Q1. 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.

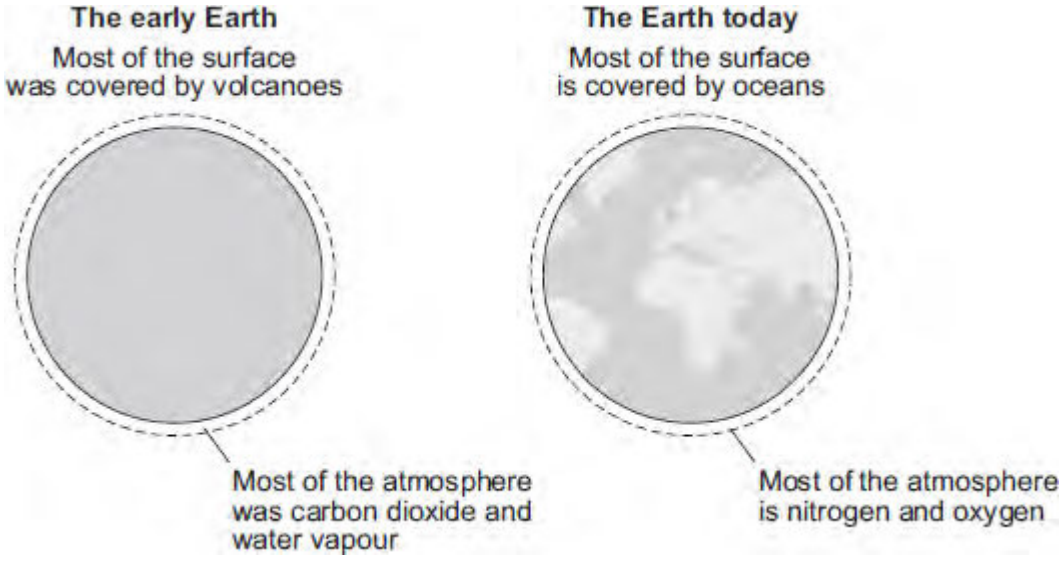
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(1)

(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.

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(6)
(Total 7 marks)

Q2. 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.

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(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

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decreases atmospheric pollution.

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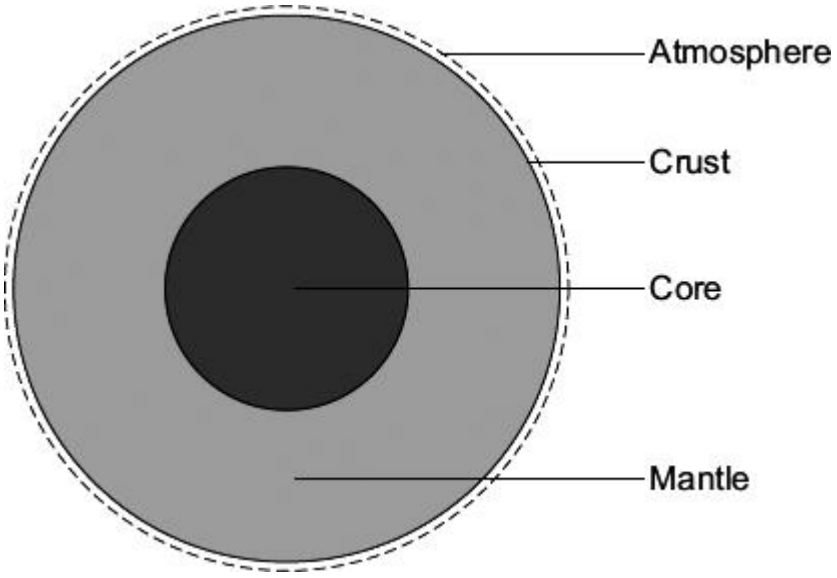
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(4)
(Total 10 marks)

Q3. The Earth has a layered structure and is surrounded by an atmosphere.



(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?

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(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.

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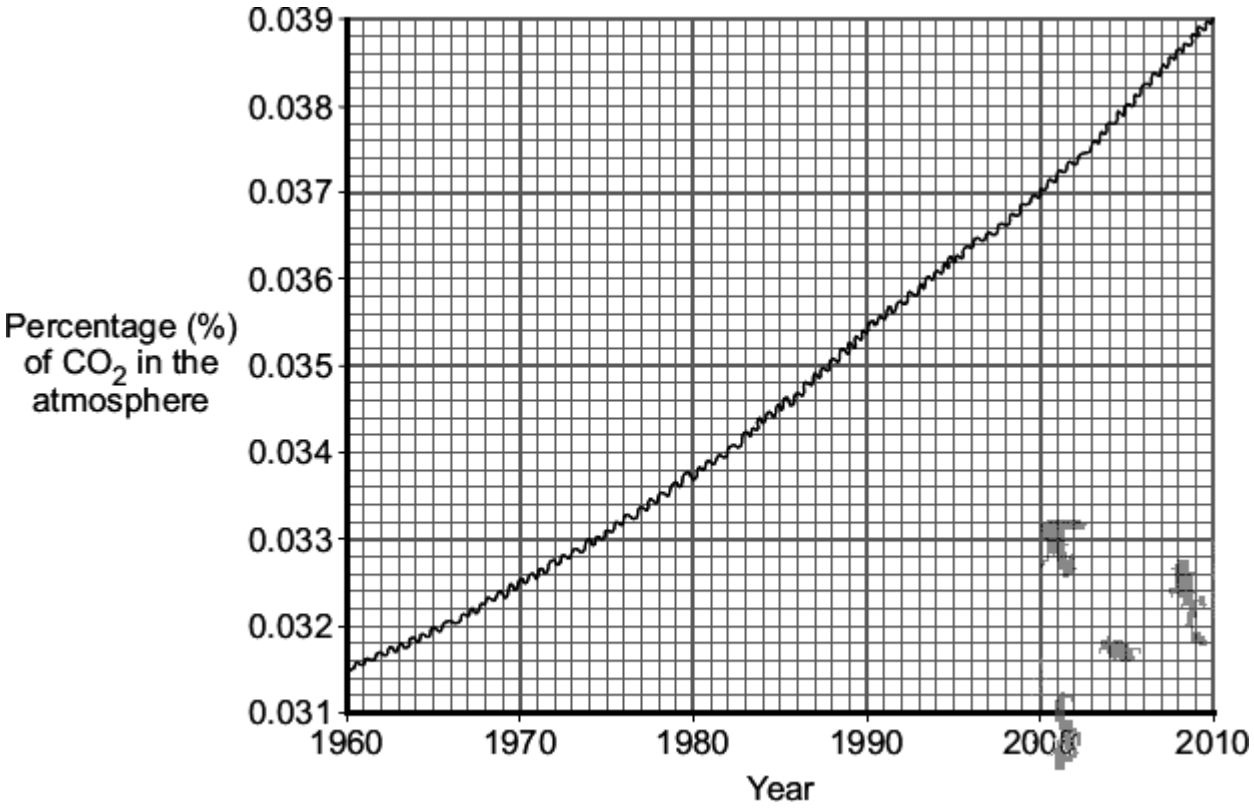
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(2)

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



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

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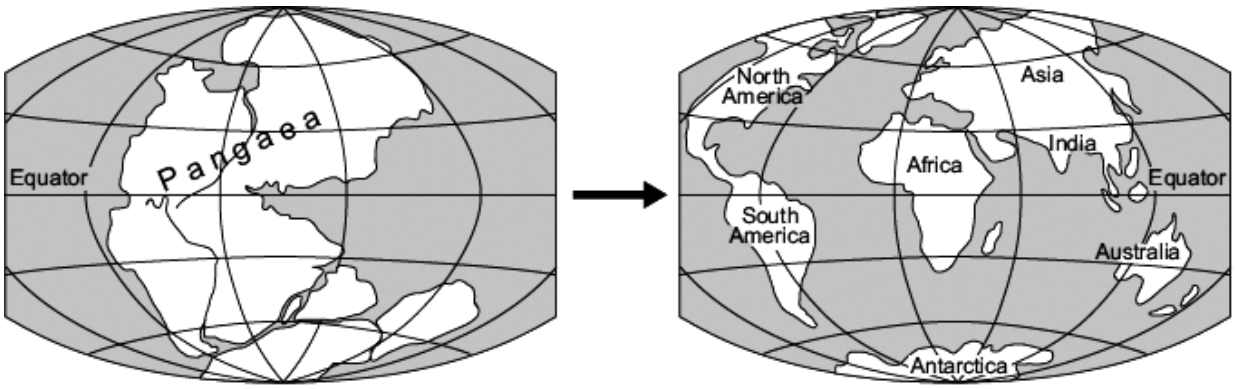
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(3)

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



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.*

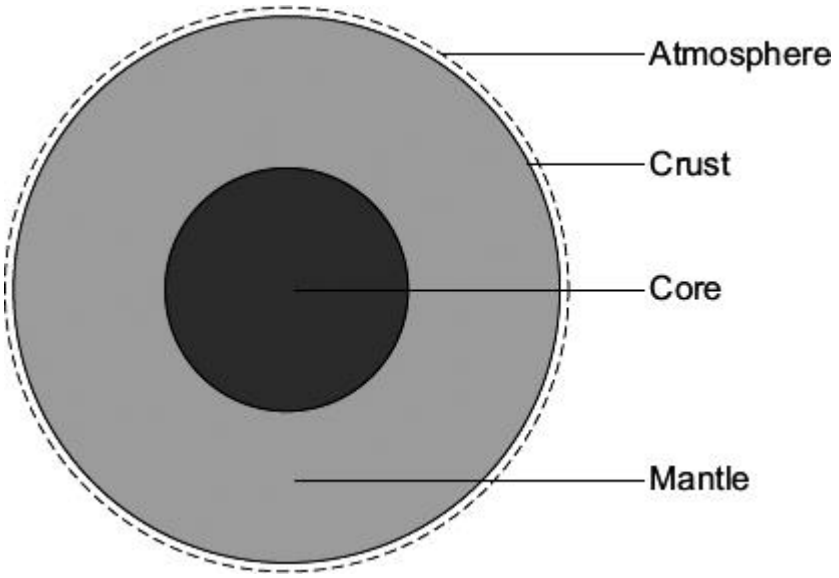
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(1)

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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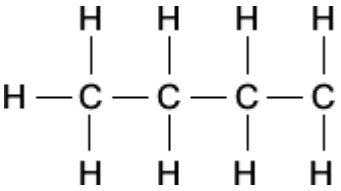
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(3)
(Total 11 marks)

Q4. Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

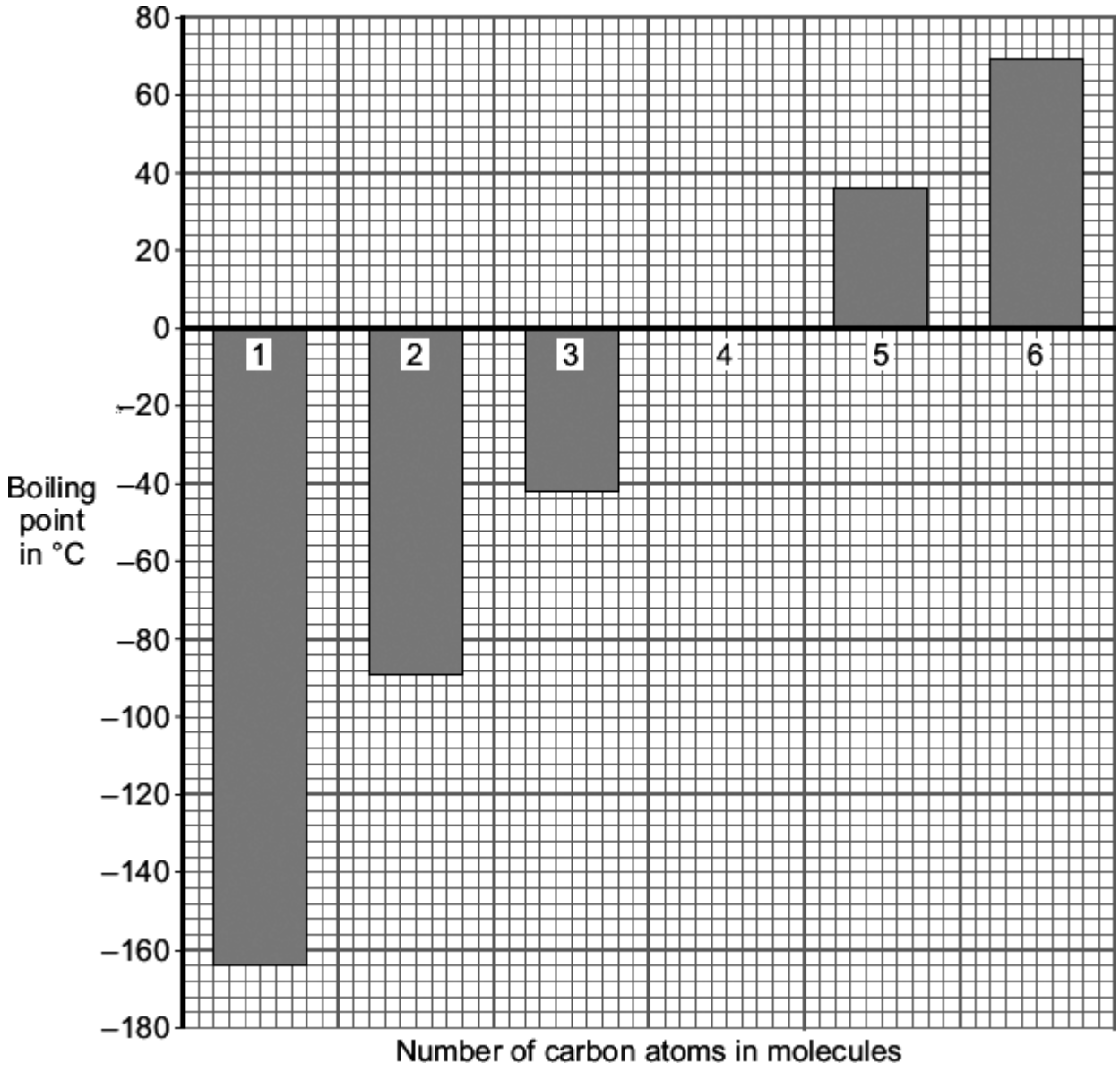
(a) The general formula of an alkane is C_nH_{2n+2}

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.



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

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(1)

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

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(2)

(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?

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(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.

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(2)
(Total 8 marks)

Q5. 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?

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(1)

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

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

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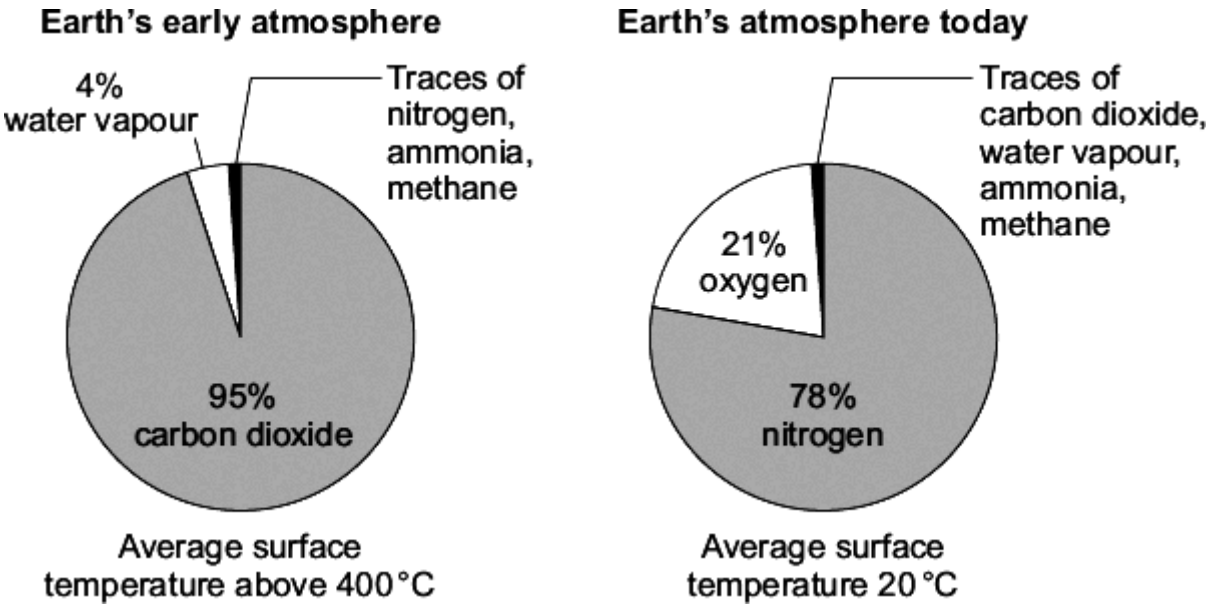
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(3)
(Total 4 marks)

Q6. (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.

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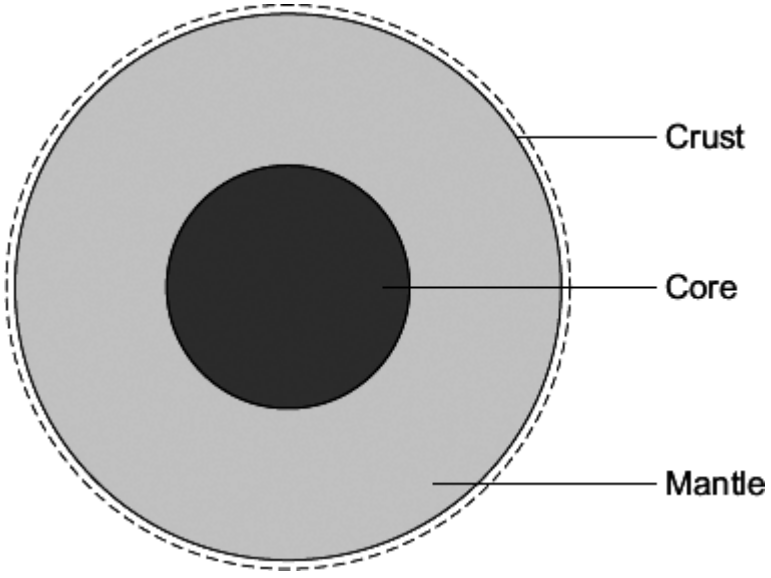
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2 .....

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(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?

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(1)

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

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(3)
(Total 8 marks)

Q7. 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?

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(1)

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

Temperature = ... °C

(1)

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

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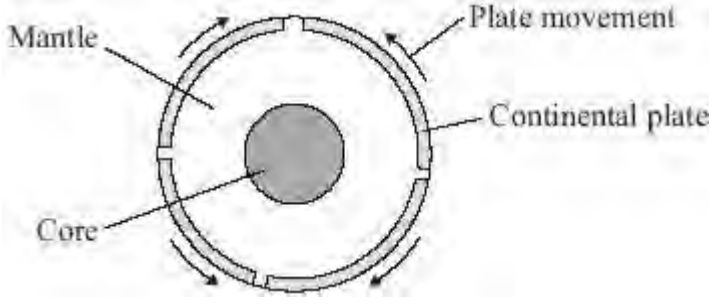
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(2)

(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.

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(1)

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

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(3)
(Total 8 marks)