AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.9.2 CARBON DIOXIDE AND METHANE AS GREENHOUSE GASES (PACK 2)

SCORE	PERCENTAGE
/144	%

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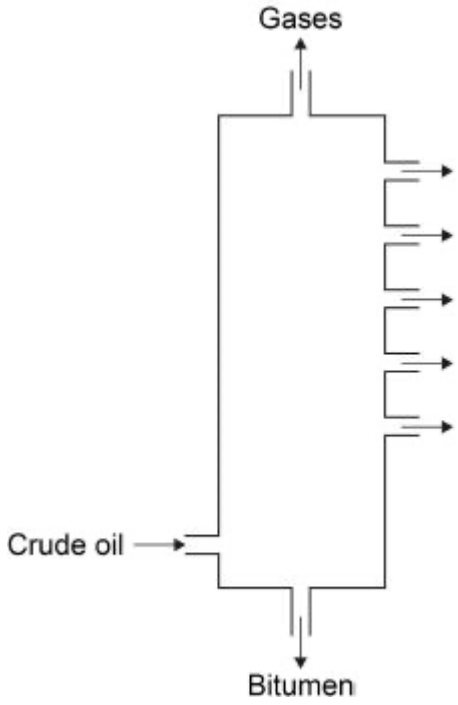
Q1.

Crude oil is a mixture of hydrocarbons.

(a) The hydrocarbons in crude oil are separated into fractions by fractional distillation.

Figure 1 shows a fractional distillation column.

Figure 1



Crude oil vapour passes up the column.

Complete the sentence.

Choose the answer from the box.

condenses	**dissolves**	**freezes**	**melts**

Each fraction _____ at a different level.

(1)

(b) Why do the fractions separate?

Tick **one** box.

The fractions have different boiling points. ☐

The fractions have different flammability. ☐

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The fractions have different melting points. ☐

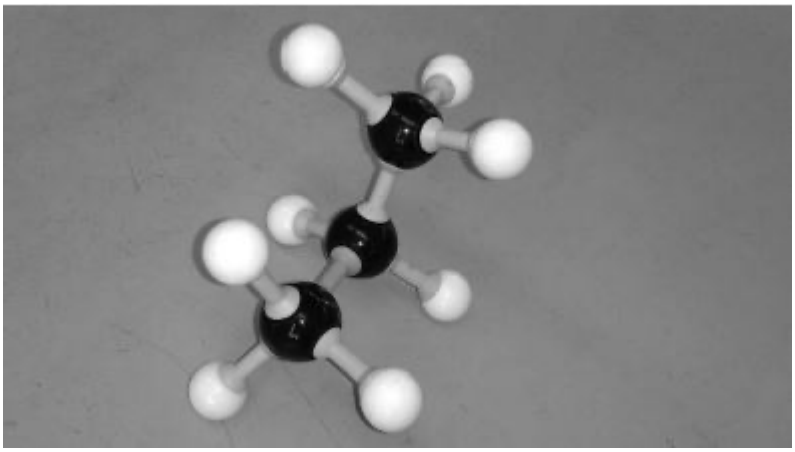
The fractions have different viscosity. ☐

(1)

Most of the hydrocarbons in crude oil are alkanes.

(c) **Figure 2** represents an alkane molecule.

Figure 2



Name the alkane.

_____

(1)

(d) Methane (CH_4) is an alkane.

What is the general formula for alkanes?

Tick **one** box.

C_nH_n ☐

C_nH_{2n} ☐

C_nH_{2n-2} ☐

C_nH_{2n+2} ☐

(1)

(e) Alkanes burn in oxygen.

Balance the equation for methane burning.

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_____ CH_4 + _____ O_2 → _____ CO_2 + _____ H_2O

(1)

(f) Ethene is an alkene.

Which reagent is used to test for alkenes?

Tick **one** box.

Anhydrous copper sulfate ☐

Bromine water ☐

Damp litmus paper ☐

Limewater ☐

(1)

The table below shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

	Burning and using the energy to generate electricity	**Landfill**
Mass of carbon dioxide produced in kg	25	15
Mass of solid residue in kg	0.050	0.070
Mass of sulfur dioxide produced in kg	0.20	0.30

(g) Why are life cycle assessments (LCA) done?

_____

_____

(1)

(h) Compare the **two** methods for the disposal of biodegradable plastic bags.

Use information from the table above.

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____

(4)

(Total 11 marks)

Q2.

This question is about the Earth's atmosphere.

(a) Carbon dioxide is a greenhouse gas.

What is another greenhouse gas?

Tick **one** box.

Argon ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

(1)

(b) Greenhouse gases cause global climate change.

Give **two** effects of global climate change.

1. _____

_____

2. _____

_____

(2)

(c) 4.1 kg of a plastic, used to make plastic bottles, has a carbon footprint of 6.0 kg of carbon dioxide.

Calculate the carbon footprint of **one** plastic bottle of mass 23.5 g

_____

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Carbon footprint = _____ kg of carbon dioxide

(2)

(d) Give **one** way that carbon dioxide emissions can be reduced when a plastic bottle is manufactured.

(1)

(e) Explain how the percentages of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere today have changed from the Earth's early atmosphere.

(6)

(Total 12 marks)

Q3.

There is limited evidence about the Earth's early atmosphere because of the age of the Earth.

(a) The Earth is 4.6 billion years old.

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Which is the correct age of the Earth?

Tick **one** box.

4.6×10^3 years ☐

4.6×10^6 years ☐

4.6×10^9 years ☐

4.6×10^{12} years ☐

(1)

Scientists think that the Earth's early atmosphere may have been similar to the atmosphere on Mars today.

Look at the table below.

Gas	**Concentration of gas in the atmosphere today in parts per million**	
	Mars	**Earth**
Nitrogen	27 000	780 000
Oxygen	1 300	210 000
Argon	16 000	9 300
Carbon dioxide	950 000	400
Carbon monoxide	800	trace

(b) Calculate the percentage increase in nitrogen from the Earth's early atmosphere to the atmosphere today.

Assume the Earth's early atmosphere was the same as the atmosphere today on Mars.

Give your answer to 2 significant figures.

_____

_____

_____

_____

Percentage increase in nitrogen = _____ %

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(3)

(c) Which process releases carbon monoxide into the Earth's atmosphere?

Tick **one** box.

Aerobic respiration ☐

Bacterial decomposition ☐

Incomplete combustion ☐

Photosynthesis ☐

(1)

(d) Explain how the oceans were formed in the first billion years of the Earth's existence.

_____

_____

_____

_____

(2)

(e) Describe how the increase in greenhouse gases has increased the mass of liquid water in the oceans.

_____

_____

(1)

(Total 8 marks)

Q4.

The table shows the gases in the Earth's atmosphere today.

Gas	**Percentage (%)**
N_2	78.0
O_2	21.0
Ar	0.9
Other gases	**X**

(a) What is the percentage of **X**?

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Tick **one** box.

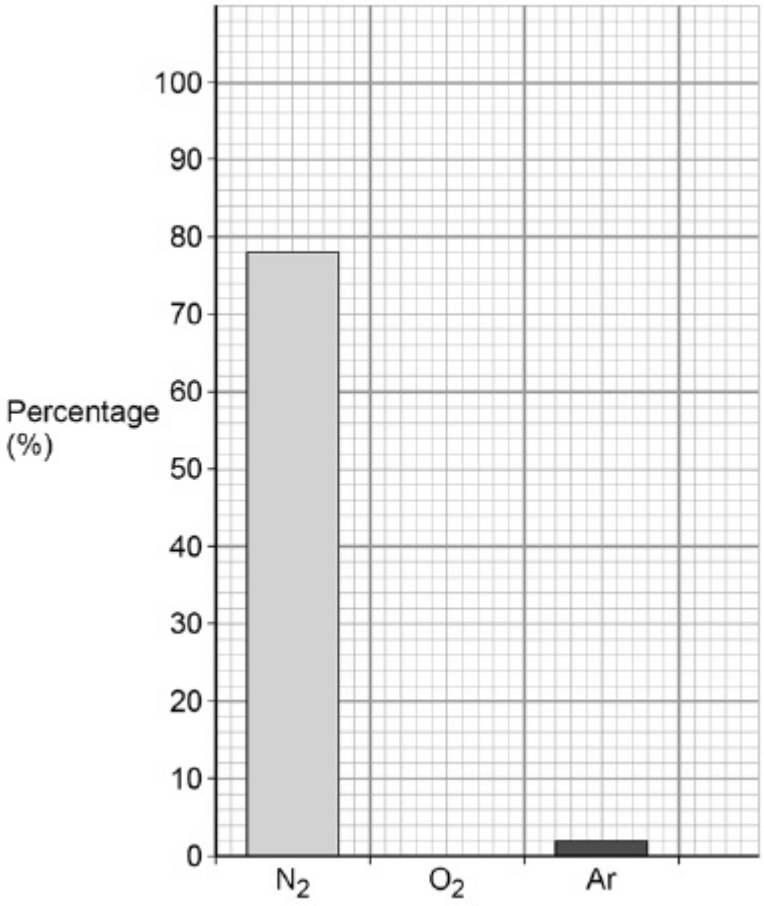
0.01% ☐ 0.1% ☐ 1% ☐ 10% ☐

(1)

(b) Complete **Figure 1**.

Plot the data from the table on **Figure 1**.

Figure 1



(1)

(c) What is the name of the gas with symbol Ar?

Tick **one** box.

Aluminium ☐

Argon ☐

Arsenic ☐

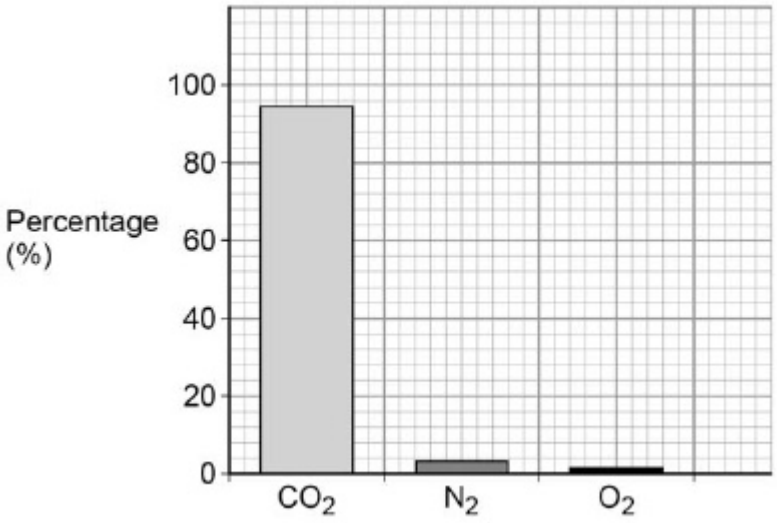
Astatine ☐

(1)

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(d) **Figure 2** shows the gases in the atmosphere of Mars today.

Figure 2



Some theories suggest that the Earth's early atmosphere was the same as the atmosphere of Mars today.

Describe the change in the percentage of oxygen from the Earth's early atmosphere to the Earth's atmosphere today.

Use values from the table and **Figure 2**.

_____

_____

_____

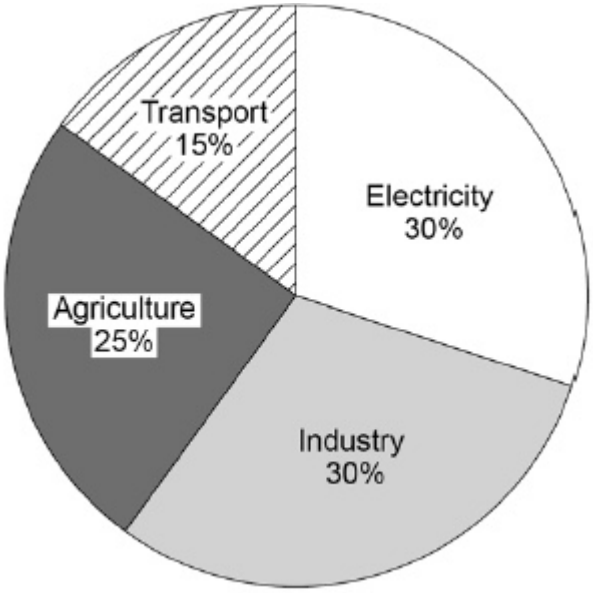
_____

(2)

(e) **Figure 3** shows the percentage of greenhouse gases from human activities.

Figure 3

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Compare the contribution of each activity to the total amount of greenhouse gases.

Use data from **Figure 3**.

(4)

(f) Suggest **one** way greenhouse gas emissions could be reduced.

(1)

(g) Give **one** reason why it is difficult for some countries to reduce emissions of greenhouse gases.

(1)

(Total 11 marks)

Q5.

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(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)

(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)

Q6.

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 _____

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_____

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)

(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)

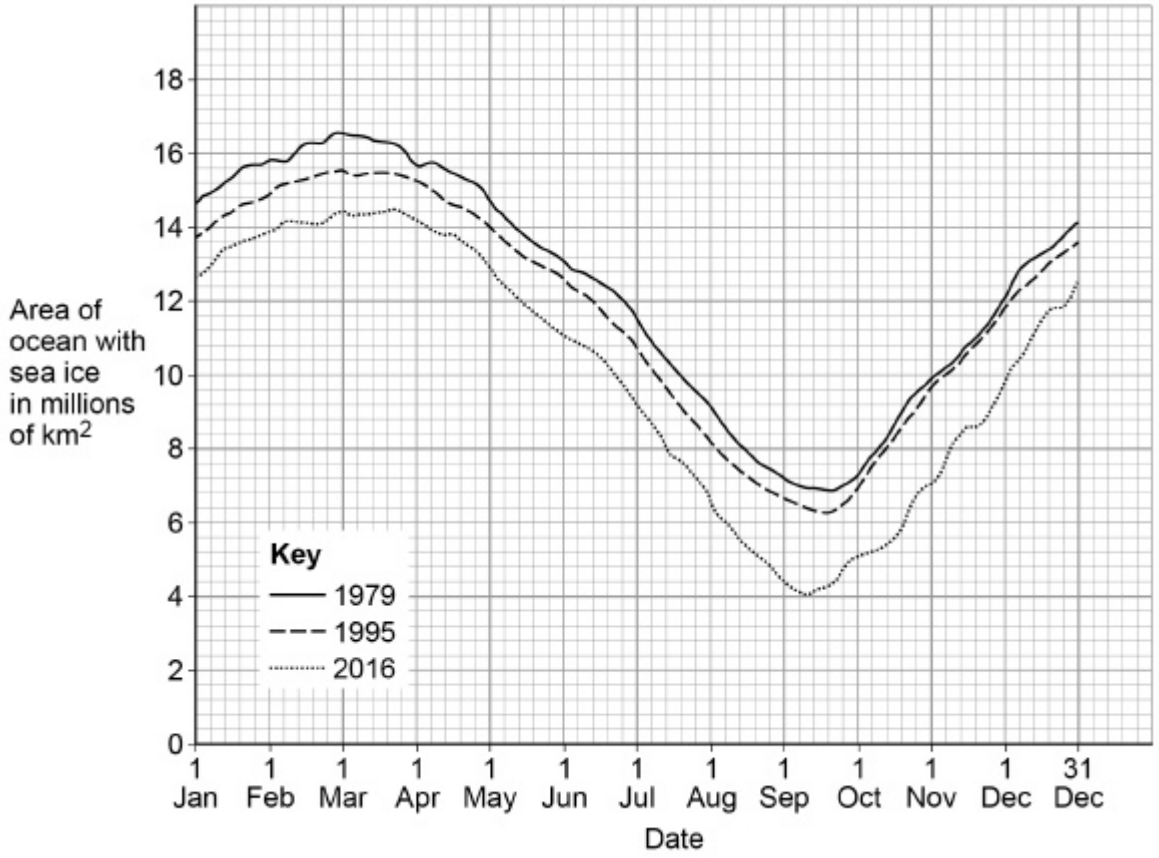
(Total 9 marks)

Q7.

Human activities can affect our ecosystem.

The graph shows information about how the area of ocean with sea ice in the arctic has changed between 1979 and 2016.

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(a) Give **two** conclusions you can make from the data shown in the graph.

1. _____

_____

2. _____

_____

(2)

(b) The area of ocean with sea ice in the arctic has changed.

Most scientists believe this is due to the activities of humans.

Explain the activities of humans that have led to the changes in sea ice from 1979 to 2016.

_____

_____

_____

_____

_____

_____

_____

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_____

_____

_____

_____

_____

(6)

(Total 8 marks)

Q8.

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

(a) The amount of carbon dioxide in the Earth's atmosphere decreased during the first billion years of the Earth's existence.

Complete the sentences. Use words from the box.

carbonates	**dissolved**	**evaporated**	**melted**	**nitrates**	**sulfates**

The amount of carbon dioxide in the Earth's atmosphere decreased because

the carbon dioxide_____ in the oceans.

Sediments were formed when _____ were produced.

Algae and plants use carbon dioxide and water to produce oxygen.

(2)

(b) What is the name of this process?

Tick **one** box.

Carbon capture ☐

Combustion ☐

Photosynthesis ☐

Polymerisation ☐

(1)

(c) Complete the word equation for this process.

carbon dioxide + _____ → glucose + _____

(1)

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(d) Draw **one** line from each gas to the approximate percentage of the gas in the Earth's atmosphere today.

Gas	Approximate percentage of gas in the Earth's atmosphere today
Carbon dioxide	<1
Nitrogen	5
Oxygen	10
	20
	50
	80
	>90

(3)

(e) Carbon dioxide is a greenhouse gas.

Why does increasing the amount of carbon dioxide change the global climate?

_____

(1)

(f) How can countries reduce carbon dioxide emissions?

Tick **one** box.

- only burn methane ☐
- use renewable energy supplies ☐
- use waste plastic bags as fuel ☐

(1)

(g) Give **one** reason why it is difficult for countries to reduce emissions of carbon

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dioxide.

_____

_____

(1)

(Total 10 marks)

Q9.

There is less carbon dioxide in the Earth's atmosphere now than there was in the Earth's early atmosphere.

(a) The amount of carbon dioxide in the Earth's early atmosphere decreased because it was used by plants and algae for photosynthesis, dissolved in the oceans and formed fossil fuels.

Give **one** other way that the amount of carbon dioxide in the Earth's early atmosphere decreased.

_____

_____

(1)

(b) Carbon dioxide is a greenhouse gas.

Describe the greenhouse effect.

_____

_____

_____

_____

_____

_____

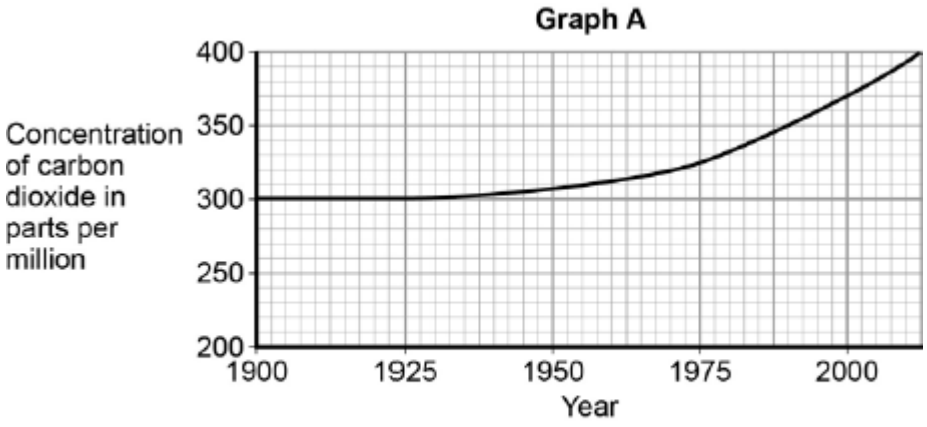
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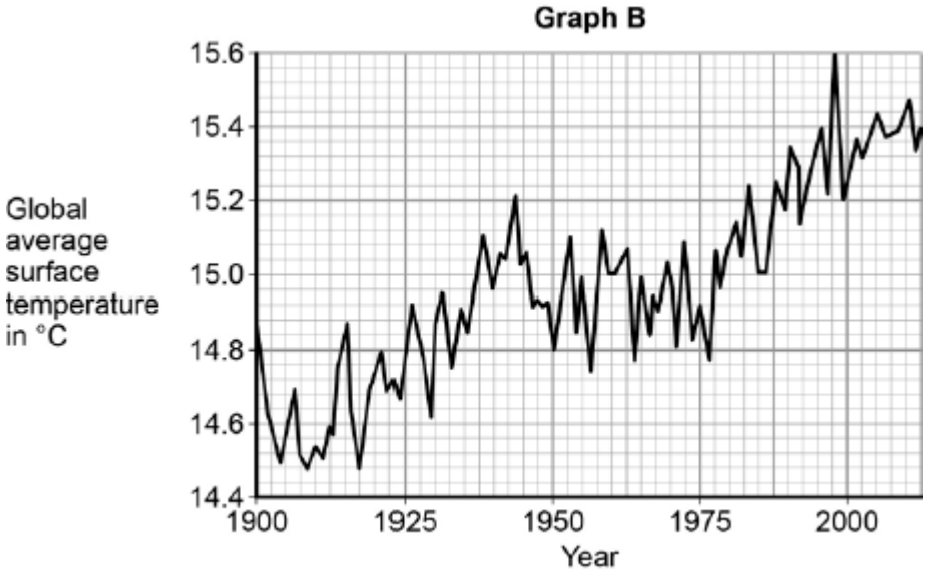
(4)

(c) The graphs in **Figure 1** show the concentration of carbon dioxide in the atmosphere and global average surface temperature since 1900.

Figure 1

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Calculate the percentage increase in the concentration of carbon dioxide from 1975 to 2000.

_____ %

(1)

(d) What was the global average surface temperature in 1980?

Global average surface temperature = _____ °C

(1)

(e) A student stated: 'The graphs show that increasing the concentration of carbon dioxide in the atmosphere causes global temperature increases.'

Discuss why this statement is only partially true.

_____

_____

_____

_____

_____

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_____

_____

_____

(4)

(Total 11 marks)

Q10.

In the last 200 years the concentration of carbon dioxide in the Earth's atmosphere has risen.

Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 6 marks)

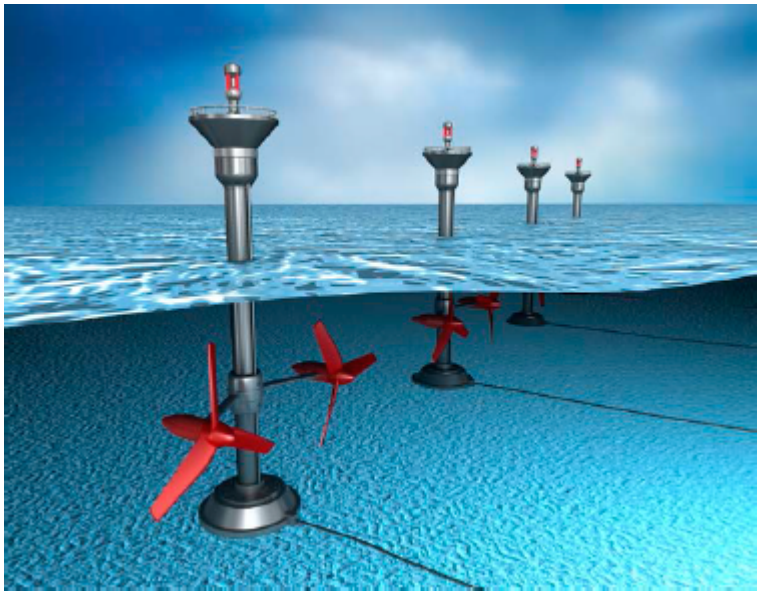
Q11.

Electricity in the UK is generated in many ways.

The figure below shows an undersea turbine.

The undersea turbine uses tidal energy to generate electricity.

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(a) What is the original source of energy for tidal power schemes?

_____

_____

(1)

(b) Explain **two** advantages of using undersea tidal turbines to generate electricity rather than burning fossil fuels.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(c) Some power stations burn wood instead of fossil fuels to generate electricity.

A coal-burning power station burns 6 million tonnes of coal per year.

Coal has an average energy value of 29.25 MJ per kg.

Wood chip from willow trees has an energy value of 13 MJ per kg.

A hectare of agricultural land can produce 9 tonnes of dry willow wood per year.

If this power station burned dry willow wood instead of coal, how much agricultural

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land would be needed to grow the willow?

Amount of land needed = _____ hectares

(3)

(d) The table below shows the carbon dioxide emissions of four fuels used to generate electricity.

Fuel	Direct CO_2 emissions in kg per MWh	Lifecycle CO_2 emissions in kg per MWh
Coal	460	540
Natural gas	185	215
Oil	264	313
Wood	2 100	58

Direct CO_2 emissions are the amounts of carbon dioxide released when the fuel is burned.

Lifecycle CO_2 emissions is the total amount of carbon dioxide released during all stages from fuel extraction to when the fuel has been used.

Use the data from the table above to explain why wood is considered to be a low carbon dioxide emitting fuel.

(2)

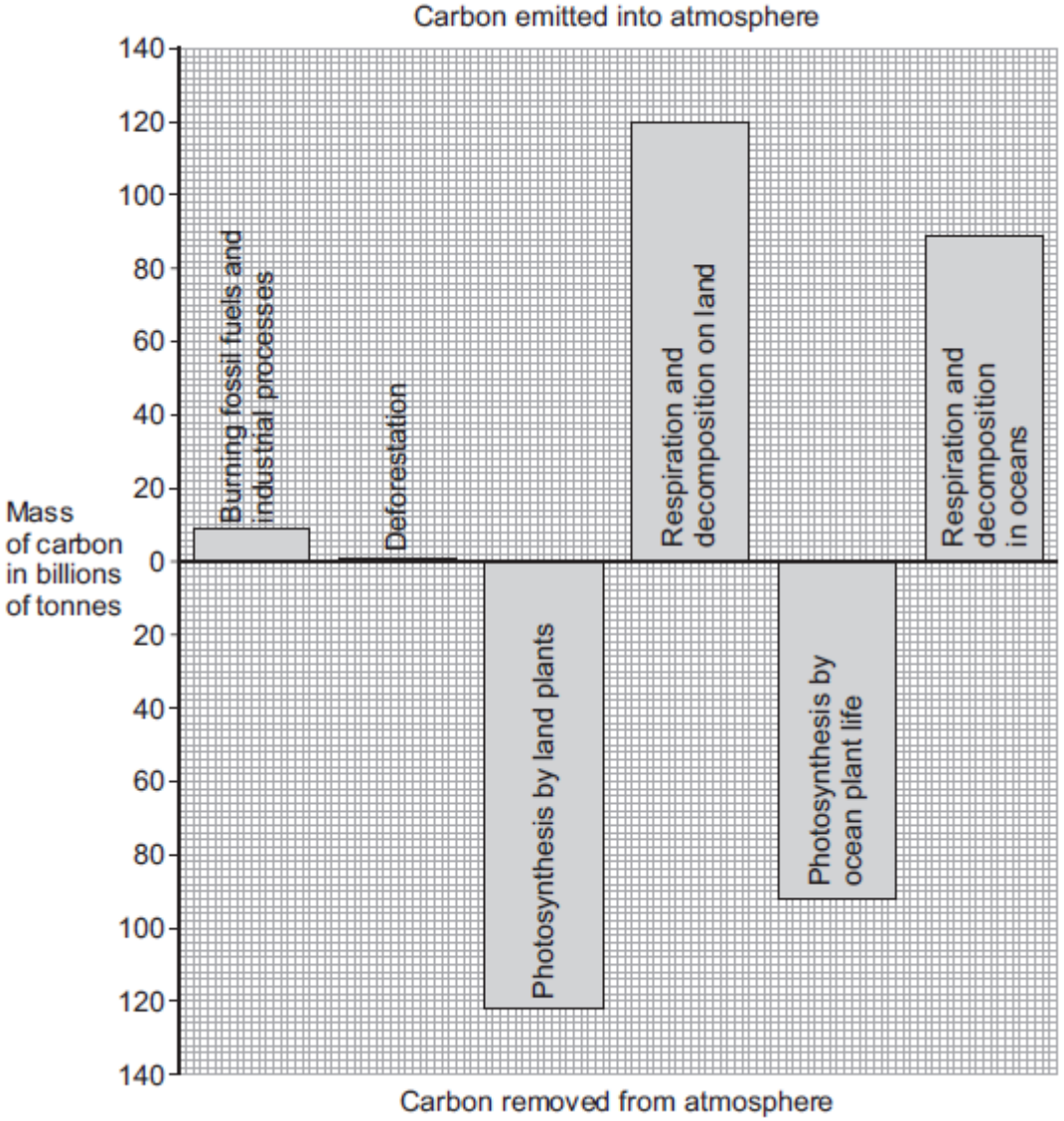
(Total 10 marks)

Q43.

The amount of carbon in the atmosphere is increasing.

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The graph shows the mass of carbon in billions of tonnes involved in some processes in the carbon cycle each year.



(a) (i) Use information from the graph to calculate the total mass of carbon removed from the atmosphere each year.

_____

_____

_____ billions of tonnes

(2)

(ii) The mass of carbon in the atmosphere is increasing by 5 billion tonnes each year.

One tonne of carbon is equivalent to 3.67 tonnes of carbon dioxide.

Calculate the increase in the mass of carbon dioxide in the atmosphere each year.

_____

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_____

_____ billion tonnes

(1)

(b) (i) Many scientists think the burning of fuels is the main cause of the increasing amount of carbon dioxide in the atmosphere. Other scientists disagree.

Use information from the graph to suggest why some scientists do **not** think that burning fuels is the main cause of the increase in carbon dioxide in the atmosphere.

_____

_____

_____

(1)

(ii) Some scientists think we should eat less meat and eat more food from plants.

Suggest how eating less meat and eating more food from plants could reduce the amount of carbon dioxide in the atmosphere.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q44.

The figure below shows a power station.

Fossil fuels are burnt at some power stations.



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

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

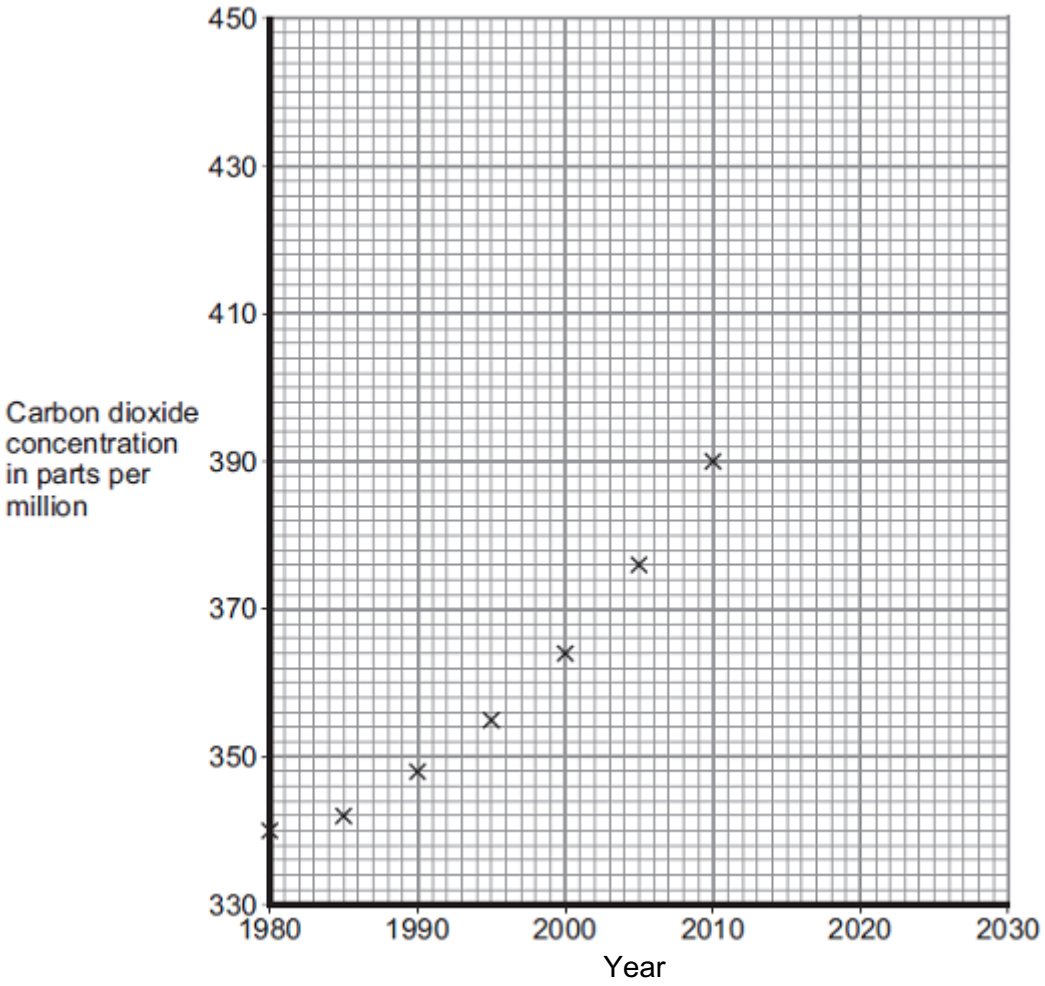
(3)
(Total 4 marks)

Q45.

Figure 1 shows the concentration of carbon dioxide in the air from 1980 to 2010.

Figure 1

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(a) What is the main cause of the change in carbon dioxide concentration shown in **Figure 1**?

_____

_____

(1)

(b) **Figure 2** shows part of the Great Barrier Reef.
The Great Barrier Reef is in an ocean and is made of coral.

Coral is made by tiny living organisms.

Figure 2

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Scientists measured the amount of coral on the reef from 1980 to 2010.

By 2010 half (50 %) of the coral present in 1980 had disappeared from the reef.

Suggest why a change in carbon dioxide concentration in the air can affect coral in the marine environment.

_____

_____

_____

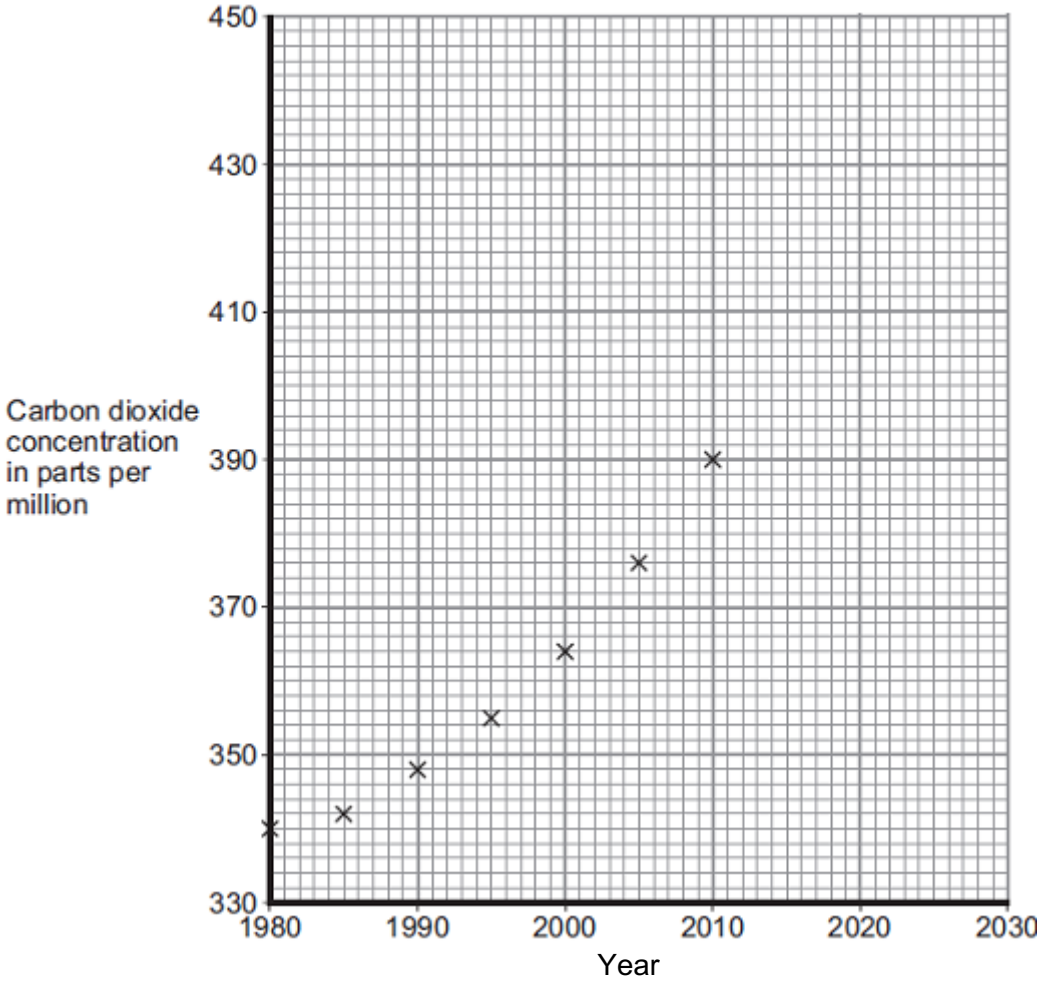
_____

(2)

Figure 3 has been repeated to help you answer the question.

Figure 3

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(c) (i) Use **Figure 3** to estimate the carbon dioxide concentration in parts per million in 2020.

Estimated carbon dioxide concentration in 2020 = _____ parts per million.

(1)

(ii) By 2010 half (50 %) of the coral present in 1980 had disappeared from the reef.
Scientists predict that half of the coral remaining in 2010 could disappear by 2020.

Consider the change in the amounts of coral and the carbon dioxide concentration in 1980, 2010 and 2020.

Use the data to explain the scientists' prediction.

_____

_____

_____

_____

_____

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_____

_____

_____

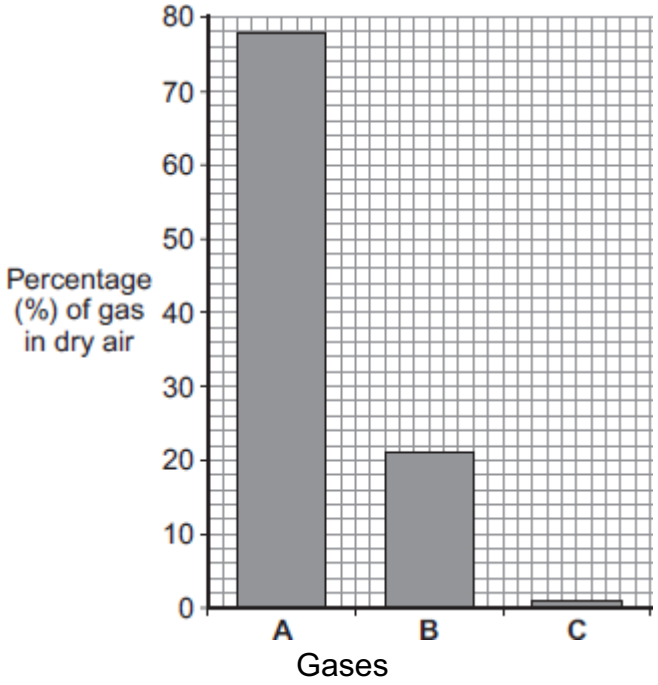
(3)

(Total 7 marks)

Q46.

This question is about the Earth's atmosphere today.

(a) The bar chart shows the percentage by mass of the gases in dry air from the atmosphere.



(i) What percentage of the atmosphere is gas **A**? _____ %

(1)

(ii) Use gases from the box to answer this question.

bromine	**hydrogen**	**nitrogen**	**oxygen**

Name gas **A** and gas **B** shown on the bar chart.

Gas **A**: _____

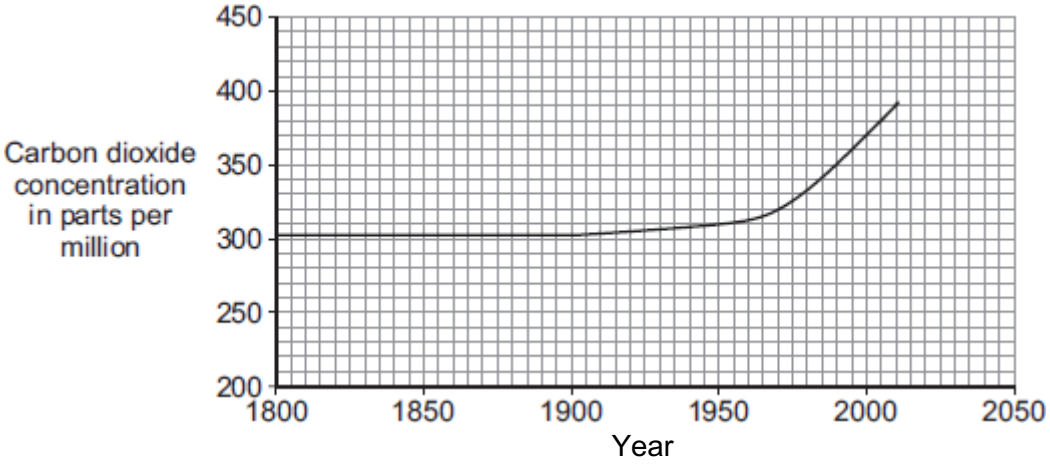
Gas **B**: _____

(2)

(b) The concentration of carbon dioxide in the atmosphere has changed.

The graph shows how the concentration of carbon dioxide has changed since 1800.

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(i) Describe how the concentration of carbon dioxide has changed since 1800.

_____

_____

_____

_____

(2)

(ii) Complete the following sentence.

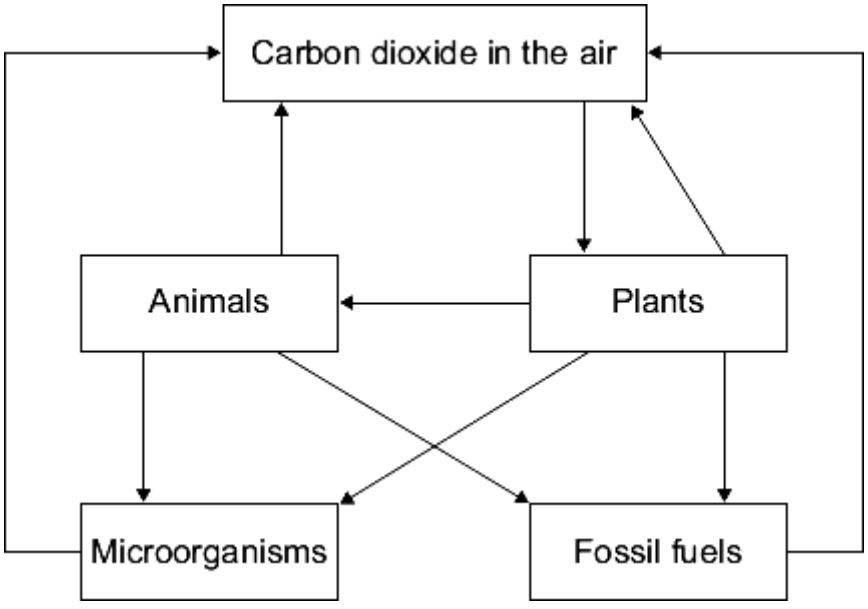
The main process that has caused the change in carbon dioxide is the burning of _____ .

(1)

(Total 6 marks)

Q47.

The diagram shows part of the carbon cycle.



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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)

Q48.

Billions of years ago, the Earth's early atmosphere was probably like the atmosphere of Venus today.

The table shows the temperature and the percentage composition of the atmospheres of the Earth and Venus today.

	Percentage (%) composition of atmosphere	
Name of gas	**Earth today**	**Venus today**
Nitrogen	78	3.5
Oxygen	20.6	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Water vapour	0.4	a trace
Average surface temperature	20 °C	460 °C

(a) Use information from the table to help you to answer each part.

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(i) In the Earth's atmosphere billions of years ago

the main gas was _____ .

(1)

(ii) The Earth's surface is mainly covered with water.

There is no water on the surface of Venus.

Suggest why.

_____

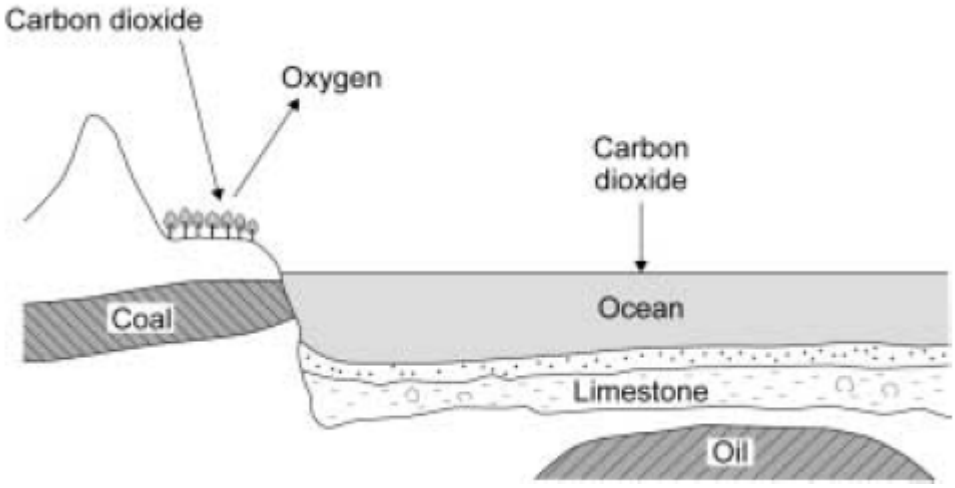
_____

_____

_____

(2)

(b) The diagram shows part of the Earth and ways that carbon dioxide can be removed from the Earth's atmosphere.



Give **three** ways that carbon dioxide can be removed from the Earth's atmosphere.

_____

_____

_____

_____

_____

_____

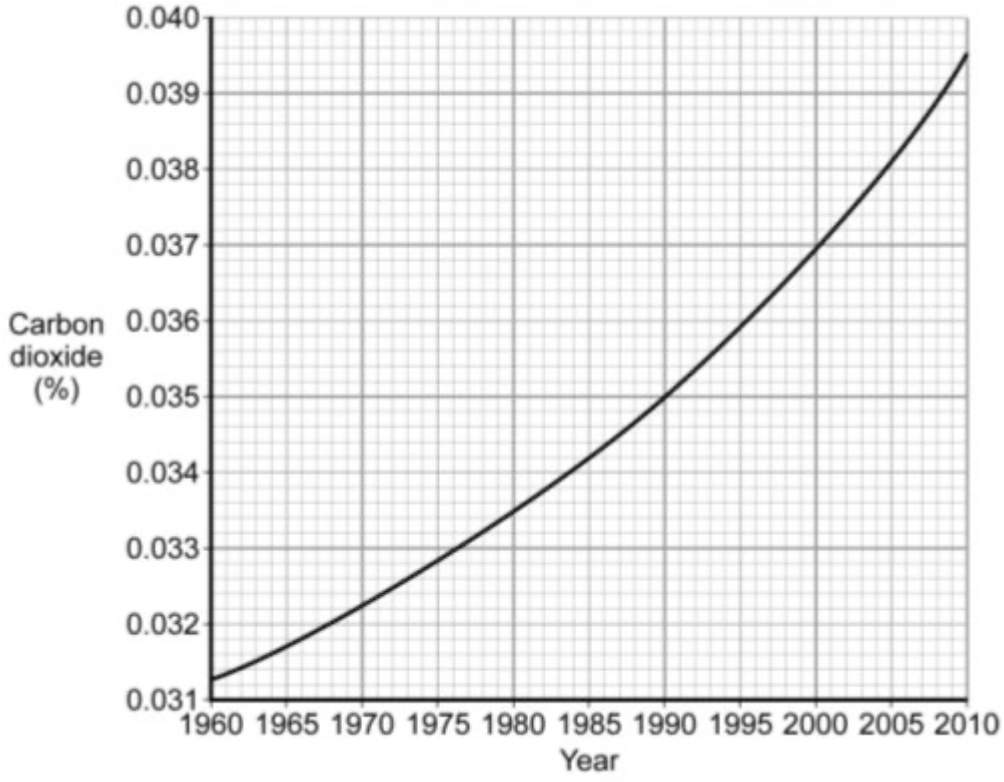
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(3)

(c) In the Earth's atmosphere the percentage of carbon dioxide has remained at about 0.03% for many thousands of years.

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



(i) What was the percentage of carbon dioxide in the Earth's atmosphere in 1965?

_____ %

(1)

(ii) What change has happened to the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years?

_____

(1)

(iii) Suggest **one** reason for this change.

_____

_____

(1)

(Total 9 marks)

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