AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.9.3 COMMON ATMOSPHERIC POLLUTANTS AND THEIR SOURCES (PACK 3)

SCORE	PERCENTAGE
/131	%

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Q1.

Figure 1 represents an atom of sulfur.

Figure 1

$^{32}_{16}S$

(a) Complete the table below.

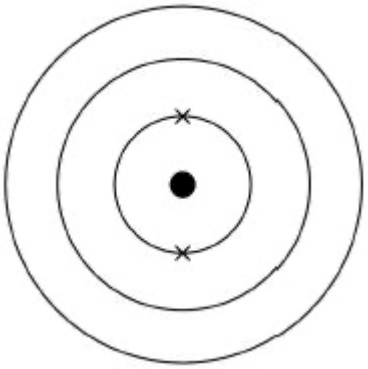
Particle	**Number of particles in a sulfur atom**
Electron	16
Neutron	
Proton	16

(1)

(b) Sulfur is in Group 6 of the periodic table.

Complete the electronic structure of the sulfur atom represented in **Figure 2**

Figure 2



(1)

(c) Sulfur reacts with oxygen to produce sulfur dioxide.

Complete the word equation for this reaction.

sulfur + _____

(1)

(d) What effect is caused by sulfur dioxide?

Tick **one** box.

Acid rain ☐

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Global dimming ☐

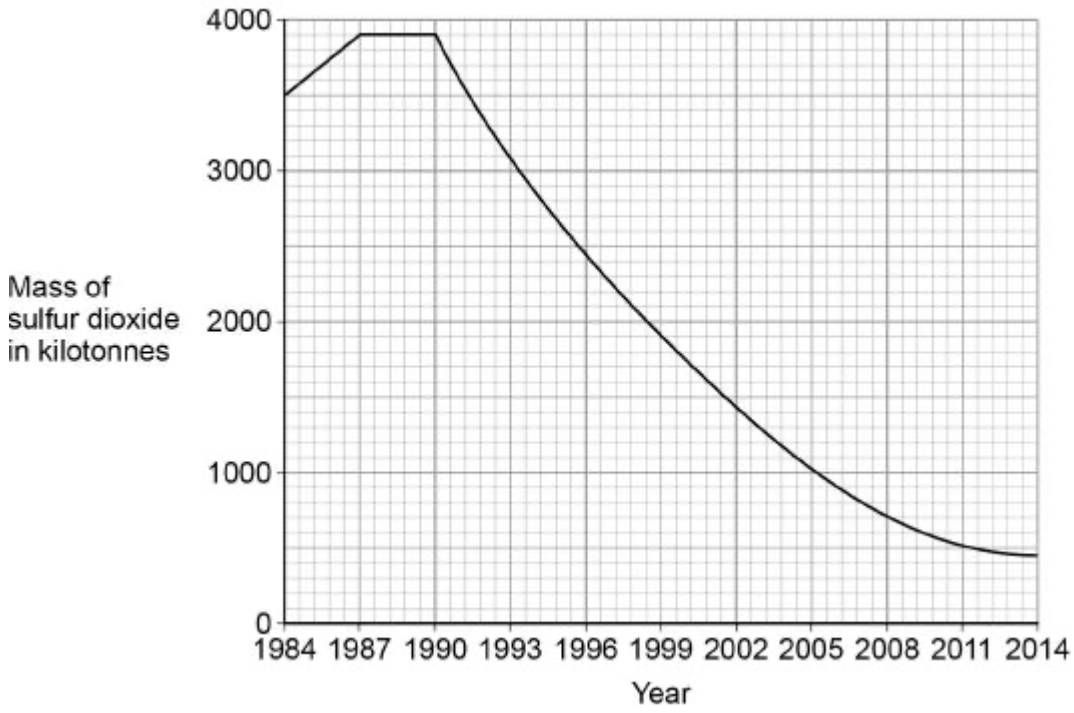
Global warming ☐

Sea levels rising ☐

(1)

(e) **Figure 3** shows the mass of sulfur dioxide in the Earth's atmosphere between 1984 and 2014

Figure 3



A student said:

'the mass of sulfur dioxide in the atmosphere decreased every year between 1984 and 2014'

Is the student correct?

Use data from **Figure 3** to justify your answer.

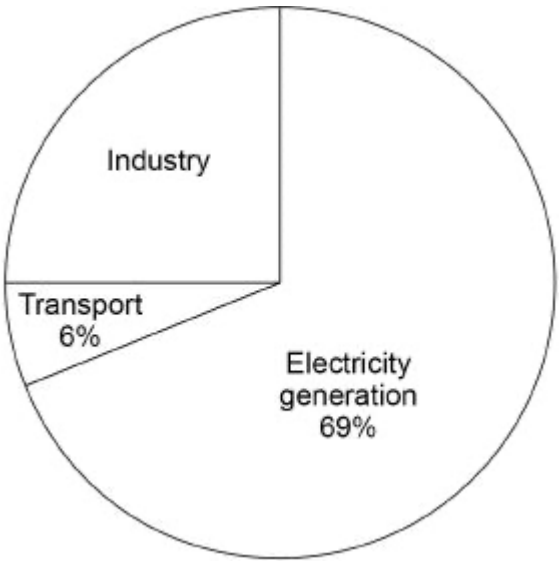
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_____

(3)

(f) **Figure 4** shows the percentage of sulfur dioxide released by human activities.

Figure 4



Calculate the percentage of sulfur dioxide released by industry.

_____

_____

_____

_____

Percentage = _____ %

(2)

(Total 9 marks)

Q2.

This question is about gases in the air.

The diagram below represents a molecule found in air.

O=C=O

(a) What is the formula of the molecule shown in the diagram above?

Tick **one** box.

Co2 ☐

2CO ☐

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CO_2 ☐

CO^2 ☐

(1)

(b) What is the name of the molecule shown in the diagram above?

You may use the periodic table to help you.

_____

(1)

(c) The percentage of oxygen in air is 21%.

The mass of air in a classroom was 220 kg

Calculate the mass of oxygen in the classroom.

_____

_____

Mass of oxygen = _____ kg

(1)

Carbon monoxide is an air pollutant.

(d) Describe how carbon monoxide is produced from fuels.

_____

_____

_____

_____

(2)

(e) Carbon monoxide can decrease the concentration of oxygen in the blood.

Which part of the blood would be most affected by carbon monoxide?

Tick **one** box.

Red blood cells ☐

Plasma ☐

Platelets ☐

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White blood cells ☐

(1)

(f) What **two** effects could a decreased concentration of oxygen in the blood have on body cells?

Tick **two** boxes.

Cell death ☐

Decreased respiration rate ☐

Faster cell division ☐

Faster cell growth ☐

More energy released ☐

(2)

(g) Some air pollutants cause acid rain.

Give **one** problem caused by acid rain.

_____

_____

(1)

(Total 9 marks)

Q3.

(a) Methane is burned in a plentiful supply of oxygen.

Which is the correct balanced chemical equation?

Tick **one** box.

$CH_4 + O_2 \rightarrow CO_2 + H_2O$ ☐

$CH_4 + 2O_2 \rightarrow CO_2 + H_2O$ ☐

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ ☐

$CH_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$ ☐

(1)

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(b) Burning fuels causes atmospheric pollution.

Write **one** effect for each pollutant in **Table 1**.

Table 1

Pollutant	Effect
Carbon monoxide	
Sulfur dioxide	
Particulates	

(3)

(c) Methane, petrol and coal are fuels.

Table 2 shows information about these fuels.

Table 2

Fuel	State	Energy content in kJ per g	Mass in mg of CO_2 produced for one kJ of energy released
Methane	Gas	52	53
Petrol	Liquid	43	71
Coal	Solid	24	93

Evaluate the use of the fuels.

Use in the information in **Table 2** and your knowledge.

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_____

(6)

(Total 10 marks)

Q4.

The table shows the percentage of some gases in the atmosphere on Earth and on Venus.

Gas	Percentage of gas in atmosphere	
	Earth	**Venus**
Nitrogen	78.08	3.50
Oxygen	20.95	0.00
Carbon dioxide	0.04	96.50

(a) Give **two** differences in the atmosphere on Earth compared with the atmosphere on Venus.

1. _____

_____

2. _____

_____

(2)

(b) Give a source of each of the gases below that are found in the Earth's atmosphere.

Carbon dioxide _____

_____

Oxygen _____

_____

(2)

(c) Water moves between the Earth and its atmosphere.

Describe how water enters and leaves the atmosphere.

How water enters the atmosphere _____

_____

How water leaves the atmosphere _____

_____

(2)

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(d) The percentage of carbon dioxide in the Earth's atmosphere is increasing.

What environmental problem is caused by the increased percentage of carbon dioxide in the atmosphere?

Tick **one** box.

Deforestation	☐
Destruction of peat bogs	☐
Global warming	☐
Pollution of streams	☐

(1)

(e) Suggest **two** negative impacts of climate change.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q5.

Rose black spot is a disease that affects rose plants.

The leaves of infected plants develop black spots, then turn yellow and drop off the plant.

(a) Give the name of the substance in leaves that is broken down when leaves change from green to yellow.

_____

(1)

(b) Rose black spot can be transferred between plants in water droplets.

Draw **one** line from each method of black spot prevention to the explanation of why that method works.

Method	Explanation
	Fungus spores are removed
Plant roses with large gaps between plants	
	Helps leaves dry faster

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Clear dead leaves	Increases infection in warm weather
	Prevents rain falling on the leaves

(2)

(c) Fungicides can be sprayed on rose plants to prevent infection with black spot.

Some fungicides appear to be less effective than they were 10 years ago.

Suggest why the fungicides are less effective now compared with 10 years ago.

_____

_____

(1)

Some gardeners claim that rose black spot has become more of a problem since the Clean Air Act of 1958.

The table shows how the mass of sulfur dioxide (SO2) emissions has changed.

Year	SO2 emissions from each source in megagrams			Total SO_2 emissions in megagrams
	Power stations	Manufacturing industry	Homes and transport	
1970	3300	1750	**X**	6200
1980	3250	900	550	4700
1990	2900	450	300	3650
2000	900	150	150	1200
2010	250	100	50	400

(d) The sulfur dioxide emissions in the table are shown in megagrams.

Calculate value **X** in the table.

_____

_____

X = _____ Mg

(1)

(e) Give your answer to part (d) in kilograms.

1 megagram = 1000 kilograms

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_____

_____

X = _____ Kg

(1)

(f) How have power stations reduced their sulfur dioxide emissions?

Tick **one** box.

Power stations used more at night than during the day	☐
Power stations generate more electricity	☐
Power stations use less coal	☐
Power stations use more oil	☐

(1)

A gardener concluded that the information in the table shows the Clean Air Act of 1958 changed sulfur dioxide emissions.

(g) Give **one** reason to support the conclusion.

_____

_____

(1)

(h) Give **one** reason why the conclusion may **not** be valid.

_____

_____

(1)

(i) Suggest how changing sulfur dioxide emissions increased the number of cases of rose black spot.

_____

_____

_____

_____

(2)

(Total 11 marks)

Q6.

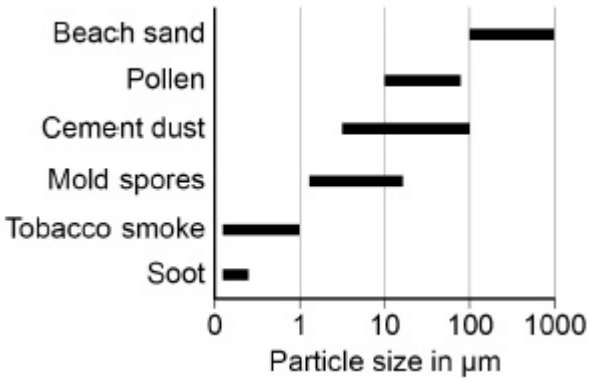
Human activity contributes to pollution.

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The concentration of particulate matter (PM) in the atmosphere is measured in different places across the world.

Figure 1 shows the diameter of some different particles.

Figure 1



(a) $PM_{2.5}$ are particles which are 2.5×10^{-6} m in diameter or smaller

What is the maximum diameter of $PM_{2.5}$ particles in millimetres?

Tick **one** box.

- 0.025 ☐
- 0.0025 ☐
- 0.000025 ☐
- 0.00000025 ☐

(1)

(b) Which **two** particles in **Figure 1** are included in the $PM_{2.5}$ measure of air pollution?

Tick **two** boxes.

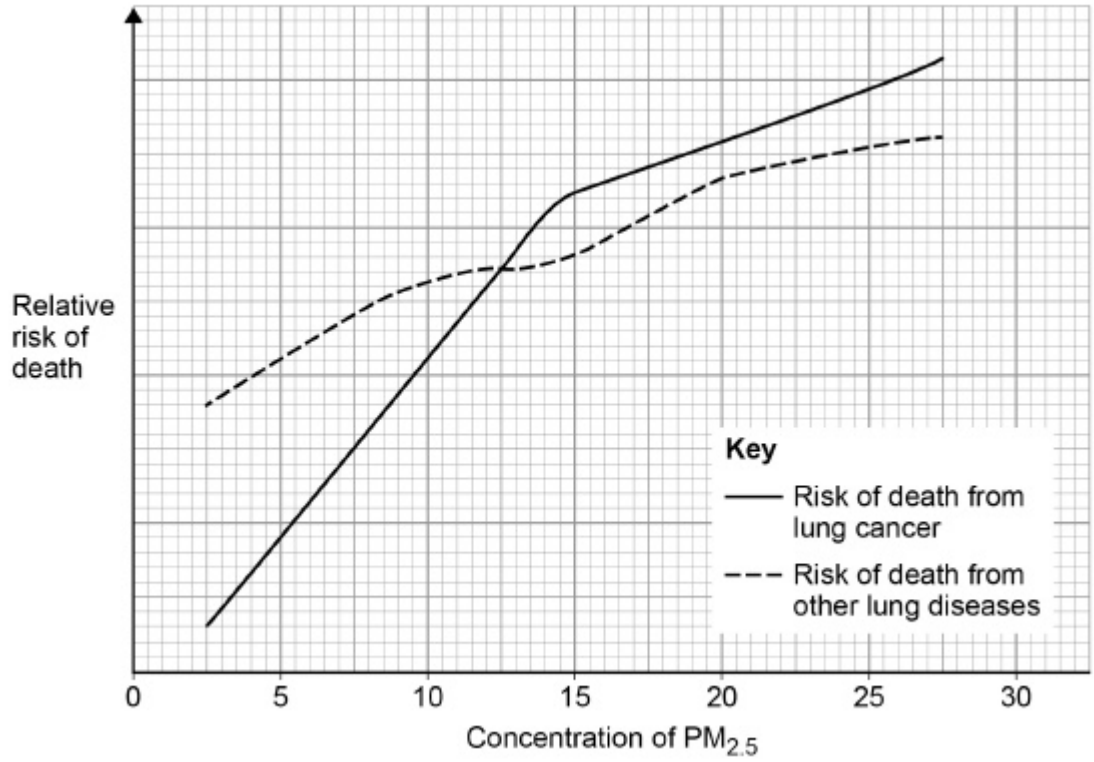
- Beach sand ☐
- Cement dust ☐
- Pollen ☐
- Soot ☐
- Tobacco smoke ☐

(2)

Figure 2 shows how the concentration of $PM_{2.5}$ affects death rates.

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Figure 2



(c) Compare the effect of $PM_{2.5}$ concentration on the death rate from lung cancer with the death rate from other lung diseases.

Use data from **Figure 2** in your answer.

(2)

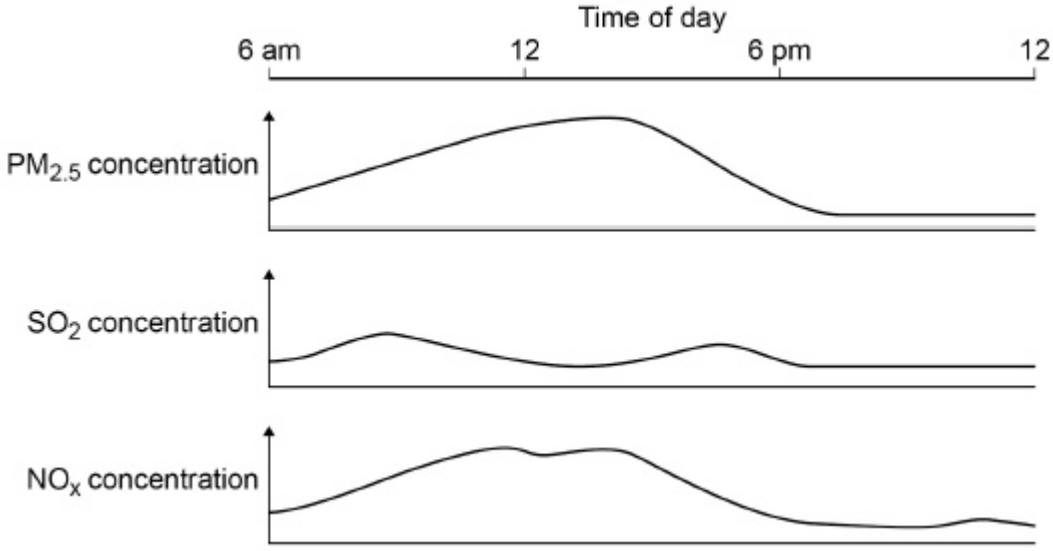
(d) Why do $PM_{2.5}$ particles cause these negative health effects?

(1)

(e) **Figure 3** shows air pollution information collected in one city in 18 hours.

Figure 3

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Suggest **two** possible reasons for the rise in $PM_{2.5}$ concentration from 6 am to 2 pm.

1. _____

_____

2. _____

_____

(2)

(f) Air Quality Index (AQI) is a measure of pollution in the atmosphere.

When the AQI value reaches 201 it is judged to be 'very unhealthy'.

Suggest **one** precaution people should take if AQI rises above 201

_____

_____

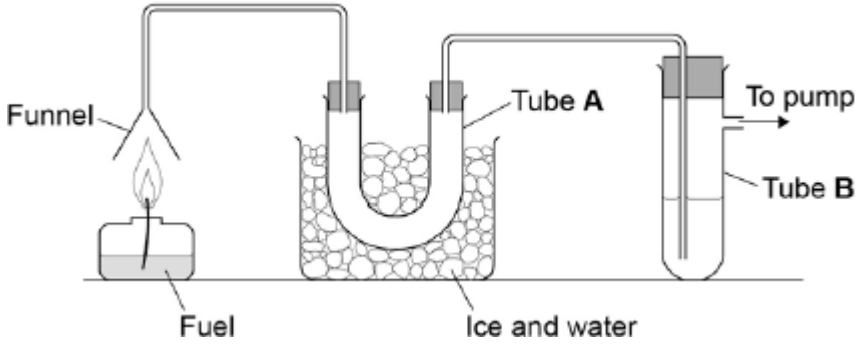
(1)

(Total 9 marks)

Q7.

A student investigated the substances produced when fuels burn.

The figure below shows the apparatus the student used.



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(a) The complete combustion of a hydrocarbon produces carbon dioxide and one other substance.

Look at the figure above. What would the student see in tube **A**?

_____

_____

(1)

(b) When the student burned the fuel she saw soot in the funnel.

Explain why soot forms.

_____

_____

_____

_____

(2)

(c) The student burned another fuel which contained impurities.

The substance in tube **B** is water containing universal indicator.

The indicator turned red.

Which gas made the indicator turn red?

Tick **one** box.

Ammonia	☐
Carbon monoxide	☐
Nitrogen	☐
Sulfur dioxide	☐

(1)

(Total 4 marks)

Q8.

Oxides of nitrogen are produced when fuels are burnt.

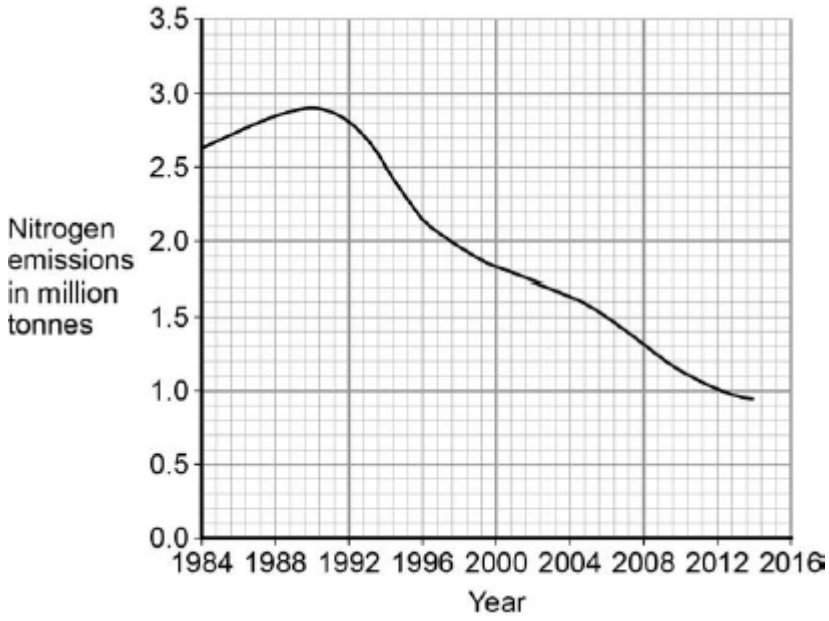
(a) Write a balanced symbol equation for the production of nitrogen dioxide (NO_2) from nitrogen and oxygen.

_____

(2)

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(b) The figure below gives information about emissions of oxides of nitrogen in the UK.



Calculate the percentage decrease in emissions of oxides of nitrogen from 1990 to 2014.

Give your answer to three significant figures.

_____

_____

_____

_____

Percentage decrease = _____ %

(3)

(c) Give **one** advantage of reducing the emissions of oxides of nitrogen.

_____

_____

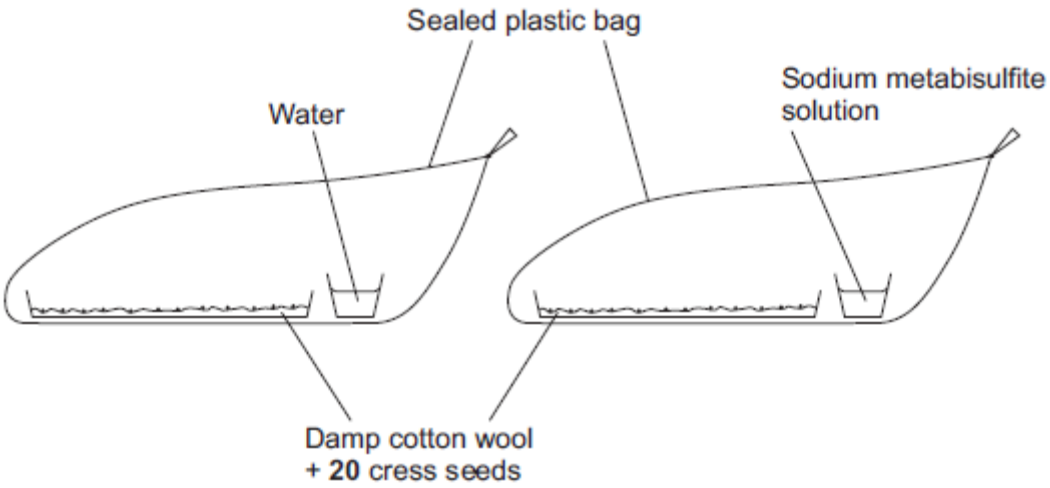
(1)

(Total 6 marks)

Q45.

(a) The diagram shows an investigation to find out if sulfur dioxide gas affects the growth of cress seeds.

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Sodium metabisulfite solution gives off sulfur dioxide gas.

Both bags were left in a warm laboratory for several days. The number of seeds that grew in each bag was counted.

What was the dependent variable in this investigation?

_____

_____

(1)

(b) The investigation was carried out five times.

The table below shows the five sets of results.

	Number of seeds that grew					**Mean**
Bag containing water	15	17	15	16	17	16
Bag containing sodium metabisulfite solution	5	9	8	5	8	7

(i) The mean percentage of seeds that grew in the bag containing water was 80%.

Calculate the mean percentage of seeds that grew in the bag containing sodium metabisulfite solution.

_____

_____

_____%

(1)

(ii) Give **one** conclusion you can make from these results.

_____

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(1)

(Total 3 marks)

Q46.

The figure below shows a power station.

Fossil fuels are burnt at some power stations.



© Uli Hamacher/iStock

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

Fossil fuels release energy by

combustion. **decomposition.** **distillation.**

(1)

(b) Burning fuels can also release substances which cause an environmental effect.

Draw **one** line from each substance to an environmental effect caused by the substance.

Substance	**Environmental effect**
	Acid rain
Carbon dioxide	
	Bioleaching
Oxides of nitrogen	
	Global dimming
Solid particles	
	Global warming

(3)

(Total 4 marks)

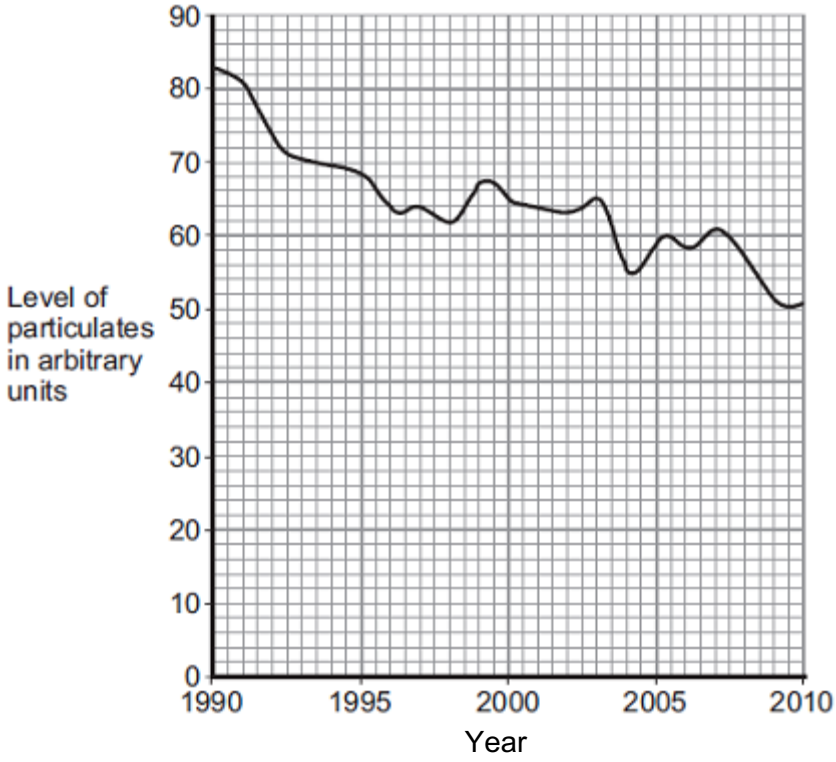
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Q47.

This question is about air pollutants.

Figure 1 shows the level of particulates in the air from 1990 to 2010.

Figure 1



(i) Particulates are produced by burning fossil fuels.

What are particulates?

_____

(1)

(ii) Name an environmental effect caused by particulates.

_____

(1)

(iii) Suggest **two** reasons why it is difficult to predict what particulate levels will be in the future.

_____

_____

_____

_____

(2)

(Total 4 marks)

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Q48.

Exhaust fumes from petrol engines pollute the air.



Photograph supplied by iStockphoto/Thinkstock

(a) Which **two** substances are produced when petrol is burned in a plentiful supply of air?

Tick (✓) **two** boxes.

Carbon dioxide ☐

Hydrocarbons ☐

Oxygen ☐

Water ☐

(2)

(b) Some petrol contains sulfur.

Use words from the box to complete each sentence.

acid rain	**dimming**	**nitrogen oxide**	**sulfur dioxide**
particles	**fuel**	**warming**	**carbon dioxide**

When sulfur is burned, the gas formed is _____ .

This gas dissolves in water to form _____ .

Solid _____ in car exhaust fumes cause

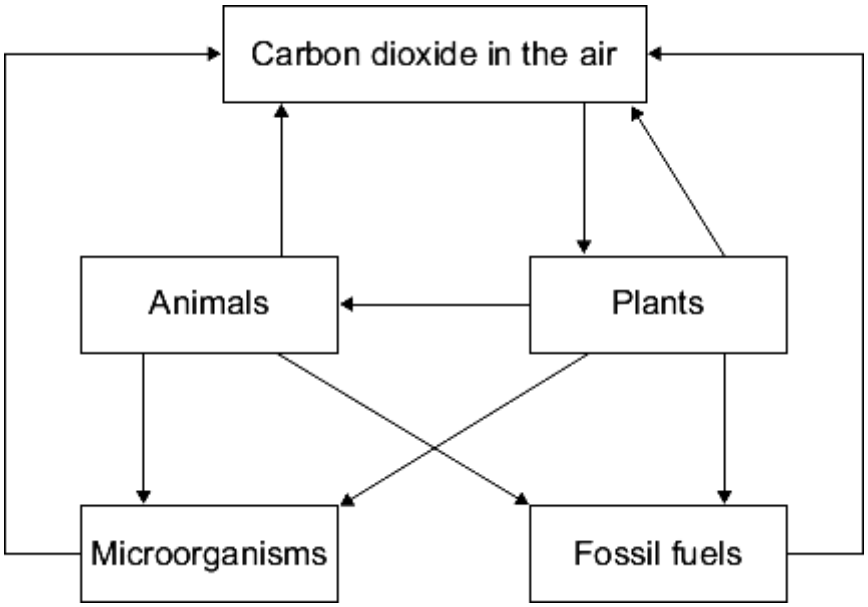
global _____ .

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(4)
(Total 6 marks)

Q49.

The diagram shows part of the carbon cycle.



Use the information in the diagram and your own knowledge to describe in detail how carbon is cycled between living organisms and the air.

Your answer should include the names of any processes involved.

(Total 6 marks)

Q50.

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A burning torch is carried by a runner.

The fuel in the torch is a mixture of propane and butane.

Propane and butane are alkanes.

Alkanes have the general formula C_nH_{2n+2}



(a) Propane has 3 carbon atoms.

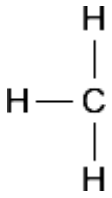
What is the formula of propane?

_____

(1)

(b) Butane has the formula C_4H_{10}

Complete the displayed (structural) formula for one molecule of butane.



(1)

(c) Complete the word equation for the complete combustion of butane.

butane + oxygen → _____ + _____

(1)

(d) In earlier designs of the torch, propene (C_3H_6) was used as the fuel.

Smoke is produced when propene is burned.

Explain why smoke is produced.

_____

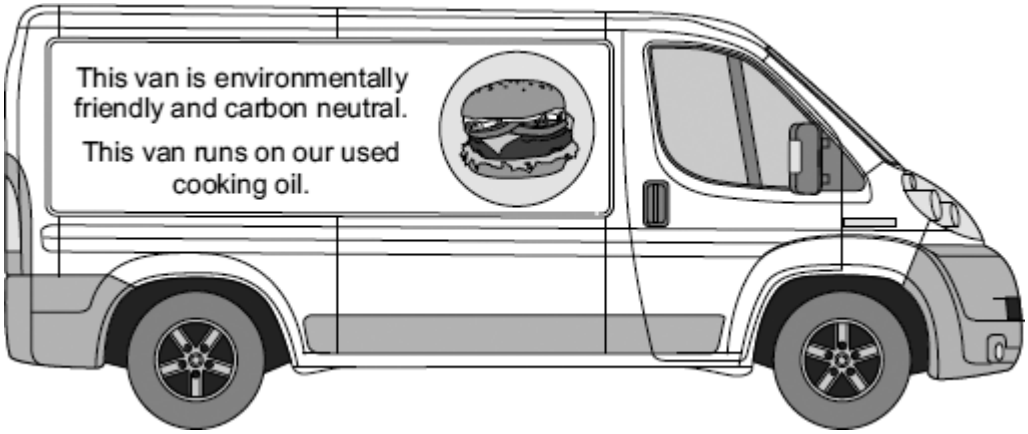
_____

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(2)
(Total 5 marks)

Q51.

A burger van has a sign on the side.



The company that owns the van makes biodiesel from cooking oil.

A scientist investigated the emissions from biodiesel and petroleum diesel.

The scientist burned the same mass of each fuel in a diesel engine.

The scientist compared the emissions produced.

The results are shown in the table.

	Biodiesel	**Petroleum diesel**
Carbon dioxide emitted in g	3000	3000
Unburnt hydrocarbons emitted in g	7	10
Soot emitted in g	6	12
Nitrogen oxides emitted in g	5	2

Use your scientific knowledge and the data in the table to evaluate the advantages and disadvantages of using biodiesel rather than petroleum diesel as a fuel.

Remember to include a supported conclusion in your answer.

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(Total 5 marks)

Q52.

Active volcanoes give off gases.



Koryaksky volcano, Russia.
Photo by Jack Lockwood of the USGS, public domain via wikimedia commons

The table shows the percentages of gases a volcano gives off.

Name of gas	Percentage (%) of gas
Carbon dioxide	49
Water vapour	37
Sulfur dioxide	12
Carbon monoxide	2

(a) Scientists use this data to predict what the Earth's early atmosphere was like and how the oceans were formed.

Use information from the table to help you answer the following questions.

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(i) Describe how a gas released from volcanoes caused the oceans to be formed.

_____

_____

_____

_____

(2)

(ii) Gases from volcanoes formed the Earth's early atmosphere.

Which was the main gas in the Earth's atmosphere billions of years ago?

_____

(1)

(iii) Which **two** other gases were also present in the Earth's early atmosphere?

Tick (✓) **two** boxes.

Gas	**Tick (✓)**
Ammonia	
Chlorine	
Fluorine	
Methane	

(2)

(b) What are the **two** main gases in the Earth's atmosphere today?

Tick (✓) **two** boxes.

Gas	**Tick (✓)**
Chlorine	
Hydrogen	
Nitrogen	
Oxygen	

(2)

(c) (i) Draw a ring around the correct answer in the box to complete the sentence.

The amount of carbon dioxide in the atmosphere is increasing.

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The main process causing this is

combustion.
condensation.
photosynthesis.

(1)

(ii) How is carbon from carbon dioxide locked up in sedimentary rocks?

Tick (✓) **two** boxes.

	Tick (✓)
In calcium carbonate	
In the mantle	
In fossil fuels	
In the Earth's core	

(2)
(Total 10 marks)

Q53.

A cement works changes the fuel it uses.

Local residents are concerned because more children are suffering asthma attacks.

Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

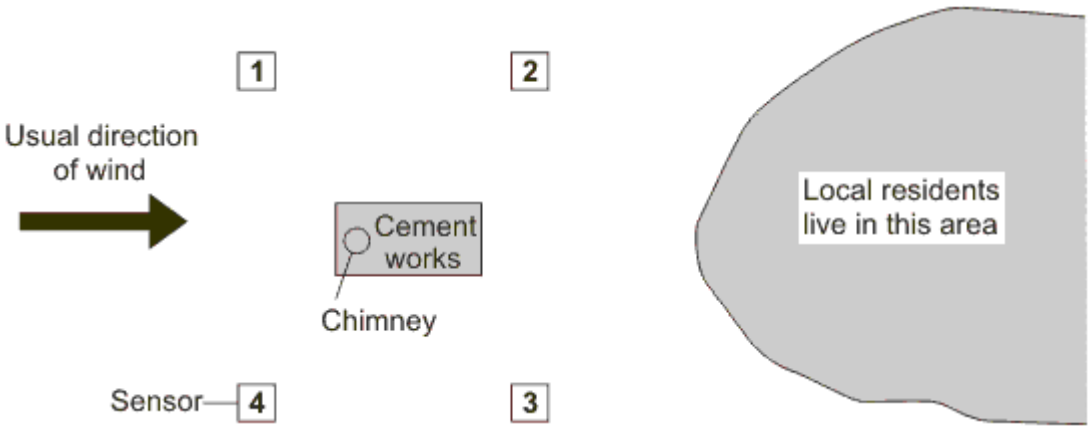
The table shows the possible medical risk from smoke particles.

Particle size in mm	**Medical effect**
Larger than 0.4	No medical risks known
0.3 and smaller	Causes asthma attacks
0.2 and smaller	May cause cancer

It is also recommended that to avoid damage to health, the concentration of any particles should be no higher than 2 parts per million (ppm).

Scientists were brought in to monitor the emissions from the cement work's chimney. They positioned four sensors around the cement works to monitor airborne smoke particles.

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These four sensors only detect particle sizes larger than 0.5 mm and measure the concentration of particles in ppm. The scientists reported that the particle sensors showed that the average concentration of particles was 1.8 ppm. The scientists concluded that there was no risk to health.

(a) Suggest why the local residents objected to the positions of the four sensors.

(2)

(b) What evidence did the scientists use to conclude that there was no risk to health?

(1)

(c) The local residents were still concerned that there was a risk to health, even though the average concentration of particles was 1.8 ppm.

Suggest why they may still be concerned.

(3)

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(Total 6 marks)

Q54.

Crude oil is a mixture of alkanes from which useful fuel fractions can be obtained.

Fraction	A hydrocarbon in this fraction	Boiling point of alkane in °C
petroleum gases	Propane	–42
petrol (gasoline)	Octane	+126
paraffin (kerosene)	Dodecane	+216
diesel	Eicosane	+344

(a) (i) Suggest the lowest temperature to which crude oil needs to be heated to vaporise all of these fuel fractions.

Temperature _____ °C

(1)

(ii) Dodecane boils at +216 °C. At what temperature will dodecane gas condense to liquid?

Temperature _____ °C

(1)

(iii) Describe what happens in a fractionating column that allows these fractions to be collected.

_____

_____

_____

_____

_____

_____

(3)

(b) Propane is a fuel because it burns in air releasing heat energy.

(i) Complete the balancing of the two chemical equations for propane burning in air.

$2C_3H_8$ + _____ O_2 → _____ CO_2 + _____ H_2O

$2C_3H_8$ + _____ O_2 → _____ CO + _____ H_2O

(2)

(ii) The products of the two chemical reactions in (b)(i) are different.

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Explain why.

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Q55.

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

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:

- could be reused
- could be recycled by melting and making them into new plastic products
- could be burned to release energy.

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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_____

_____

(Total 6 marks)

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