AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.9.1 THE COMPOSITION AND EVOLUTION OF THE EARTH'S ATMOSPHERE (PACK 2)

SCORE	PERCENTAGE
/222	%

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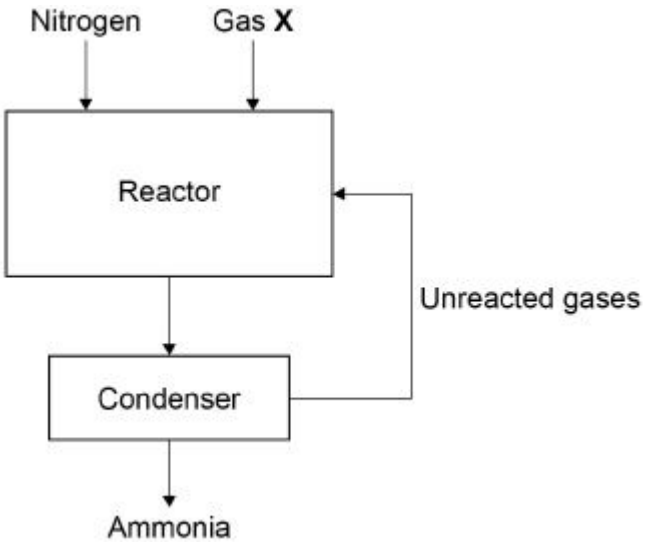
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Q1.

This question is about gases.

The diagram below shows how nitrogen is used in the Haber Process to produce ammonia.



(a) Gas **X** in the diagram above is obtained from methane.

Name gas **X**.

_____

(1)

(b) Give the approximate temperature and pressure used in the reactor.

Temperature _____

Pressure _____

(2)

(c) The mixture of gases from the reactor cools in the condenser.

Suggest why ammonia condenses but the other gases do not.

_____

_____

(1)

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

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

The table below shows the amounts of carbon dioxide and oxygen in the atmospheres of Venus and Earth today.

Gas	**Percentage (%) in**	**Percentage (%) in**

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	Venus' atmosphere today	Earth's atmosphere today
Carbon dioxide	96.50	0.04
Oxygen	0.00	20.95

(d) The percentages of carbon dioxide and oxygen have changed from Earth's early atmosphere to Earth's atmosphere today.

Explain the processes that led to these changes.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(e) Why are scientists **not** certain about the percentage of each gas in the Earth's early atmosphere?

_____

_____

(1)

(Total 11 marks)

Q2.

This question is about mixtures and analysis.

(a) Which **two** substances are mixtures?

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Tick **two** boxes.

Air ☐

Carbon dioxide ☐

Graphite ☐

Sodium Chloride ☐

Steel ☐

(2)

(b) Draw **one** line from each context to the correct meaning.

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons
Pure substance in everyday life	A substance that can be separated by filtration
	A useful product made by mixing substances

(2)

(c) What is the test for chlorine gas?

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

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Limewater turns milky ☐

(1)

(d) A student tested a metal chloride solution with sodium hydroxide solution.

A brown precipitate formed.

What was the metal ion in the metal chloride solution?

Tick **one** box.

Calcium ☐

Copper(II) ☐

Iron(II) ☐

Iron(III) ☐

(1)

(Total 6 marks)

Q3.

The table below gives information about four alcohols.

Alcohol	Formula	Melting point in °C	Boiling point in °C
Methanol	CH_3OH	−94	65
Ethanol	CH_3CH_2OH	−118	78
Propanol	$CH_3CH_2CH_2OH$	−129	97
Butanol	$CH_3CH_2CH_2CH_2OH$	−89	118

(a) Which alcohol in the table is liquid over the greatest temperature range?

_____

(1)

(b) Which statement is correct?

Tick **one** box.

A molecule of ethanol has 5 hydrogen atoms ☐

Butanol has the highest boiling point ☐

Methanol has the largest molecules ☐

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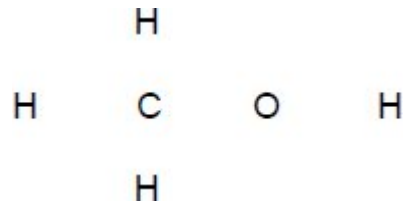
Propanol has the highest melting point ☐

(1)

(c) A molecule of methanol has five single covalent bonds.

Draw the missing bonds in **Figure 1** to complete the displayed formula for methanol.

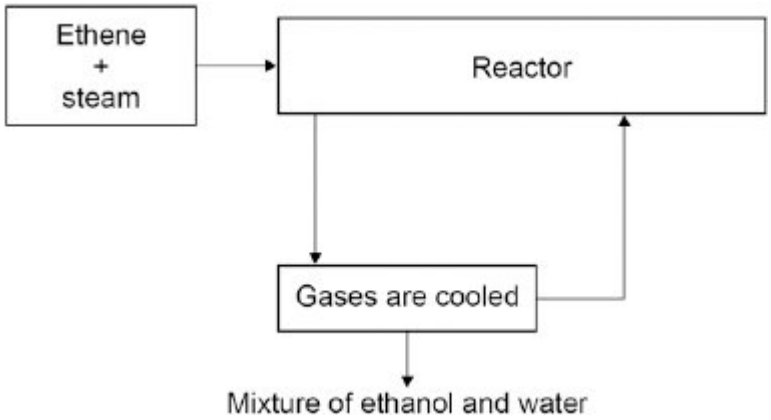
Figure 1



(1)

(d) **Figure 2** shows a flow diagram of the process to produce ethanol.

Figure 2



Complete the word equation for the reaction to produce ethanol.

_____ + _____ → ethanol

(1)

(e) What happens to the unreacted ethene?

_____

_____

(1)

(f) Wine contains ethanol.
A bottle of wine was left open in air.
After a few days, the wine tasted of vinegar.
Vinegar is a solution of ethanoic acid in water.

Explain how oxidation causes the wine to taste of vinegar after a few days.

_____

_____

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_____

_____

_____

_____

_____

_____

(3)

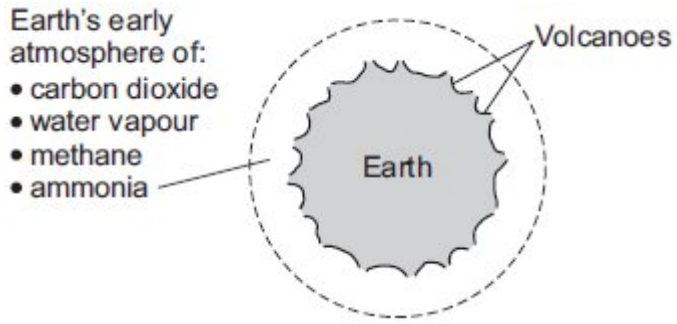
(Total 8 marks)

Q4.

This question is about the Earth and its atmosphere.

(a) **Figure 1** shows the Earth and its atmosphere billions of years ago.

Figure 1



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)

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

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

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

(3)

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

Tick (✔) **one** box.

carbon dioxide ☐

nitrogen ☐

oxygen ☐

(1)

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

Tick (✔) **one** box.

about 40% ☐

about 60% ☐

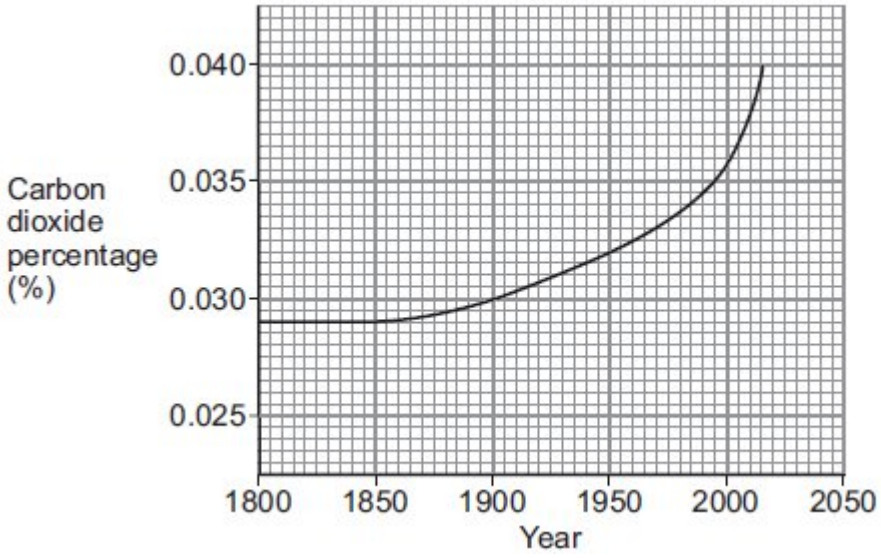
about 80% ☐

(1)

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

Figure 2

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

_____ %

(1)

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

_____

_____

_____

_____

(2)

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

1. _____

_____

2. _____

_____

(2)

(Total 11 marks)

Q5.

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

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

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

_____

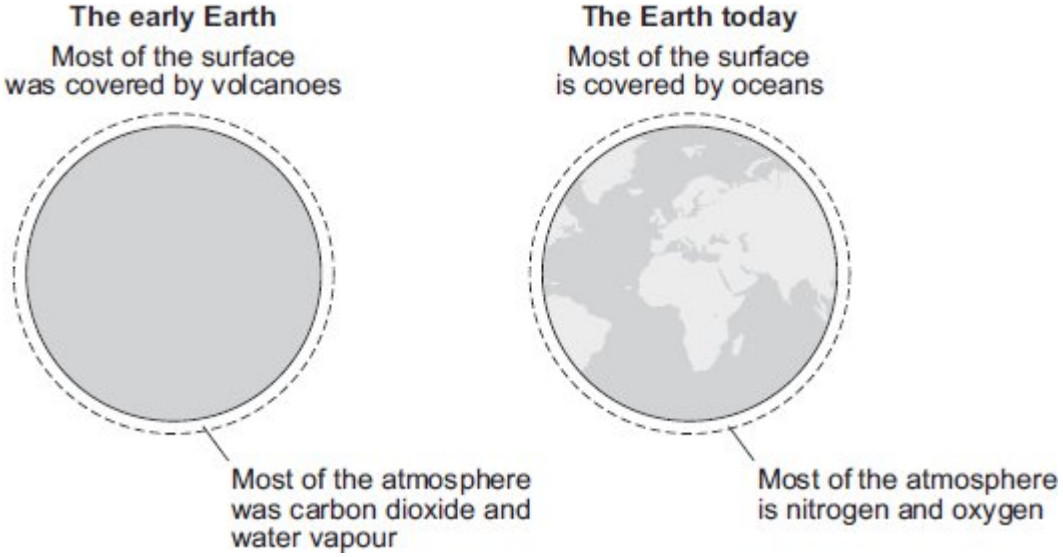
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_____

(1)

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

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



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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 7 marks)

Q6.

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

The table below shows the percentage of four gases in the atmosphere of Mars today and the atmosphere of Earth today.

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Gases	The atmosphere of	
	Mars today	Earth today
Carbon dioxide	95.00%	0.04%
Nitrogen	3.50%	78.00%
Argon	1.00%	0.96%
Oxygen	0.50%	21.00%

(a) Which **one** of the gases in the table is a noble gas?

_____

(1)

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

(i) Noble gases are in Group

0
1
7

(1)

(ii) Noble gases are

slightly reactive.
unreactive.
very reactive.

(1)

(c) The percentage of carbon dioxide in the Earth's early atmosphere was 95.00%. It is 0.04% in the Earth's atmosphere today.

(i) Calculate the decrease in the percentage of carbon dioxide in the Earth's atmosphere.

_____

_____

Decrease in percentage = _____%

(1)

(ii) Give **two** reasons for this decrease.

_____

_____

_____

_____

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(2)
(Total 6 marks)

Q7.

Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

(a) Millions of years ago the Earth's atmosphere was probably just like that of Mars today.

The table shows data about the atmosphere of Mars and Earth today.

Mars today		**Earth today**	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace
Carbon dioxide	95%	Carbon dioxide	trace
Average surface temperature −23°C		Average surface temperature 15°C	

The percentages of some gases in the Earth's atmosphere of millions of years ago have changed to the percentages in the Earth's atmosphere today.

For **two** of these gases describe how the percentages have changed **and** suggest what caused this change.

_____

_____

_____

_____

(2)

(b) Titan is the largest moon of the planet Saturn.
Titan has an atmosphere that contains mainly nitrogen.
Methane is the other main gas.

Main gases in Titan's atmosphere	**Percentage (%)**	**Boiling point in °C**
Nitrogen	95	−196
Methane	5	−164
Average surface temperature −178°C		

When it rains on Titan, it rains methane!

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Use the information above and your knowledge and understanding to explain why.

_____

_____

_____

_____

_____

_____

(2)

(c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene (C_2H_4) and propene (C_3H_6) from methane in Titan's atmosphere.

State the general formula for alkenes.

_____

(1)

(Total 5 marks)

Q8.

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

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

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

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

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

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

(2)

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

What is *locked up* carbon dioxide?

_____

_____

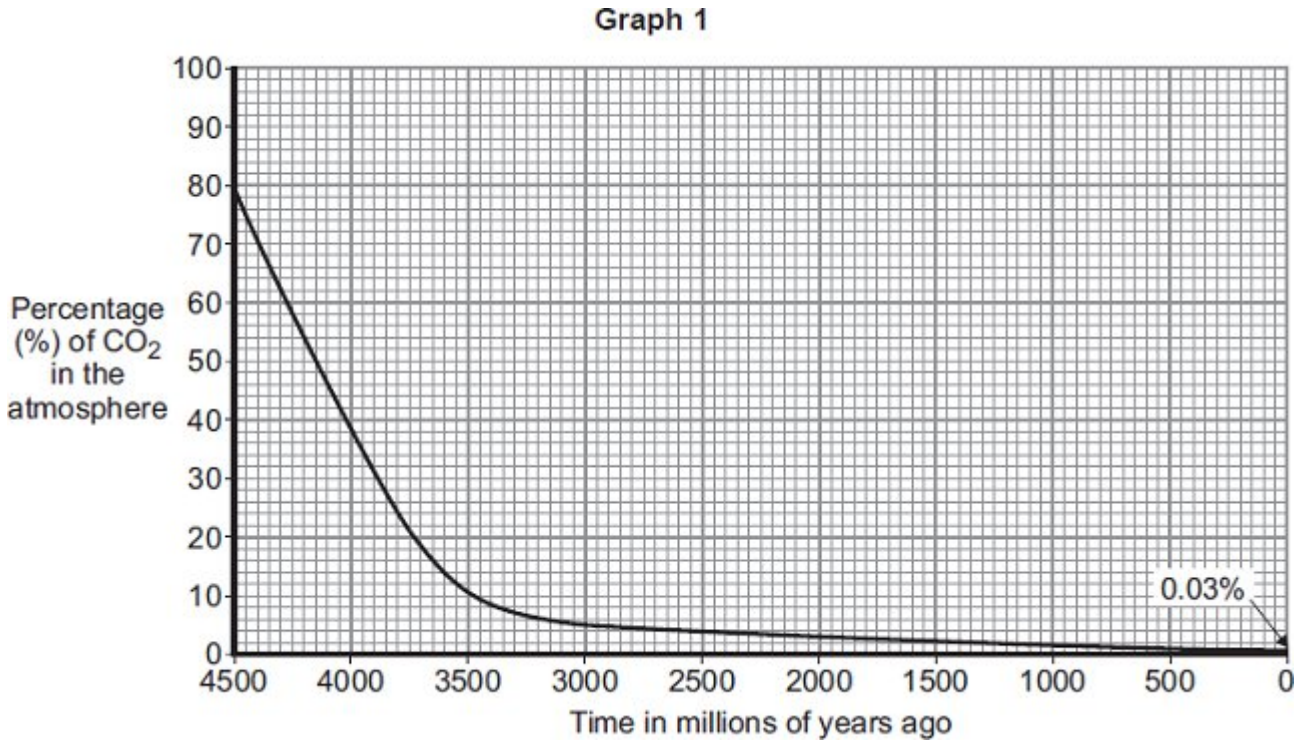
_____

_____

(2)

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



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

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

_____

_____

_____

_____

(2)

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

_____

_____

_____

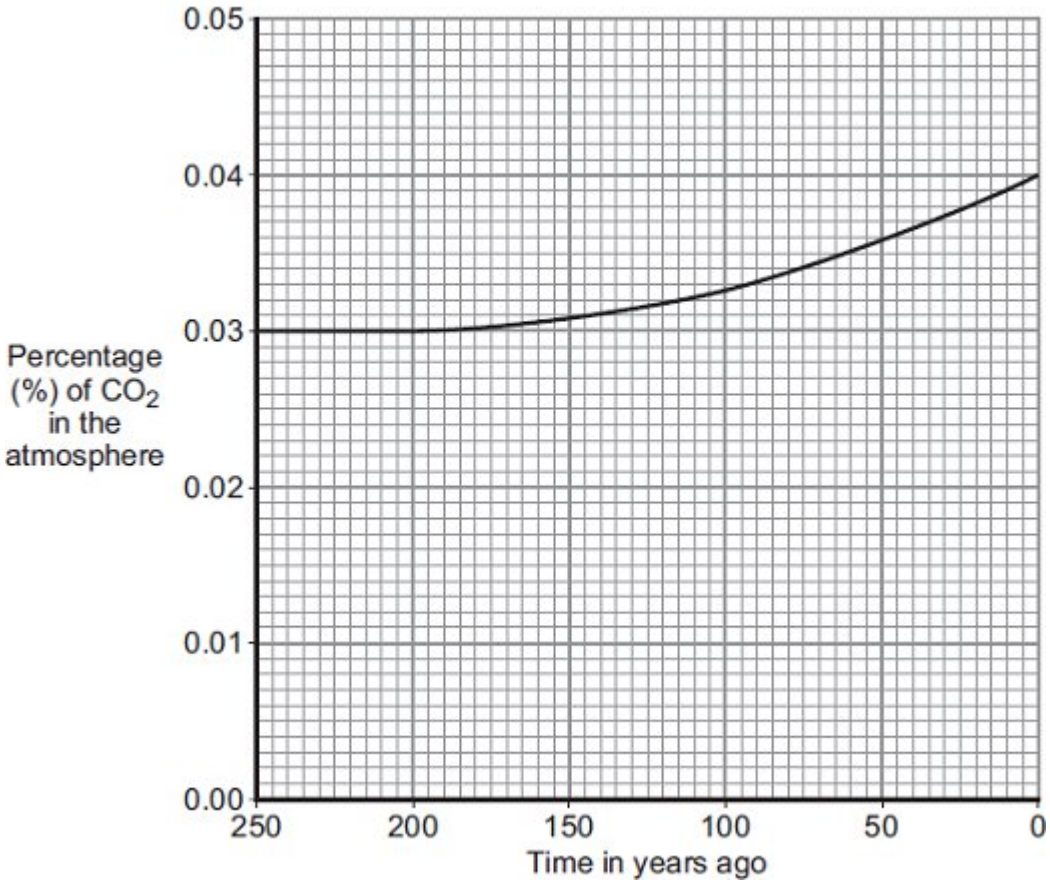
_____

(2)

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

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Graph 2



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

Explain your answer.

_____

_____

_____

_____

(2)

(Tota 10 marks)

Q9.

About 3000 million years ago, carbon dioxide was one of the main gases in the Earth's atmosphere.

About 400 million years ago, plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

(a) Describe and explain how the composition of the Earth's atmosphere was changed by the formation of coal.

_____

_____

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_____

_____

_____

_____

_____

_____

(3)

(b) Today, coal is burned in power stations to release the energy needed by industry. Carbon dioxide, water and sulfur dioxide are produced when this coal is burned.

Name **three** elements that are in this coal.

_____

_____

_____

(2)

(c) In some power stations coal is mixed with calcium carbonate (limestone). The mixture is crushed before it is burned.

(i) Many chemical reactions happen when this mixture is burned. The chemical equation represents one of these reactions.

Balance the chemical equation.

$2CaCO_3(s)$ + $2SO_2(g)$ + $O_2(g)$ → ..... + ...
$CaSO_4(s)$ $CO_2(g)$

(1)

(ii) Explain how the use of calcium carbonate in the mixture:

increases atmospheric pollution

_____

_____

_____

_____

decreases atmospheric pollution.

_____

_____

_____

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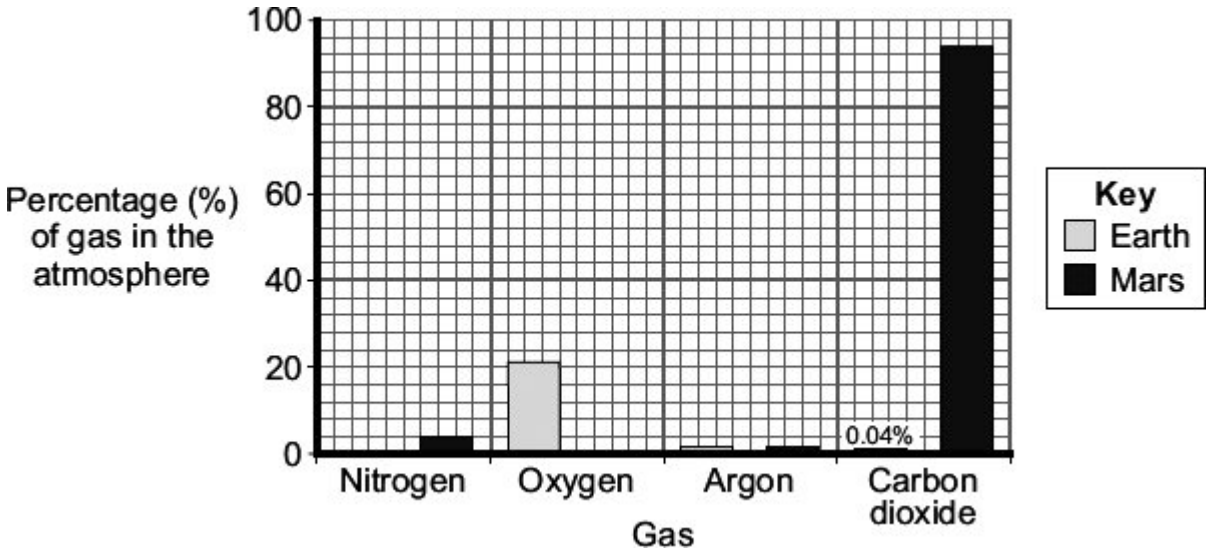
_____

(4)

(Total 10 marks)

Q10.

The bar chart shows some of the gases in the atmospheres of Earth today and Mars today.



(a) Complete the bar chart to show the percentage of nitrogen in the Earth's atmosphere today.

(1)

(b) Some scientists suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

(i) There is **not** much oxygen in the atmosphere of Mars.

Suggest why.

_____

_____

(1)

(ii) The percentage of argon in the Earth's atmosphere today is the same as it was in the Earth's early atmosphere.

Suggest why.

_____

_____

(1)

(c) Compared with the percentage of carbon dioxide in the Earth's early atmosphere there is **not** much carbon dioxide in the Earth's atmosphere today.

Give **one** reason for this change.

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_____

_____

(1)

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

Some theories suggest that the Earth's early atmosphere was

made by

burning fossil fuels.
the formation of oceans.
the eruption of volcanoes.

(1)

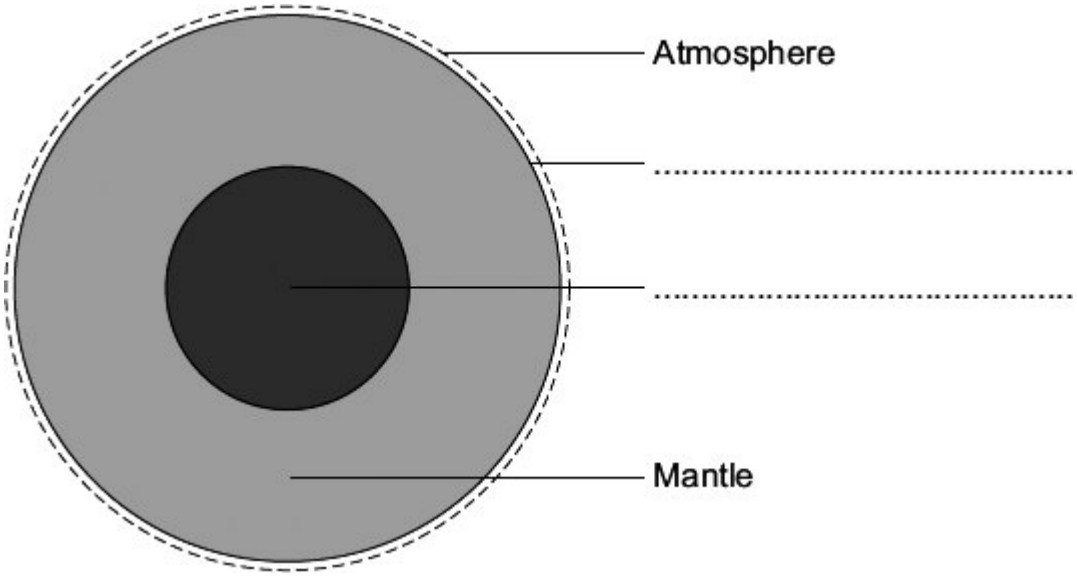
(Total 5 marks)

Q11.

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

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

Complete the labels on the diagram.



(2)

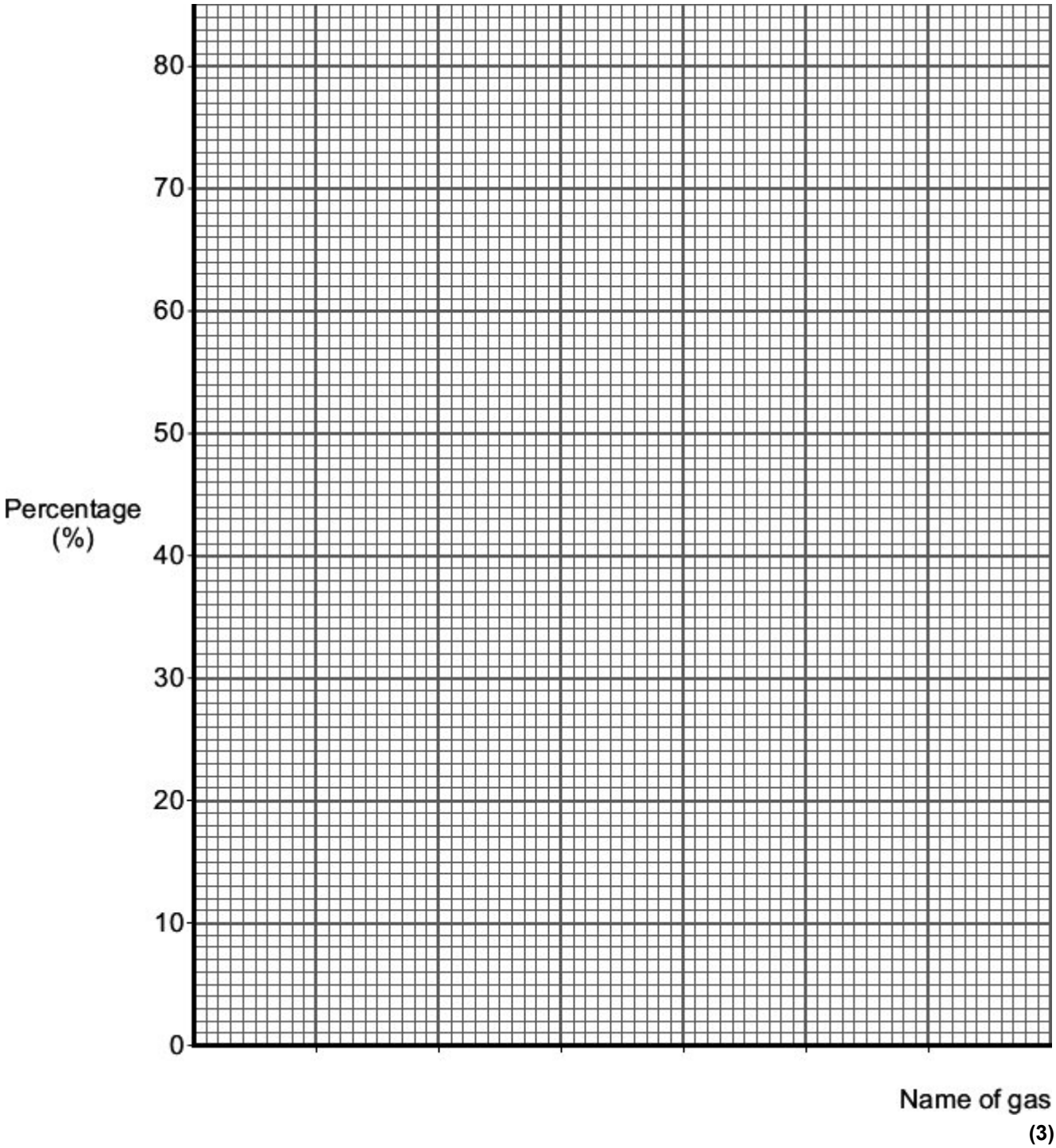
(b) The data in the table shows the percentages of the gases in the Earth's atmosphere.

Name of gas	Percentage (%) of gas
Nitrogen	78
Oxygen	21

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Other gases	1

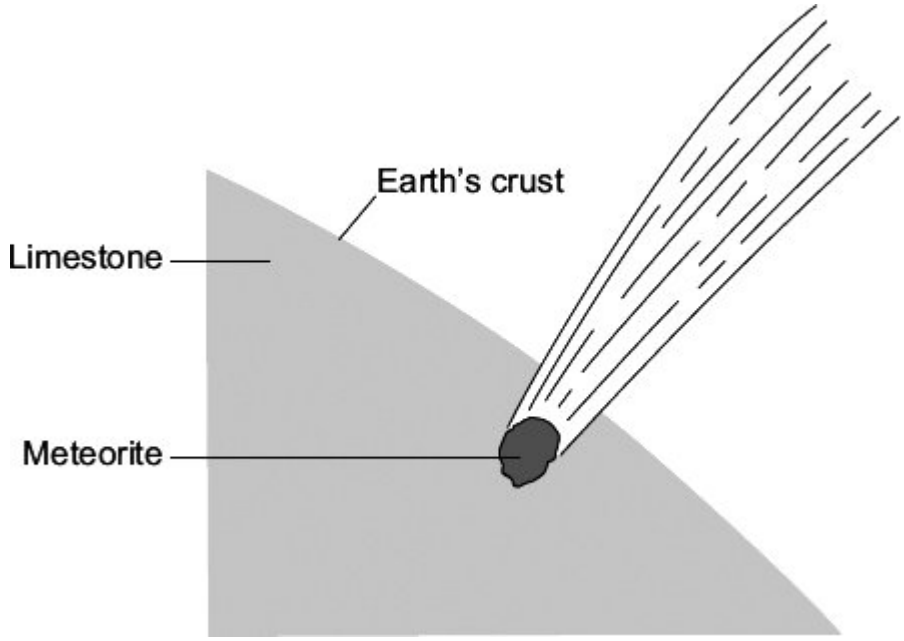
Present the data in the table on the grid below.



(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.

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

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

decomposed.
evaporated.
reduced.

(1)

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

acid rain.
global dimming.
global warming.

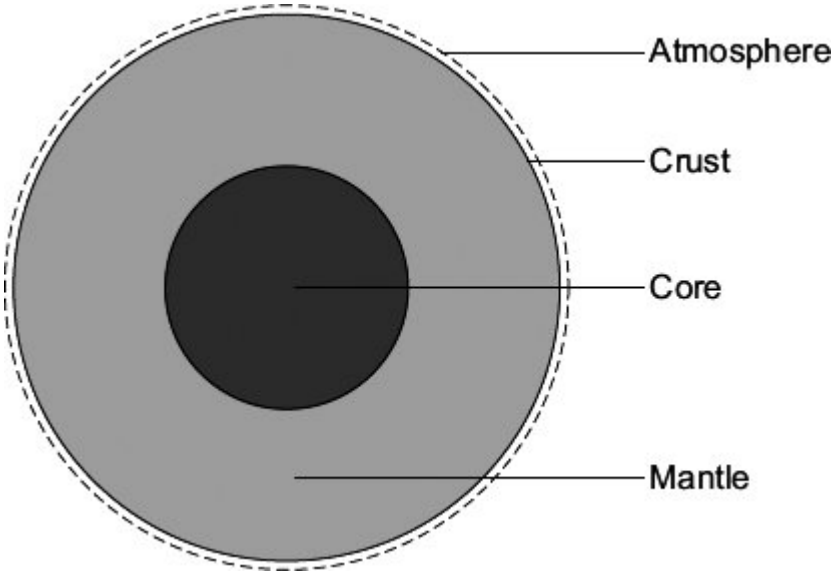
(1)

(Total 7 marks)

Q12.

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

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

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

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

_____

_____

_____

_____

(2)

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

Explain how carbon dioxide is released from limestone.

_____

_____

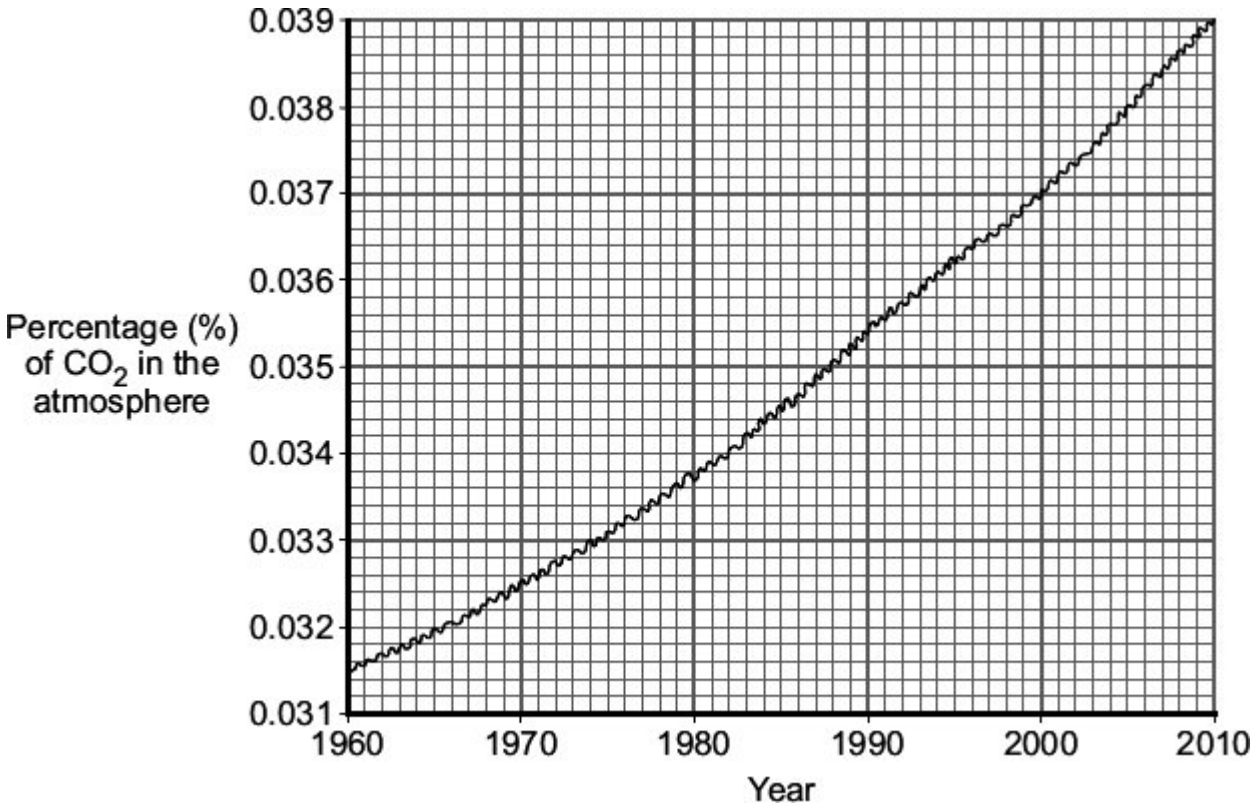
_____

_____

(2)

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

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

_____

_____

_____

_____

_____

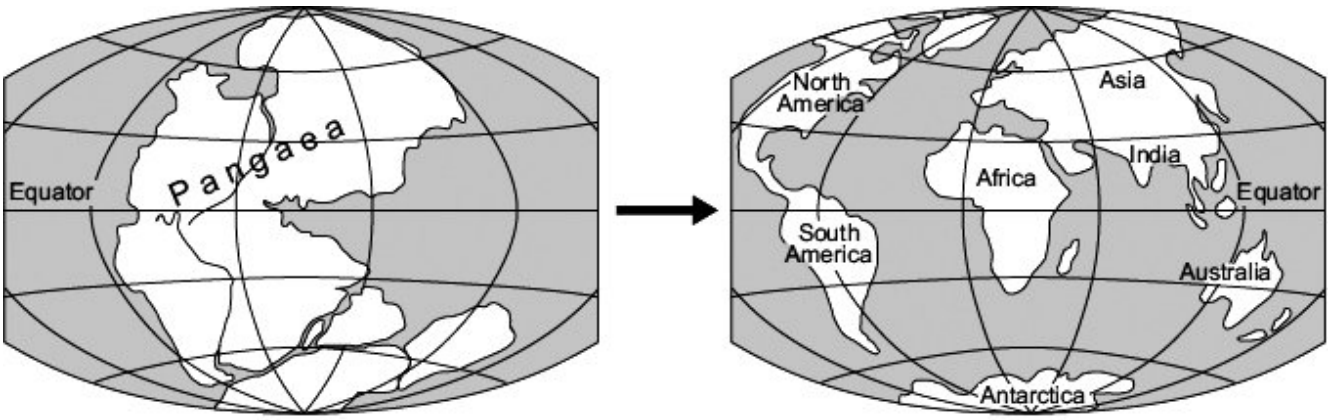
_____

_____

(3)

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

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

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

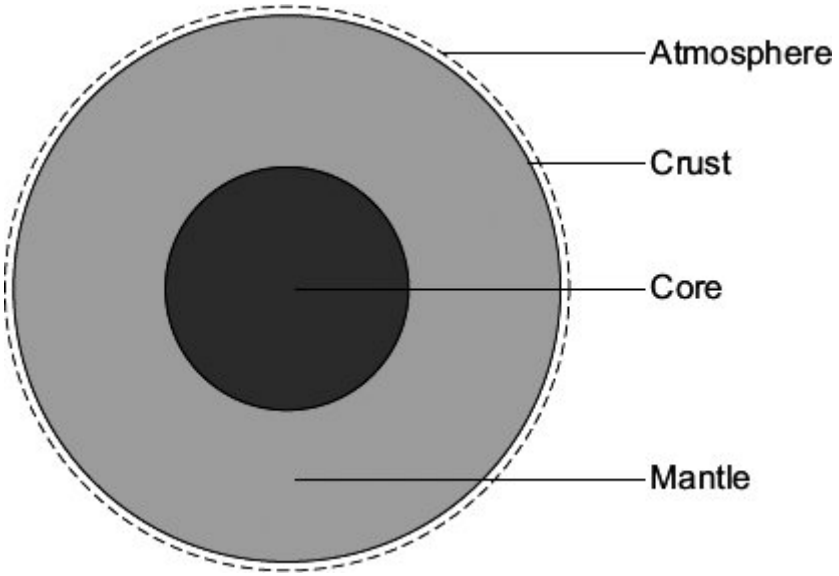
_____

_____

(1)

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

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



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

_____

_____

_____

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_____

_____

_____

(3)

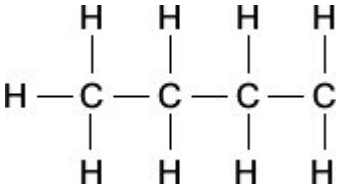
(Total 11 marks)

Q13.

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

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

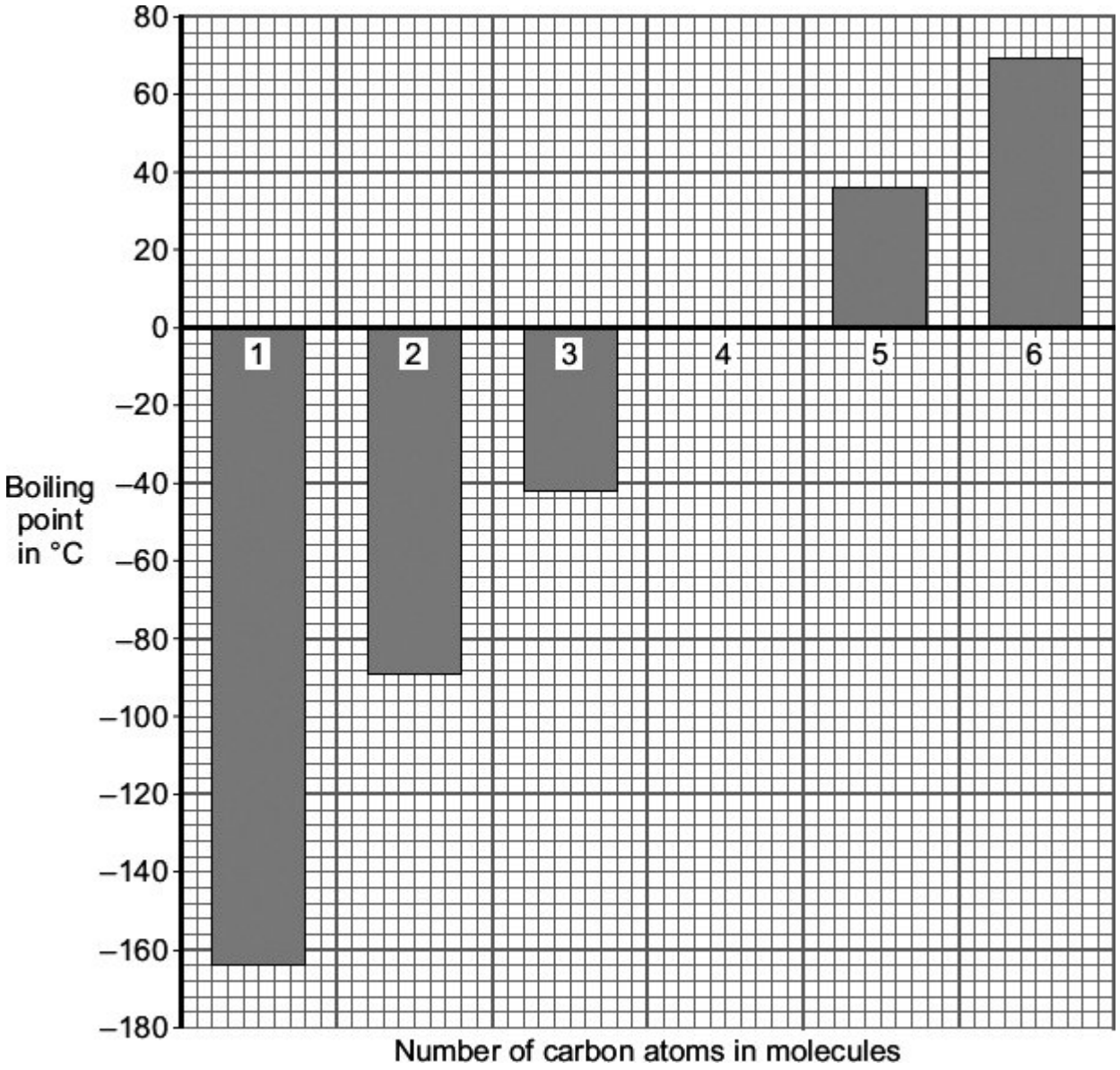
Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1)

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

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

_____

_____

(1)

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

1. _____

_____

2. _____

_____

(2)

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

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

$2\ C_8H_{18} + 25\ O_2 \longrightarrow ____\ CO_2 + ____\ H_2O$

(1)

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

_____

_____

(1)

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

_____

_____

_____

_____

_____

_____

(2)

(Total 8 marks)

Q14.

Many human activities result in carbon dioxide emissions.
Our carbon footprint is a measure of how much carbon dioxide we each cause to be produced.

(a) Why should we be concerned about our carbon footprint?

_____

_____

_____

(1)

(b) Most power stations in the UK burn coal.
Coal was formed from tree-like plants over millions of years.

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Suggest why burning wood instead of coal would help to reduce our carbon footprint.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

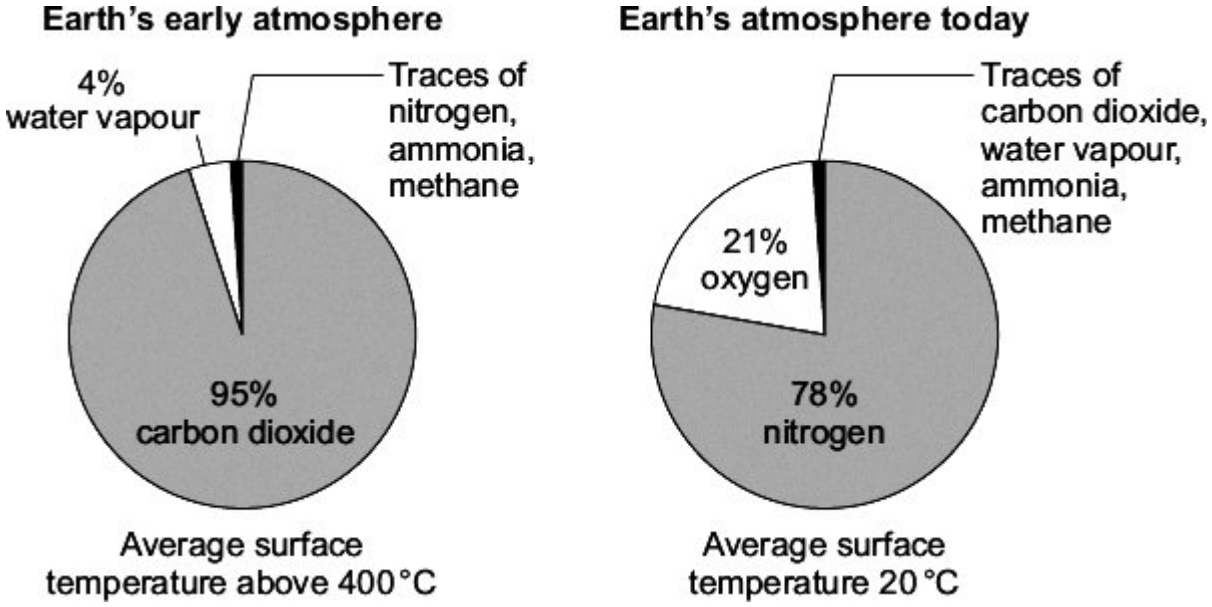
(Total 4 marks)

Q15.

(a) Scientists have suggested that:

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

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



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

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_____

_____

_____

_____

(2)

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

1. _____

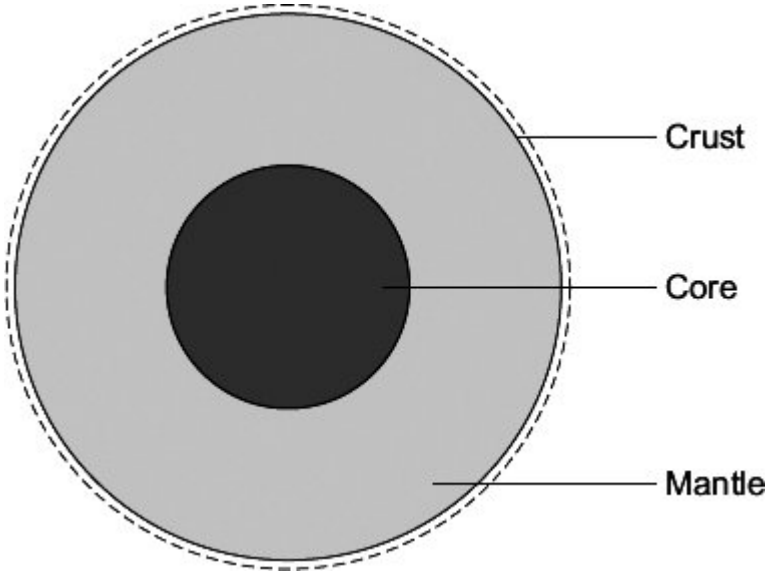
_____

2. _____

_____

(2)

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



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

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

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

_____

_____

(1)

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

_____

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_____

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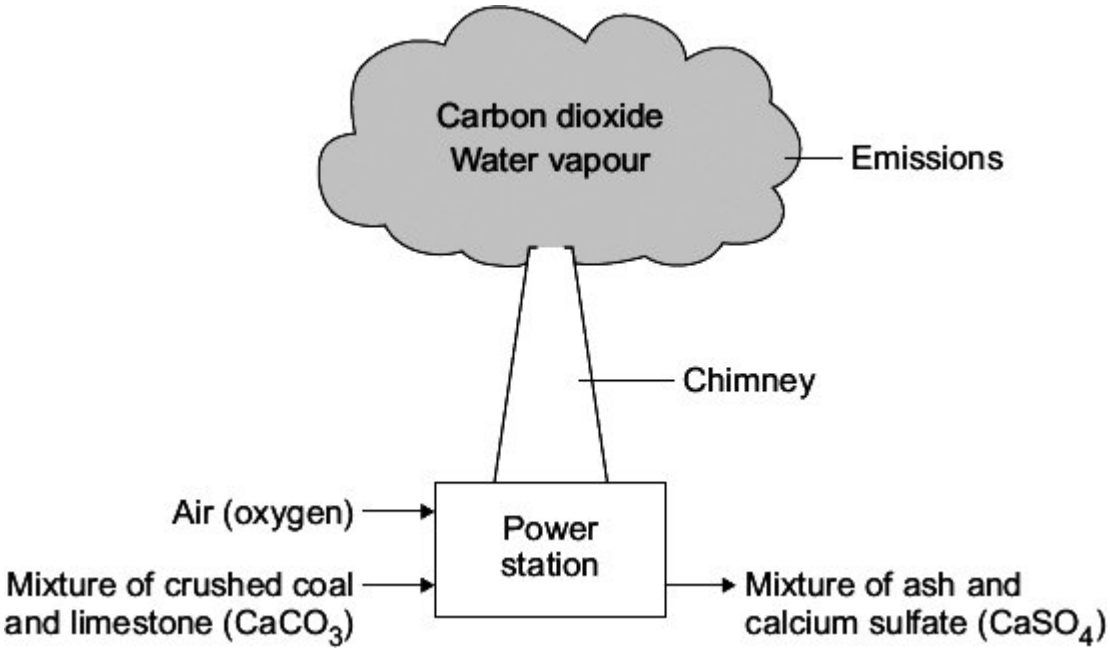
_____

(3)

(Total 8 marks)

Q16.

Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone.
This prevents sulfur dioxide from entering the atmosphere and causing acid rain.
One disadvantage of using limestone in a power station is that it releases 'locked up carbon dioxide' into the atmosphere.



(a) How does the limestone used in a power station:

(i) release carbon dioxide

_____

_____

(1)

(ii) remove sulfur dioxide?

_____

_____

(1)

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(b) The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide.

Explain how carbon monoxide would be formed.

_____

_____

_____

_____

(2)

(c) The use of limestone in a power station releases 'locked up carbon dioxide' into the atmosphere.

(i) Explain the meaning of 'locked up carbon dioxide'.

_____

_____

_____

_____

(2)

(ii) Why does the release of this carbon dioxide cause an environmental problem?

_____

_____

_____

(1)

(Total 7 marks)

Q17.

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

The table shows a comparison 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	21	a trace
Argon	0.97	a trace

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Carbon dioxide	0.03	96.5
Average surface temperature	20 ºC	460 ºC

(a) Use the names of gases from the table to complete the sentences.

(i) In the Earth's atmosphere today, the main gas is _____ .

(1)

(ii) In the Earth's atmosphere billions of years ago, the main gas was

_____.

(1)

(b) (i) Scientists do **not** know the accurate composition of the Earth's early atmosphere.
Suggest why.

_____

_____

(1)

(ii) Use information from the table to answer this question.

Water vapour is present in the atmospheres of the Earth and Venus today.
The Earth's surface is mainly covered by water.

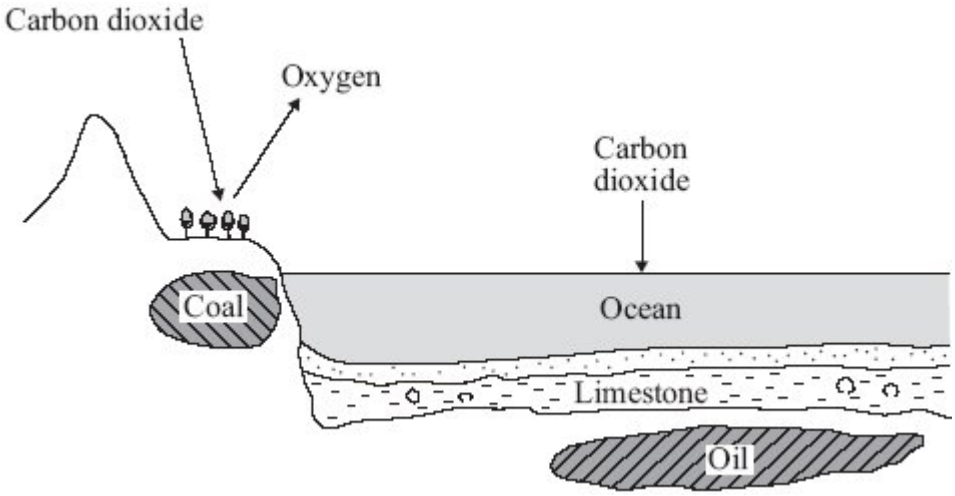
Suggest why there is no water on the surface of Venus.

_____

_____

(1)

(c) The diagram shows how carbon dioxide is removed from the Earth's atmosphere.



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Describe what happened to the carbon dioxide in the Earth's early atmosphere. Use the diagram to help you.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q18.

There are many ideas about the formation of the Earth and its atmosphere from a molten ball of rock and minerals.

(a) One idea is that the Earth's early atmosphere and average surface temperature were probably like that of Venus today.

The table shows information about the Earth and Venus today.

	Percentage composition of atmosphere	
Name of gas	**Earth today**	**Venus today**
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 °C	460 °C

There is a variable amount of water vapour in both atmospheres.

(i) How was the Earth's early atmosphere formed?

_____

_____

(1)

(ii) The Earth's average surface temperature decreased over time. At what temperature would oceans have started to form?

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Temperature = _____ °C

(1)

(iii) Describe how the evolution of plants changed the Earth's atmosphere.

_____

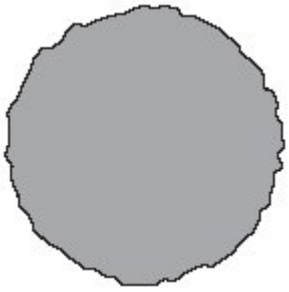
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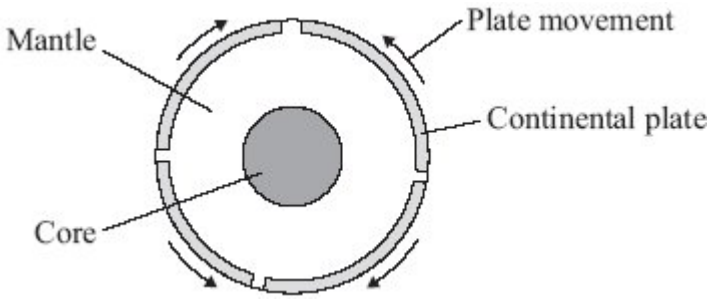
_____

(2)

(b) Another idea was that the Earth's mountains and continents formed in fixed positions as the molten ball of rock and minerals cooled and wrinkled.



Wegener, in 1915, had the idea that the Earth's crust and the upper part of the mantle had cracked into plates that were able to move. His idea meant that the mountains and continents were not in fixed positions.



(i) Give **one** piece of evidence that led to Wegener's idea being accepted.

_____

_____

(1)

(ii) Describe what causes the Earth's tectonic plates to move.

_____

_____

_____

_____

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_____

_____

(3)

(Total 8 marks)

Q19.

Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

(a) Millions of years ago the Earth's atmosphere was probably just like that of Mars today.

The table shows data about the atmospheres of Mars and Earth as they are now.

Mars		**Earth**	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace
carbon dioxide	95%	carbon dioxide	trace
Average surface temperature –23 °C		Average surface temperature 15 °C	

Suggest what has caused the main gases in the Earth's atmosphere of millions of years ago to change to the present-day atmosphere.

_____

_____

_____

_____

(2)

(b) Titan is the largest moon of the planet Saturn. It has an atmosphere that, like the Earth's, contains mainly nitrogen. Methane is the other main gas.

Main gases in Titan's atmosphere	**Percentage (%)**	**Boiling point in °C**
Nitrogen	95	–196
Methane	5	–164
Average surface temperature –178 °C		

When it rains on Titan, it rains methane! Explain why.

_____

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_____

_____

(2)

(c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene and propene, from methane in Titan's atmosphere.

(i) Draw the structure of propene, C_3H_6, to show the covalent bonds.

(1)

(ii) Explain how propene molecules form a polymer. You should name the polymer formed.

_____

_____

_____

_____

_____

_____

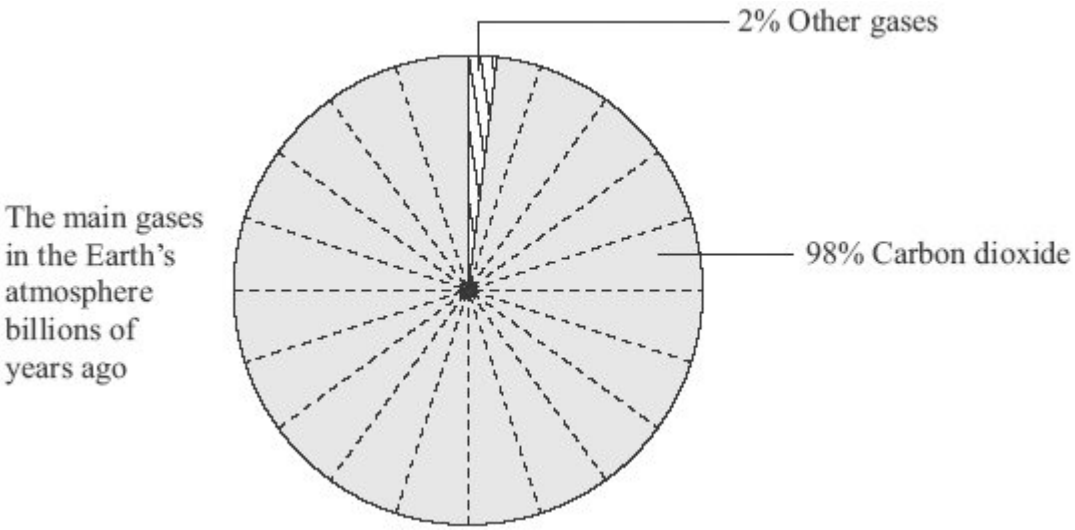
(3)

(Total 8 marks)

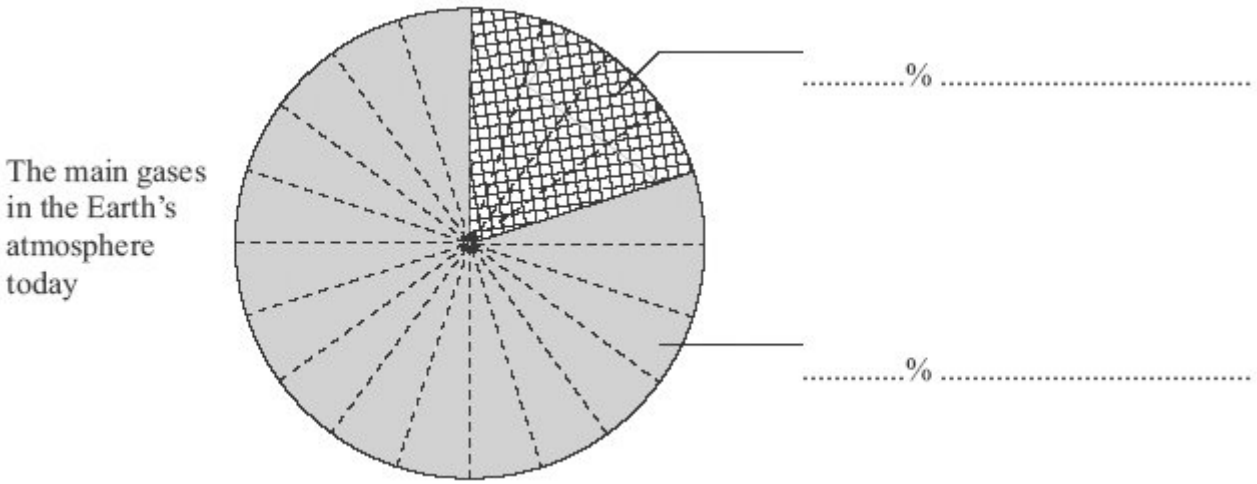
Q20.

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.

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



(2)

(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)

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

_____

_____

(1)

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

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Complete the word equation for this reaction.

methane + _____ → carbon dioxide + _____

(2)

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

Explain why.

_____

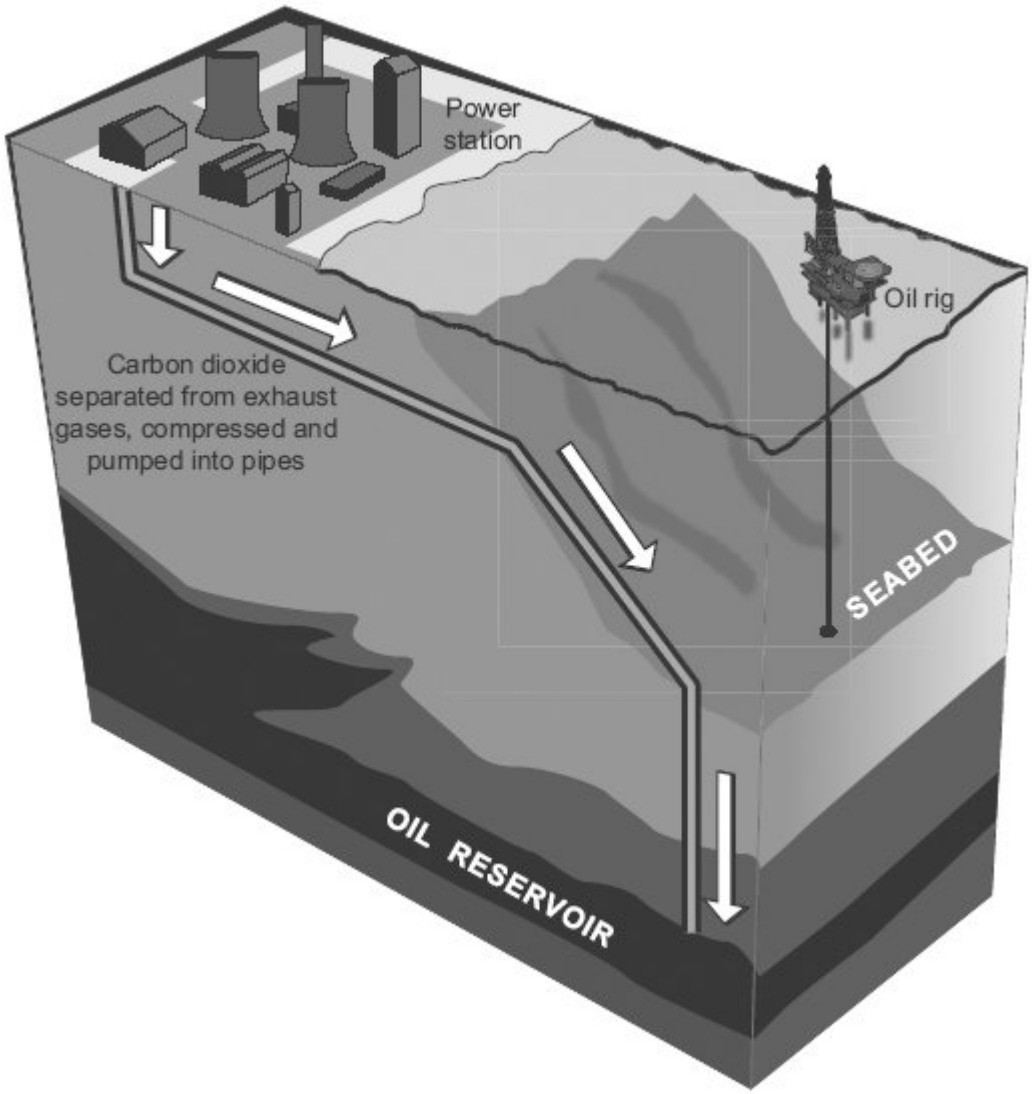
_____

_____

_____

(2)

(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.

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_____

_____

_____

_____

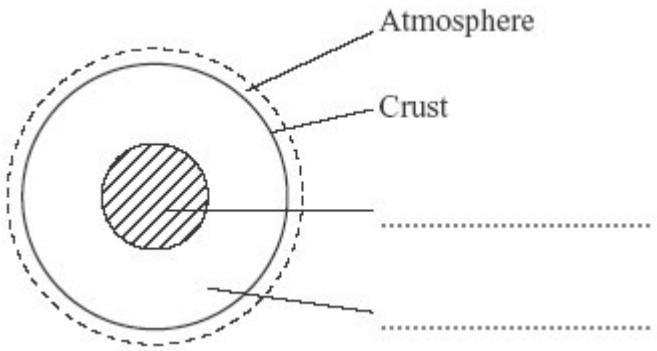
(2)

(Total 10 marks)

Q21.

The Earth is shaped like a ball and is surrounded by an atmosphere.

(a) The diagram shows the layered structure of the Earth.



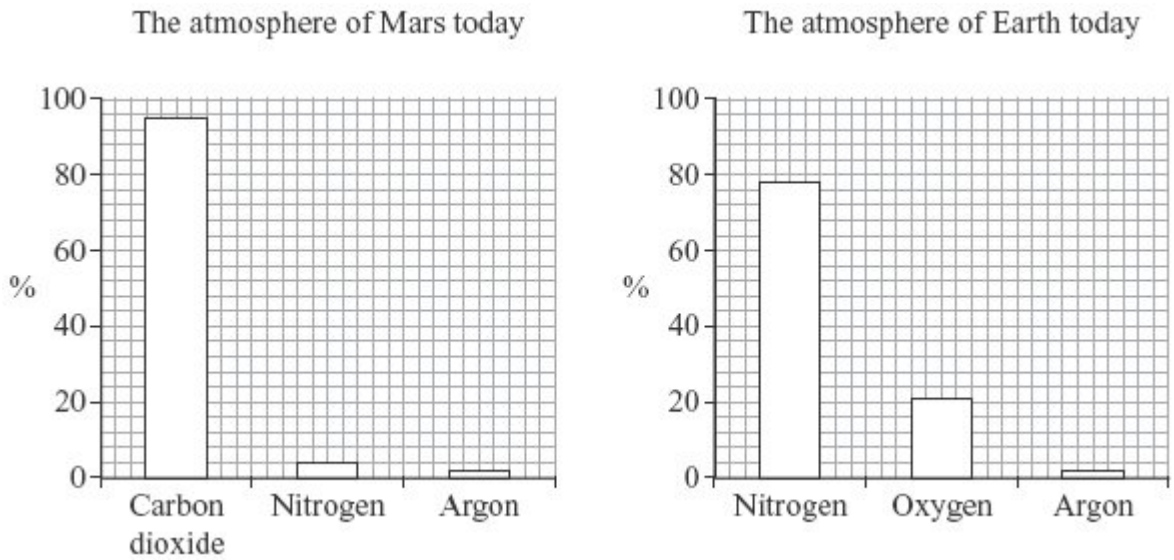
Choose words from the box to complete the labels on the diagram.

core	**mantle**	**plate**

(2)

(b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

The bar charts show the three most common gases in each atmosphere today.



(i) Use the bar charts to complete the sentence by writing in the correct gases.

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In the atmosphere of Mars today there is mainly _____

and no _____ .

(2)

(ii) Use the bar charts to complete the sentence by writing in the correct number.

These theories suggest that there was about _____ % nitrogen in the Earth's early atmosphere.

(1)

(iii) The atmosphere of the Earth today has much more nitrogen than in the early atmosphere. Denitrifying bacteria released most of this nitrogen into the atmosphere.

There are other differences between the Earth's early atmosphere and the atmosphere of the Earth today.

Use the bar charts to describe and explain **two** of these other differences.

_____

_____

_____

_____

_____

_____

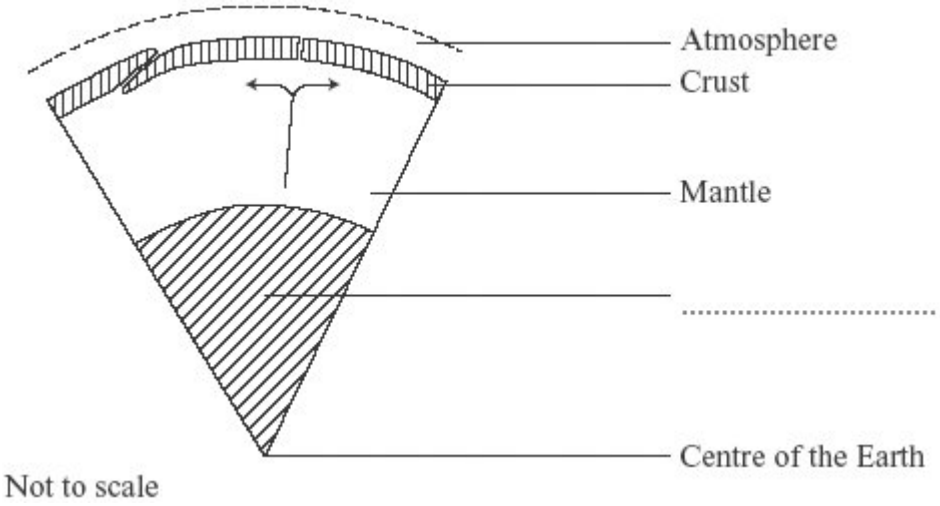
(3)

(Total 8 marks)

Q22.

The Earth is shaped like a sphere and is surrounded by an atmosphere.

(a) The diagram shows a section of the layered structure of the Earth.



(i) Complete the diagram by writing in the missing label.

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(1)

(ii) Earthquakes within the Earth's crust can be sudden and disastrous. Scientists cannot accurately predict when earthquakes will occur.

Explain why.

To obtain full marks you must support your answer with a description of what causes earthquakes.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

Gases	The atmosphere of Mars today	The atmosphere of Earth today
Carbon dioxide %	95	0.03
Nitrogen %	3	
Argon %	1.5	0.97
Oxygen %	0.5	21

(i) Complete the table by writing in the percentage of nitrogen in the atmosphere of Earth today.

(1)

(ii) Use the information in the table to describe the changes that have happened to **two** of the gases in the Earth's atmosphere.

Explain what has caused these changes.

_____

_____

_____

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_____

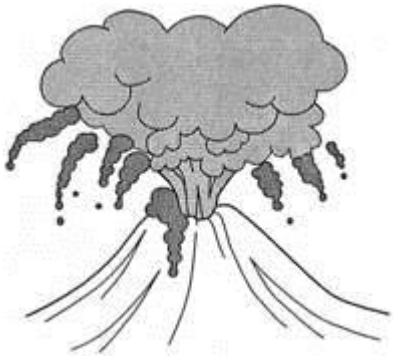
_____

(4)

(Total 10 marks)

Q23.

(a) During the first billion years of the Earth's existence, there were many active volcanoes. The volcanoes released the gases that formed the early atmosphere.



Describe how volcanoes caused the oceans to be formed.

_____

_____

_____

_____

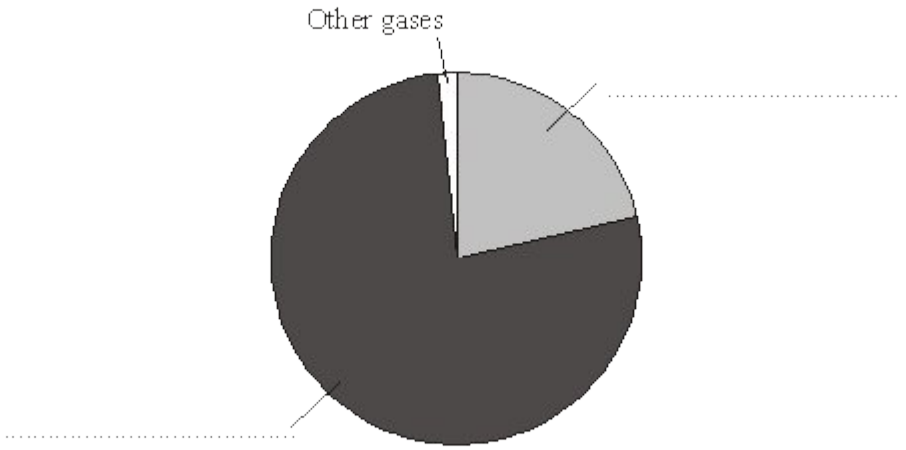
(2)

(b) The atmosphere on Earth today is very different from the early atmosphere.

The pie chart shows the amounts of different gases in the air today. Choose gases from the box to label the pie chart.

argon	**carbon dioxide**	**hydrogen**	**nitrogen**	**oxygen**

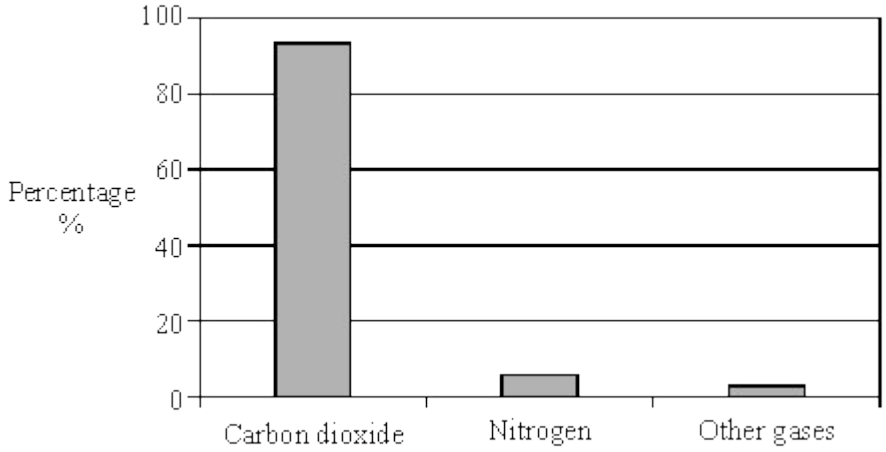
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(2)
(Total 4 marks)

Q24.

The bar chart shows the percentage composition of the atmosphere on Mars.



(a) State **three** ways in which the atmosphere on Earth today is different from that on Mars.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(b) The atmosphere on Earth may once have been like that on Mars. The evolution of green plants has changed the atmosphere on Earth.

Explain why.

_____

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_____

_____

_____

(2)

(Total 5 marks)

Q25.

(a) For the last 200 million years the amount of carbon dioxide in the atmosphere has remained almost the same.

Describe the natural processes which remove carbon dioxide from the atmosphere.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) The amount of carbon dioxide in the atmosphere has increased over the last one hundred years. Suggest **two** reasons why this has happened.

_____

_____

_____

_____

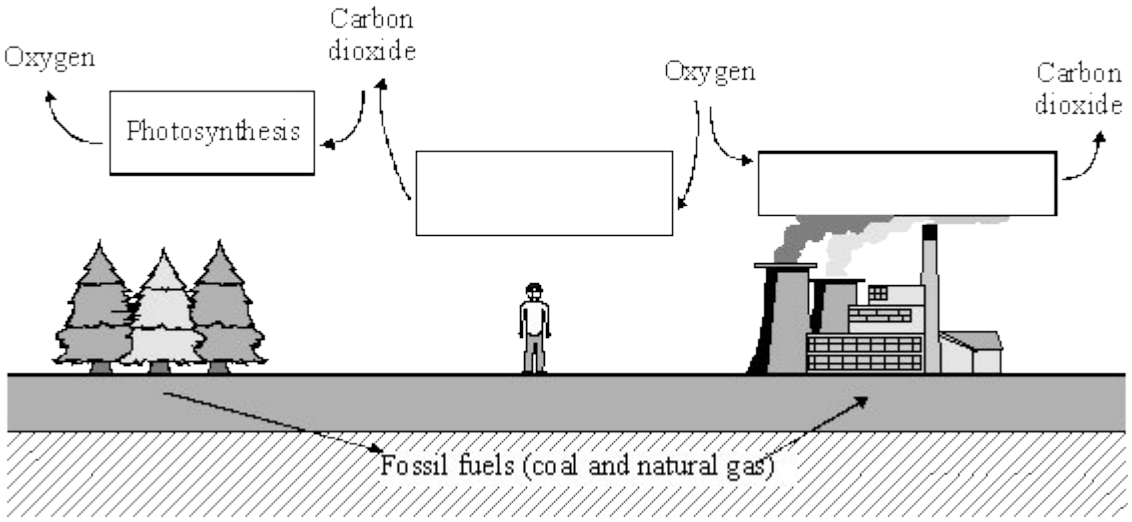
(2)

(Total 6 marks)

Q26.

In the carbon cycle the amounts of carbon dioxide and oxygen in the air are changed by several processes.

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(a) The names of some processes are given in the box below.

combustion	decomposition	neutralisation
photosynthesis		respiration

Choose the correct process for each box in the diagram. The first one has been done for you.

(2)

(b) Fossil fuels, such as natural gas, react with oxygen.

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

_____ + oxygen → carbon dioxide + _____

Complete the word equation for this reaction

(2)

(c) What problem is caused by the formation of large amounts of carbon dioxide?

_____

_____

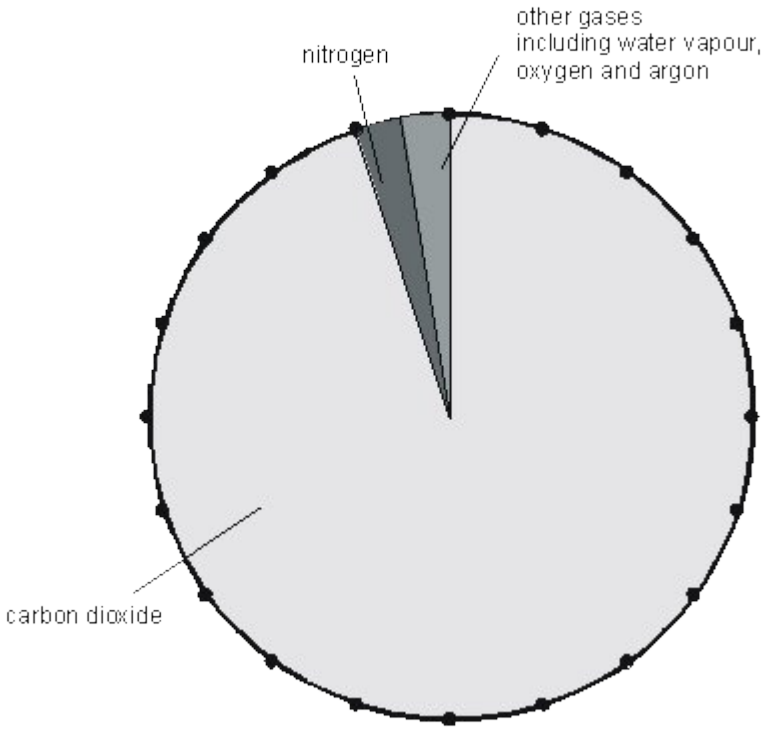
(1)

(Total 5 marks)

Q27.

The pie chart below shows the composition of the atmosphere on the planet Mars.

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(a) Use the pie chart above to calculate the percentage of carbon dioxide in the atmosphere on Mars.

_____

_____

_____%

(2)

(b) The atmosphere on Earth is very different from that on Mars. One important difference is that the Earth's atmosphere contains a large amount of oxygen.

Give **two** other ways in which the Earth's atmosphere is different from the atmosphere on Mars.

1. _____

_____

2. _____

_____

(2)

(c) When the Earth was formed its atmosphere is thought to have been similar to the atmosphere on Mars. Explain how green plants and other organisms have changed the composition of the Earth's atmosphere.

_____

_____

_____

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_____

_____

_____

_____

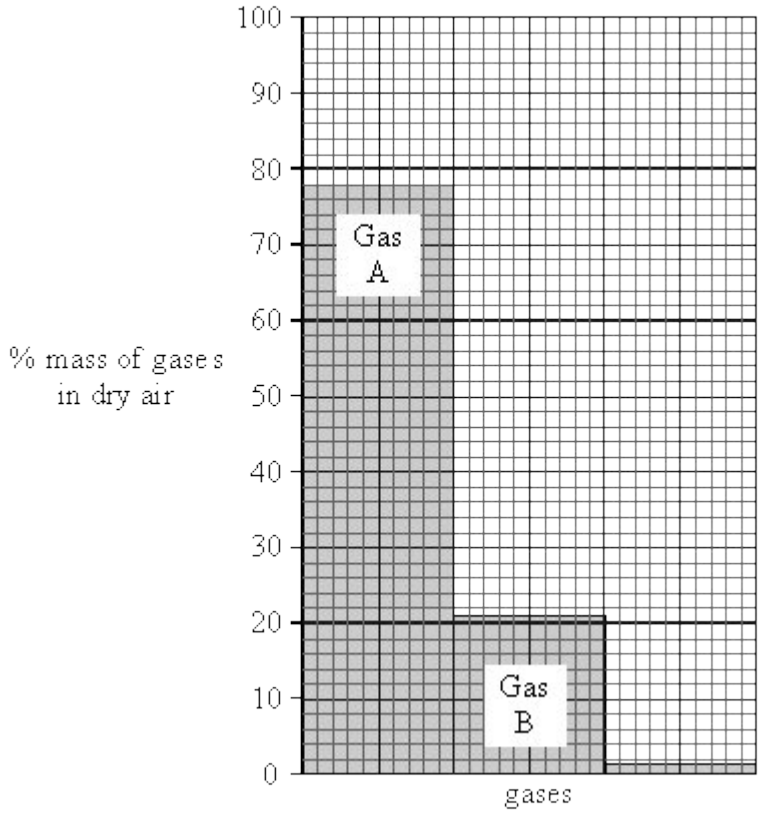
_____

(4)

(Total 8 marks)

Q28.

The bar chart below shows the percentage by mass of gases in dry air. Two of the gases are labelled as A and B.



What are the names of gas A and gas B?

Gas A is _____

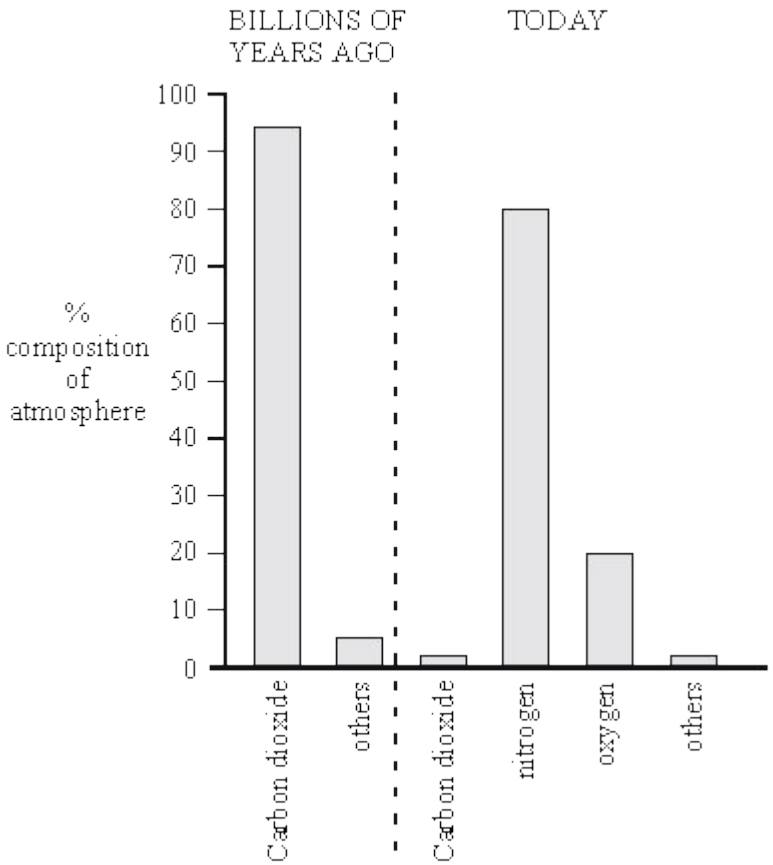
Gas B is _____

(Total 2 marks)

Q29.

The bar chart shows the composition of the Earth's atmosphere today, and as it was billions of years ago.

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(a) Use information from the bar chart to describe how the atmosphere today is different from the atmosphere of billions of years ago.

_____

_____

_____

_____

(2)

(b) Describe the processes which have brought about the changes in the proportions of these gases in the air over billions of years.

_____

_____

_____

_____

_____

_____

(4)

(Total 6 marks)

Q30.

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For 200 million years the proportions of the different gases in the atmosphere have been much the same as today. Over the past 150 years the amount of carbon dioxide in the atmosphere has increased from 0.03% to 0.04%.

(a) Describe how carbon dioxide is released into the atmosphere:

(i) by human and industrial activity;

_____

_____

_____

_____

(2)

(ii) from carbonate rocks by geological activity.

_____

_____

_____

_____

(2)

(b) Explain how the seas and oceans can decrease the amount of carbon dioxide in the atmosphere.

_____

_____

_____

_____

_____

_____

(3)

(c) (i) Give **one** reason why the amount of carbon dioxide in the atmosphere is increasing gradually.

_____

_____

(1)

(ii) Give **one** effect that increasing levels of carbon dioxide in the atmosphere may have on the environment.

_____

_____

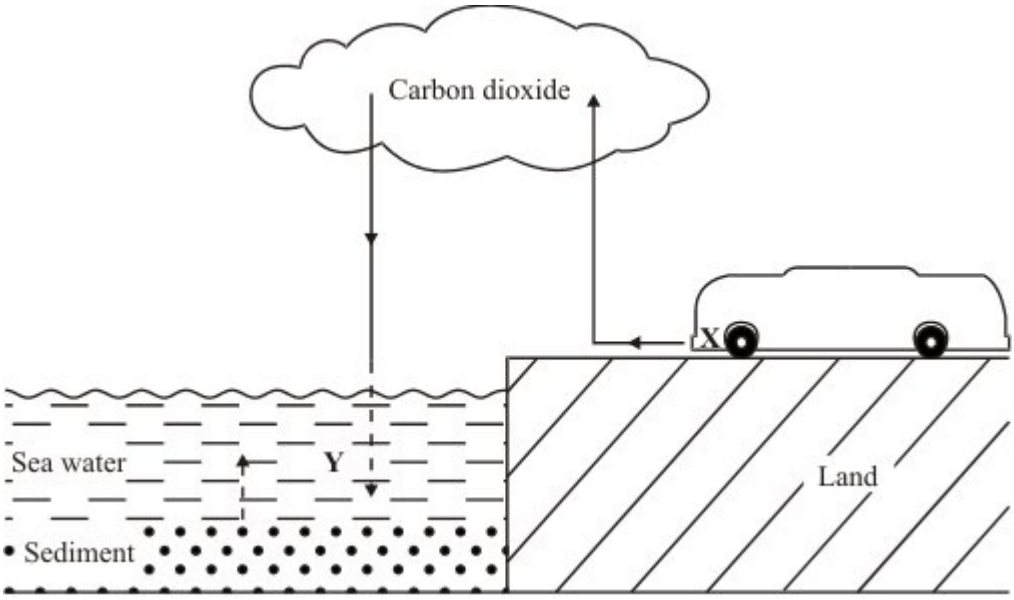
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(1)

(Total 9 marks)

Q31.

The amount of carbon dioxide in the atmosphere is increased by reactions that occur in internal combustion engines (**X**) and is decreased by reactions in sea water (**Y**).



Describe, in as much detail as you can, the reactions which take place at **X** and **Y**.

(a) **X** _____

_____

_____

_____

(2)

(b) **Y**

_____

_____

_____

_____

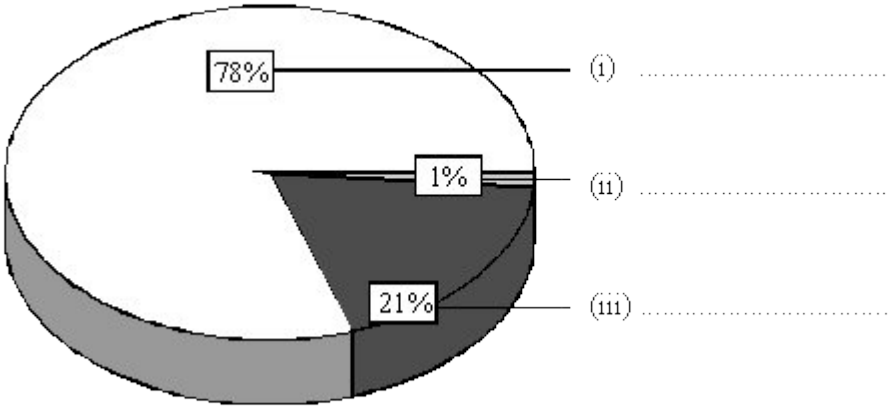
(3)

(Total 5 marks)

Q32.

(a) Air is a mixture of gases. The pie chart shows the percentages, by volume, of the main gases in dry air. Complete the chart by adding the names of these **three** gases.

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(3)

(b) Complete each of the **four** spaces in the sentences by choosing the best word from the box.

condenses	**condensing**	**evaporates**	**evaporating**
melts	**sea**	**trees**	**vapour**

The air in the atmosphere above this country always contains _____ .

Most of this is the result of water _____ from the surface of the

_____ . Some of it _____ to form millions of tiny

drops of water in clouds.

(4)

(c) Thousands of millions of years ago the Earth's early atmosphere was formed. Complete the following sentence.

The carbon dioxide in this early atmosphere probably came from _____

_____ .

(1)

(Total 8 marks)

Q33.

Read the passage, which is from the start of a magazine article. It will help you to answer the questions.

Third rock from the Sun

Geologists now have evidence that the Earth's crust began to form about four and a half billion years ago. The surface of the Earth was then at temperatures well above 100 °C and the atmosphere was mostly carbon dioxide with some ammonia, methane and water vapour. About a quarter of a billion years after it had first formed, the crust had become thicker and had cooled down to below 100 °C.

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Slowly, over a period of about three billion years, oxygen became established in the atmosphere. Some was released from the Earth's interior by volcanoes and some was produced, by the process of photosynthesis, by algae which had evolved in the seas.

(a) Explain how the first seas formed.

_____

_____

_____

(2)

(b) Briefly describe **two** processes which reduced the proportion of carbon dioxide in the Earth's atmosphere over the period of three billion years.

1. _____

_____

2. _____

_____

(2)

(Total 4 marks)

Q34.

(a) Apart from water vapour, two gases account for about 99% of the present atmosphere of our planet.

What are the names of these gases?

_____ and _____

(1)

(b) Scientists now have evidence that, over three billion years ago, our planet's atmosphere was mostly a mixture of water vapour, carbon dioxide, methane and ammonia. Since then the mixture has gradually changed.

(i) Suggest why there is now less water vapour in the atmosphere.

_____

_____

_____

_____

(2)

(ii) Suggest why there is now less carbon dioxide in the atmosphere.

_____

_____

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_____

_____

(2)

(c) The following information suggests that the continents of Africa and South America were once joined together but then began to move apart.

Fossilised remains of a large fern-like plant called Glossopteris have been found in the rocks of the Carboniferous period in both Africa and South America.

Fossilised remains of a freshwater reptile called Mesosaurus have been found in the rocks of the Permian period in both Africa and South America.

No fossils of identical organisms have been found in the rocks of the Jurassic or the Cretaceous period in Africa or South America.

The following table gives the names of some of the periods in our planet's geological history.

Start of the period millions of years ago	Name of the period
2	Quaternary
65	Tertiary
136	Cretaceous
190	Jurassic
225	Triassic
280	Permian
345	Carboniferous
395	Devonian
435	Silurian
500	Ordovician
570	Cambrian

(i) Use this information to suggest when Africa and South America began to move apart.

About _____ million years ago.

(1)

(ii) What conditions were necessary for Africa and South America to move apart?

_____

_____

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_____

_____

_____

_____

(3)

(Total 9 marks)

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