 mark]

0 2 . 4 Particulates and sulfur dioxide are pollutants produced when some fuels burn.

Draw **one** line from each pollutant to the polluting effect.

[2 marks]

Pollutant	Polluting effect
	Acid rain
Particulates	Global dimming
	Global warming
Sulfur dioxide	Landfill
	Sewage sludge

4.9.3.1 Atmospheric pollutants from fuels

Question 62 · continued

0 2 . 5 Which **two** gases are produced when fuels burn in car engines?

[2 marks]

Tick **two** boxes.

- Ammonia ☐
- Carbon dioxide ☐
- Carbon monoxide ☐
- Nitrogen ☐
- Oxygen ☐

0 2 . 6 Vehicles produce most of the atmospheric pollution in cities.

How could the atmospheric pollution in cities be reduced?

[2 marks]

Tick **two** boxes.

- Build more roads in cities ☐
- Build new car factories ☐
- Develop fuel efficient engines ☐
- Make car tax cheaper ☐
- Use electric cars ☐

4.9.3.1 Atmospheric pollutants from fuels

Question 63

June 2019 | 8462/2F | Original Q2

0 2 Some central heating boilers use methane as a fuel.

Carbon monoxide detectors are placed near central heating boilers.

0 2 . 1 Which **three** properties of carbon monoxide make it necessary to use carbon monoxide detectors?

Choose answers from the box.

[3 marks]

acidic	**alkaline**	**colourless**	**corrosive**
insoluble	**odourless**	**toxic**	

1 _____

2 _____

3 _____

0 2 . 2 Complete the sentence.

[1 mark]

Methane produces carbon monoxide when burning in a limited supply of

_____.

0 2 . 3 8 g of methane has a volume of 12 dm^3 at room temperature and pressure.

Calculate the mass of 36 dm^3 of methane.

[2 marks]

_____

_____

_____

_____

Mass = _____ g

4.9.3.1 Atmospheric pollutants from fuels

Question 63 · continued

0 2 . 4 Most methane is obtained from natural gas, which is a fossil fuel.

Methane can also be produced renewably.

Which **two** are renewable sources of methane?

[2 marks]

Tick (✓) **two** boxes.

- Animal waste ☐
- Food in landfill ☐
- Nitrogen in the air ☐
- Non-biodegradable plastics ☐
- Scrap iron ☐

8

4.9.3.1 Atmospheric pollutants from fuels

Question 64

June 2019 | 8462/2F | Original Q3

0 3 Hydrogen is a raw material in the Haber process.

Hydrogen is produced from methane.

The word equation for the reaction is:

methane + steam ⇌ carbon monoxide + hydrogen

0 3 . 1 How can you tell that the reaction is reversible?

[1 mark]

0 3 . 2 The forward reaction is endothermic.

Name the type of energy change in the reverse reaction.

[1 mark]

0 3 . 3 A nickel catalyst is used in this reaction.

Why is a catalyst used in this reaction?

[2 marks]

Tick (✓) **two** boxes.

- To increase the temperature ☐
- To produce less carbon monoxide ☐
- To reduce costs ☐
- To use less energy ☐
- To use less methane ☐

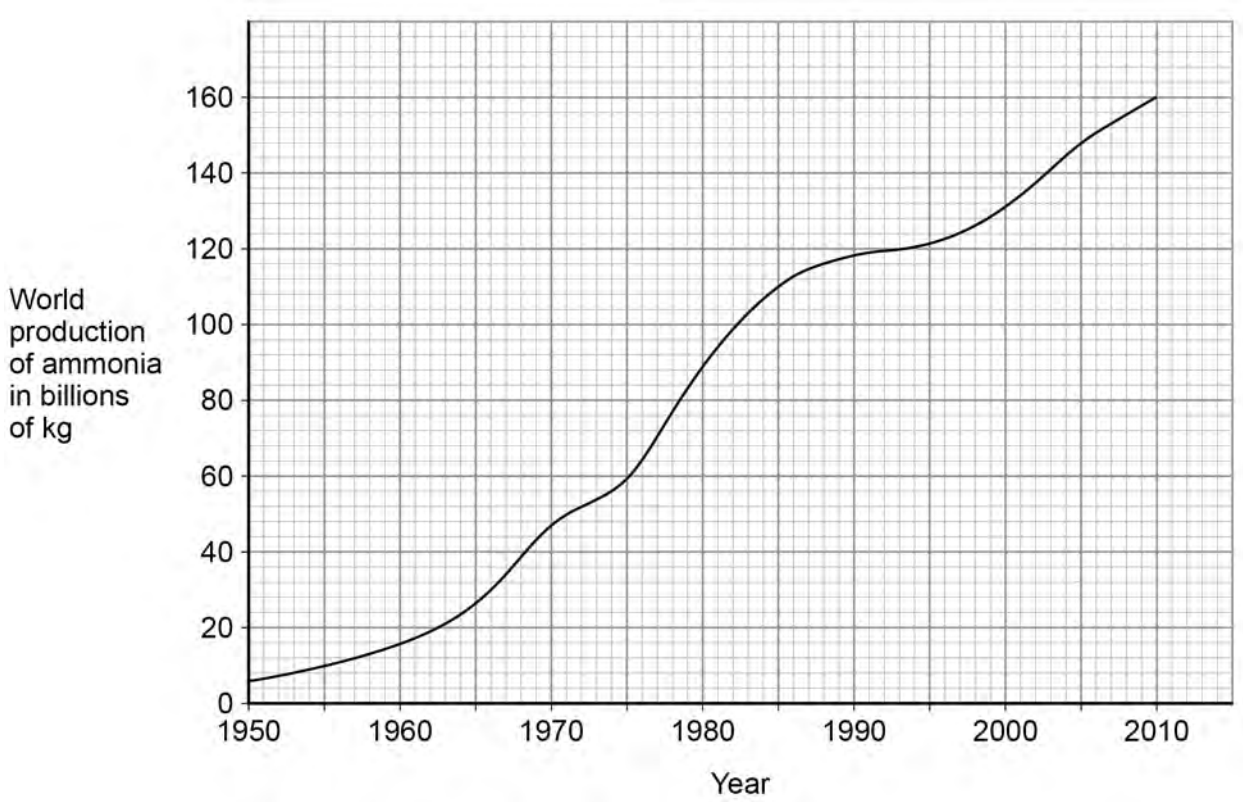
4.9.3.1 Atmospheric pollutants from fuels

Question 64 · continued

0 3 . 4 The Haber process also uses nitrogen to produce ammonia.

Figure 1 shows how the world production of ammonia changed between 1950 and 2010.

Figure 1



Describe how the world production of ammonia changed between 1950 and 2010.

[2 marks]

Question 64 · continued

Most of the ammonia produced is used to make fertilisers.

0 3 . 5 Why did the world production of ammonia change between 1950 and 2010?

[2 marks]

Tick (✓) **two** boxes.

- The demand for food changed. ☐
- The demand for fuels changed. ☐
- The nitrogen percentage in air changed. ☐
- The number of cars changed. ☐
- The world population changed. ☐

Table 1 shows data about four fertilisers, **A**, **B**, **C** and **D**.

Table 1

Fertiliser	Percentage by mass of nitrogen (%)	Percentage by mass of phosphorus (%)	Percentage by mass of potassium (%)
A	35.0	0.0	0.0
B	21.2	0.0	0.0
C	21.2	23.5	0.0
D	0.0	0.0	52.3

4.9.3.1 Atmospheric pollutants from fuels

Question 64 · continued

0 3 . 6 Which combination of fertilisers **A**, **B**, **C** and **D** provides **all** of the elements needed for an NPK fertiliser?

Use **Table 1**.

[1 mark]

Tick (✓) **one** box.

A and **C** ☐

A and **D** ☐

B and **C** ☐

C and **D** ☐

0 3 . 7 Which fertiliser is **not** made using ammonia?

Use **Table 1**.

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

10

4.9.3.1 Atmospheric pollutants from fuels

Question 65

November 2020 | 8462/2F | Original Q2

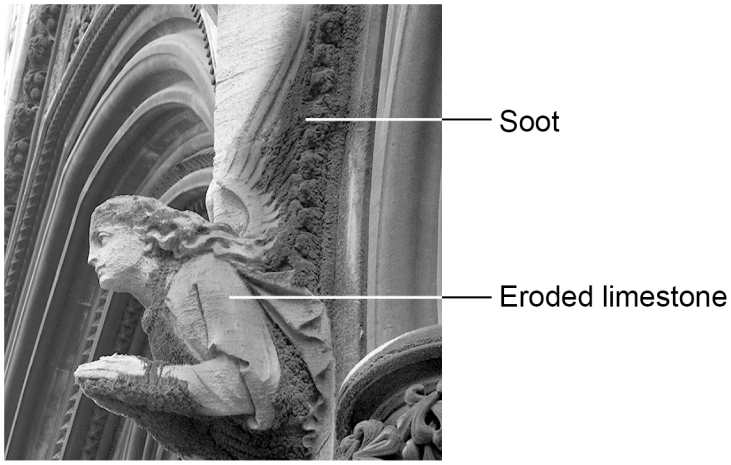
0 2 This question is about atmospheric pollution.

Figure 3 shows a limestone carving which has been damaged by atmospheric pollution.

The carving has been:

- blackened by soot
- eroded where the limestone has reacted with atmospheric pollutants.

Figure 3



0 2 . 1 What reacted with the limestone to cause the erosion?

[1 mark]

Tick (✓) **one** box.

- Acid rain ☐
- Ammonia ☐
- Carbon monoxide ☐
- Oxygen ☐

4.9.3.1 Atmospheric pollutants from fuels

Question 65 · continued

0 2 . 2 Soot is produced by the incomplete combustion of diesel oil.

Complete the sentences.

Choose answers from the box.

[2 marks]

ammonia	**carbon**	**methane**
nitrogen	**oxygen**	

Incomplete combustion happens when there is not enough _____.

Incomplete combustion produces particles of _____.

0 2 . 3 Complete the sentence.

[1 mark]

Particles of soot in the atmosphere cause global _____.

0 2 . 4 Carbon monoxide is produced by the incomplete combustion of methane.

Balance the equation for the reaction.

[1 mark]

$$2\,CH_4 + 3\,O_2 \rightarrow ____\ CO + 4\,H_2O$$

4.9.3.1 Atmospheric pollutants from fuels

Question 65 · continued

0 2 . 5 Car engines work at high temperatures.

Complete the sentences.

Choose answers from the box.

[3 marks]

air	**methane**	**oxides of nitrogen**
oxygen	**petrol**	**sulfur dioxide**

In car engines, nitrogen is present.

The nitrogen in car engines comes from _____.

At high temperatures, the nitrogen reacts with _____.

This reaction produces _____.

8

4.9.3.1 Atmospheric pollutants from fuels

Question 66

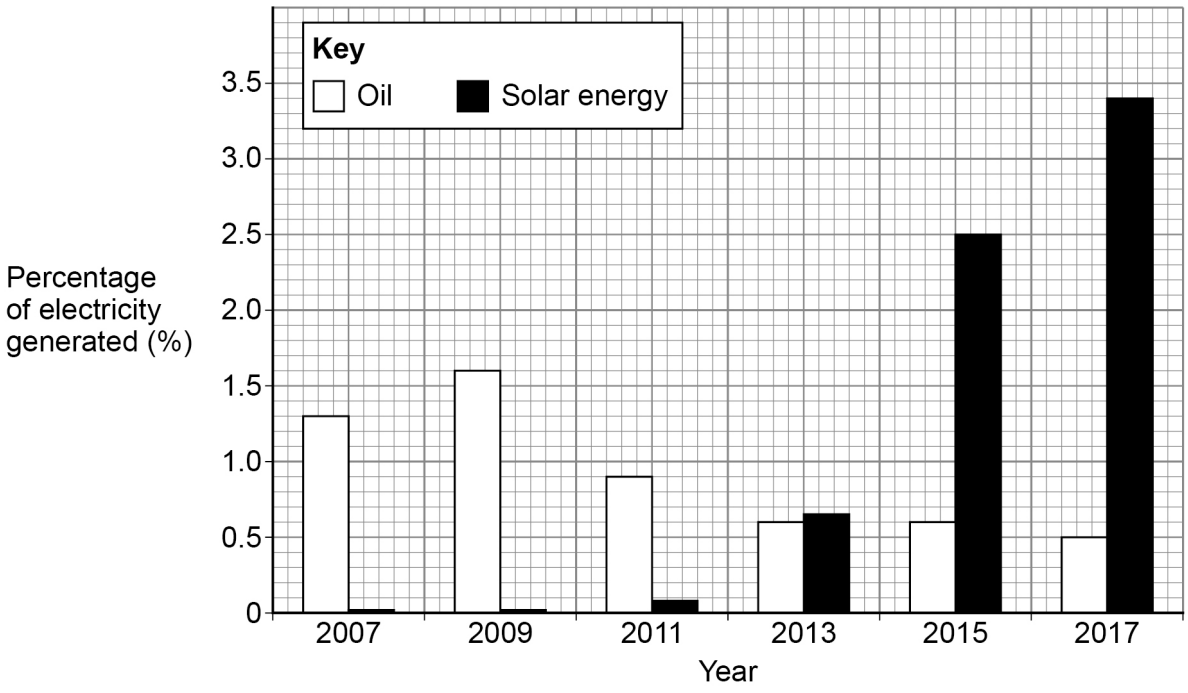
November 2021 | 8462/2F | Original Q8

0 8 This question is about fuels and energy.

Figure 6 shows the percentage of electricity generated in the UK between 2007 and 2017 using:

- oil
- solar energy.

Figure 6



0 8 . 1 Describe the changes in the percentage of electricity generated in the UK between 2007 and 2017 using:

- oil
- solar energy.

Use data from **Figure 6** in your answer.

[3 marks]

4.9.3.1 Atmospheric pollutants from fuels

Question 66 · continued

0 8 . 2 Oil contains carbon and some sulfur.

When oil is burned, the products of combustion may be released into the atmosphere.

Explain the environmental effects of releasing these products of combustion into the atmosphere.

[6 marks]

4.9.3.1 Atmospheric pollutants from fuels

Question 66 · continued

November 2021 | 8462/2F | Original Q8

0 8 . 3 Suggest **one** reason why using solar energy is a more sustainable way of generating electricity than burning oil.

[1 mark]

0 8 . 4 Solar energy may **not** be able to replace the generation of electricity from fossil fuels completely.

Suggest **two** reasons why.

[2 marks]

1

2

12

4.9.3.1 Atmospheric pollutants from fuels

Question 67

June 2023 | 8462/2F | Original Q6

0 6 This question is about fuels.

The energy produced by burning fuels is used to generate electricity in power stations.

Table 5 shows information about three fuels used to generate electricity.

Table 5

	Fuel		
	Coal	**Oil**	**Natural gas**
State of fuel at room temperature	solid	liquid	gas
Transportation of fuel to power station	train	pipeline	pipeline
Percentage by mass of sulfur in fuel (%)	5	1	0.001
Relative quantity of solid particles produced when fuel is burned	high	medium	low

0 6 . 1 Explain why coal is usually transported to power stations by train and **not** by pipeline.

Use **Table 5**.

[2 marks]

4.9.3.1 Atmospheric pollutants from fuels

Question 67 · continued

Sulfur dioxide and particulates are atmospheric pollutants produced when fuels are burned.

0 6 . 2 1 kg of each fuel in **Table 5** is burned.

Which fuel produces the **most** sulfur dioxide?

Give **one** reason for your choice.

[2 marks]

Fuel _____

Reason _____

_____

0 6 . 3 Give **one** problem caused by sulfur dioxide.

[1 mark]

_____

_____

0 6 . 4 Particulates are formed from solid particles.

1 kg of each fuel in **Table 5** is burned.

Which fuel produces the **least** particulates?

Give **one** reason for your choice.

[2 marks]

Fuel _____

Reason _____

_____

0 6 . 5 Give **one** problem caused by particulates.

[1 mark]

_____

_____

4.9.3.1 Atmospheric pollutants from fuels

Question 67 · continued

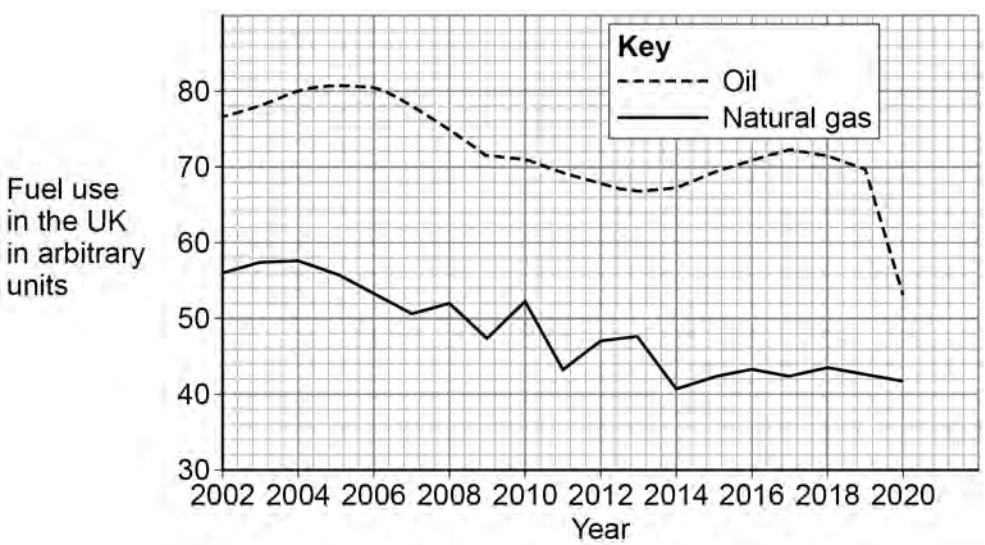
0 6 . 6 Complete the sentence.

[1 mark]

Solid particles are formed when fuels undergo incomplete _____.

0 6 . 7 **Figure 6** shows how the use of oil and of natural gas as fuels changed in the UK between 2002 and 2020.

Figure 6



Describe the trends shown in **Figure 6**.

[3 marks]

12

4.9.3.1 Atmospheric pollutants from fuels

Question 68

June 2024 | 8462/2F | Original Q1

0 1 This question is about hydrocarbons.

A hydrocarbon has the formula C_6H_{14}

0 1 . 1 Name the **two** elements in a hydrocarbon.

[2 marks]

1 _____

2 _____

0 1 . 2 How many atoms are there in one molecule of C_6H_{14}?

[1 mark]

Tick (✓) **one** box.

2 ☐

6 ☐

14 ☐

20 ☐

C_6H_{14} is a member of a homologous series.

0 1 . 3 What is the general formula for the homologous series that contains C_6H_{14}?

[1 mark]

Tick (✓) **one** box.

C_nH_{2n-2} ☐

C_nH_{2n} ☐

C_nH_{2n+2} ☐

4.9.3.1 Atmospheric pollutants from fuels

Question 68 · continued

0 1 . 4 Which homologous series has C_6H_{14} as a member?

[1 mark]

Tick (✓) **one** box.

Alcohols ☐

Alkanes ☐

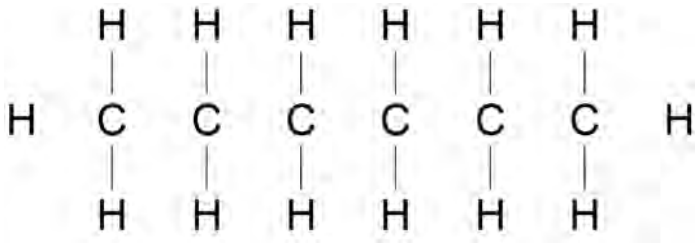
Alkenes ☐

Carboxylic acids ☐

0 1 . 5 Complete **Figure 1** to show the displayed structural formula of C_6H_{14}

[1 mark]

Figure 1



0 1 . 6 Petrol contains C_6H_{14}

Petrol is burned in car engines.

What general name is used to describe petrol when petrol is burned to release energy?

[1 mark]

_____

Question 1 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 68 · continued

0 1 . 7 Atmospheric pollutants are formed when C_6H_{14} undergoes incomplete combustion.

Complete the sentences.

Choose answers from the box.

[2 marks]

ammonia	**carbon monoxide**	**coal**
soot	**sulfur**	**sulfur dioxide**

The solid atmospheric pollutant formed during incomplete combustion of C_6H_{14} is

_____ .

The gaseous atmospheric pollutant formed during incomplete combustion of C_6H_{14} is

_____ .

0 1 . 8 A different organic compound ($C_{12}H_{26}$) can be broken down to produce C_6H_{14} and one other compound.

Complete the equation for the reaction.

[1 mark]

$$C_{12}H_{26} \rightarrow C_6H_{14} + C__ H__$$

4.9.3.1 Atmospheric pollutants from fuels

Question 68 · continued

0 1 . 9 The percentage by mass of each element in C_6H_{14} is:

- 84% C
- 16% H

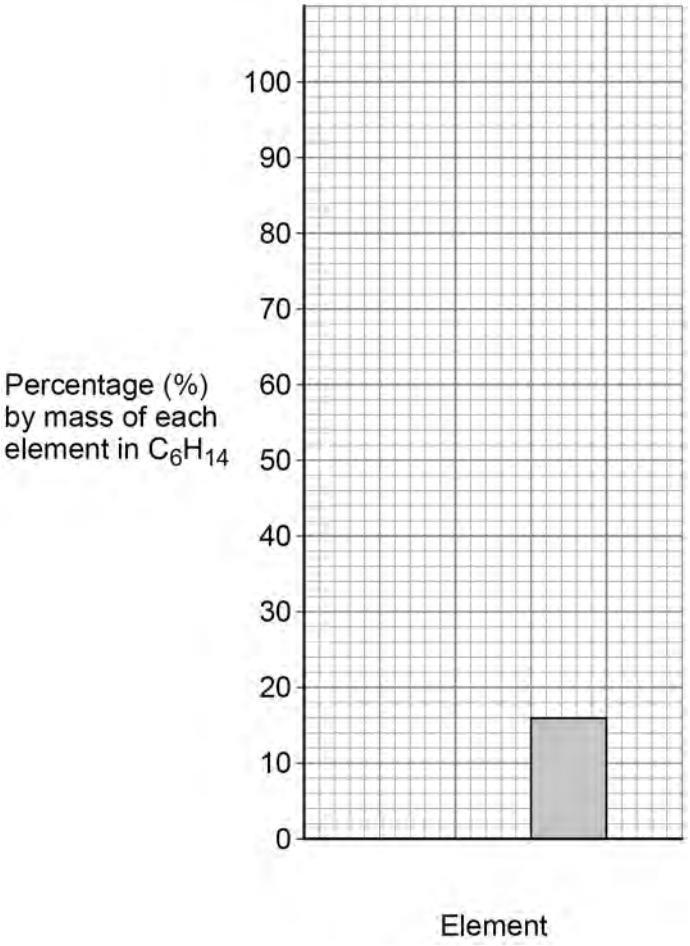
Complete **Figure 2**.

You should:

- label each element on the x-axis
- plot the percentage by mass of C in C_6H_{14}

[2 marks]

Figure 2



12

4.9.3.1 Atmospheric pollutants from fuels

Question 69

June 2024 | 8462/2F | Original Q2

0 2 This question is about burning coal.

A power station has four coal-burning furnaces.

Each furnace burns 3000 kg of coal per minute.

Table 1 shows some information about this coal burning power station

Table 1

Number of furnaces in use	Mass of coal burned per minute in kilograms	Mass of sulfur dioxide produced per minute in kilograms	Mass of carbon dioxide produced per minute in kilograms
0	0	0	0
1	3000	100	7000
2	6000	200	14 000
3	9000	300	21 000
4	12 000	400	28 000

0 2 . 1 Carbon dioxide is a greenhouse gas.

What is the effect on the rate of global climate change of using more furnaces in this power station?

Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	**stays the same**	**increases**

Use **Table 1**.

The rate of global climate change _____.

4.9.3.1 Atmospheric pollutants from fuels

Question 69 · continued

0 2 . 2 7000 kg of carbon dioxide are produced when 3000 kg of coal are burned.

Calculate the mass of carbon dioxide produced when 1 kilogram of coal is burned.

[2 marks]

Mass of carbon dioxide = _____ kg

0 2 . 3 Complete the sentence.

[1 mark]

Sulfur dioxide causes an environmental effect called acid _____ .

Question 2 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 69 · continued

Table 1 is repeated below.

Table 1

Number of furnaces in use	Mass of coal burned per minute in kilograms	Mass of sulfur dioxide produced per minute in kilograms	Mass of carbon dioxide produced per minute in kilograms
0	0	0	0
1	3000	100	7000
2	6000	200	14 000
3	9000	300	21 000
4	12 000	400	28 000

0 2 . 4 **Figure 3** shows how the mass of sulfur dioxide produced per minute varies with the mass of coal burned per minute.

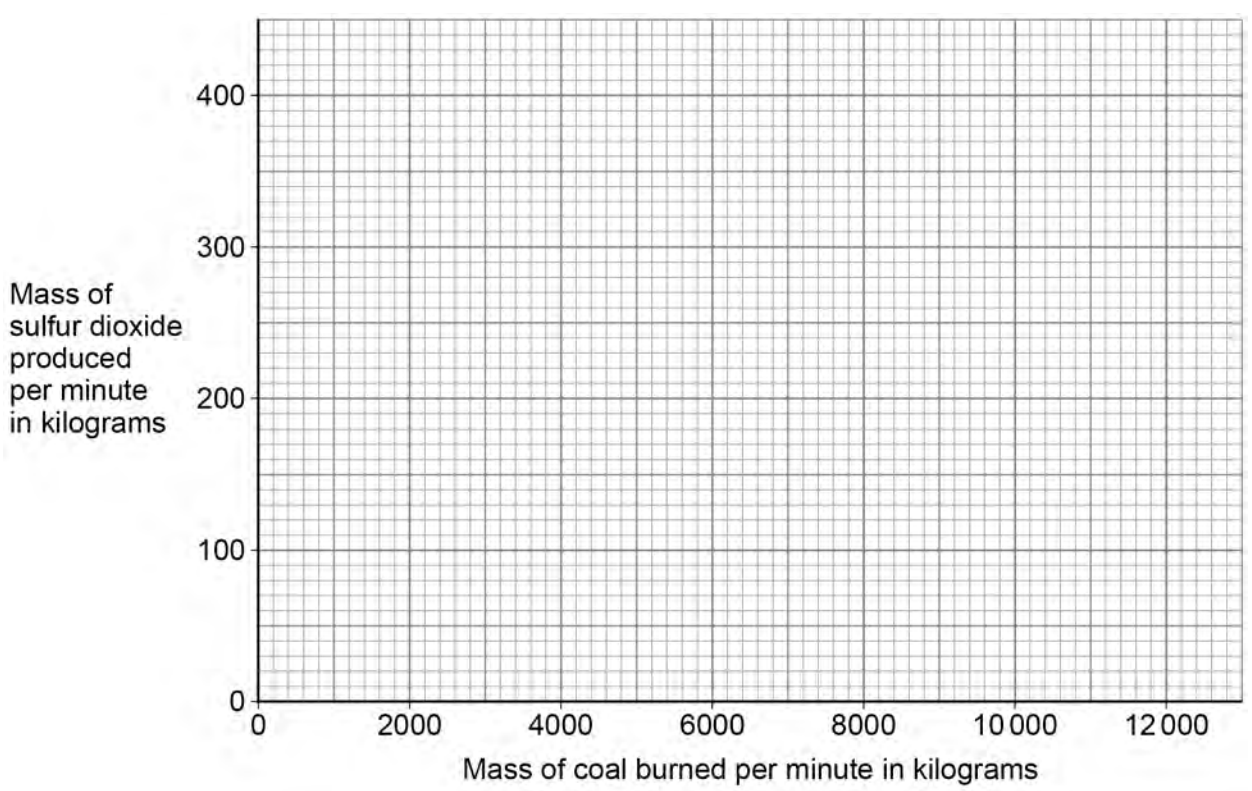
Complete **Figure 3**.

You should:

- plot data from **Table 1** on **Figure 3**
- draw a line of best fit.

[3 marks]

Figure 3



4.9.3.1 Atmospheric pollutants from fuels

Question 69 · continued

0 2 . 5 Complete the sentence.

Use **Table 1** and **Figure 3**.

[1 mark]

As the mass of coal burned per minute increases, the mass of sulfur dioxide produced per minute _____ .

0 2 . 6 This power station also releases particulates into the air.

Complete the sentence.

[1 mark]

The release of particulates into the air causes global _____ .

9

Turn over for the next question