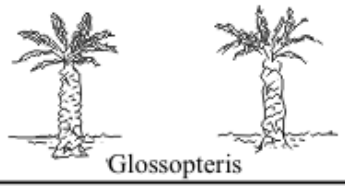
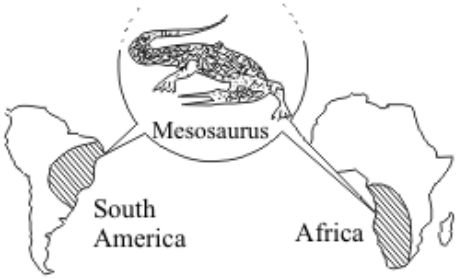
Q1. The following information suggests that South America and Africa were once attached and then moved apart.

Fossil remains of a large fern-like plant are found in Carboniferous rocks of S. Africa and S. America.	 Glossopteris
Fossil remains of a freshwater alligator-type reptile are found in the Permian rocks of S. America and Africa.	
No fossils of similar organisms are found in Jurassic/Cretaceous rocks of S. Africa and S. America.	

Suggest **when** South America and Africa began to move apart.

[Make use of dates in your answer, where possible.]

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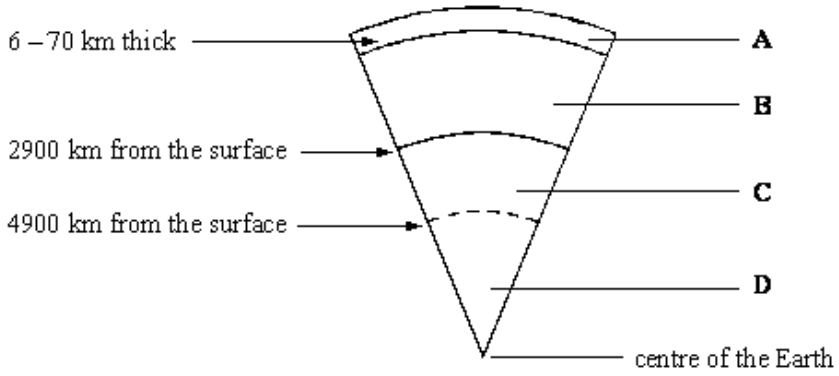
(Total 3 marks)

Q2. The diagram represents a section through the Earth showing the layers which are labelled **A**, **B**, **C** and **D**.



(a) Give the name of:

(i) layer **A** .....

(ii) layer **B** .....

(2)

(b) Give one difference between layer **C** and layer **D**.

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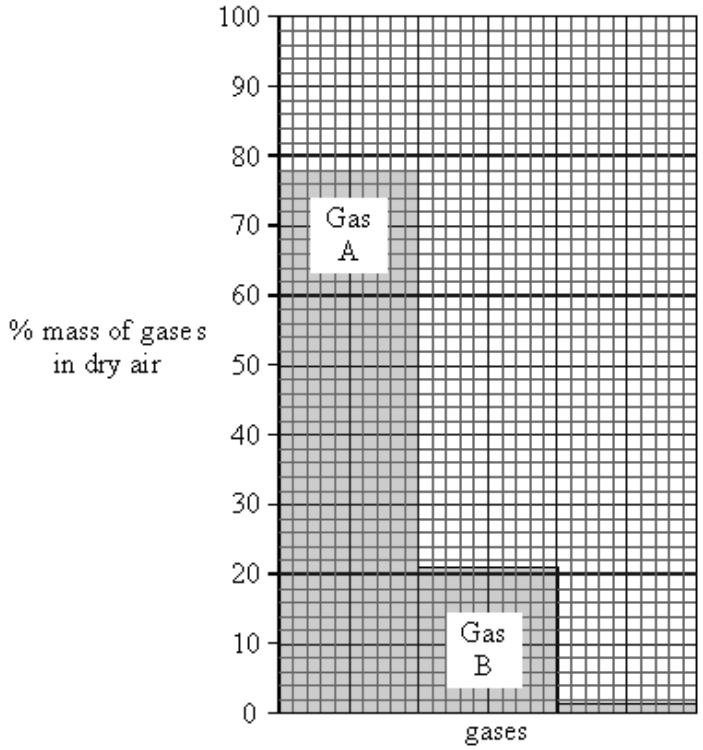
(1)

(Total 3 marks)

Q3. The bar chart below shows the percentage by mass of gases in dry air. Two of the gases are labelled as A and B.



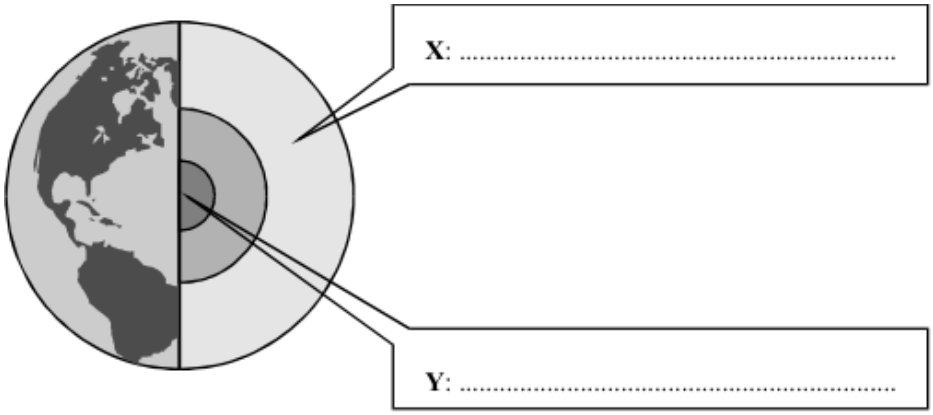
What are the names of gas A and gas B?

Gas A is .....

Gas B is .....

(Total 2 marks)

Q4. (a) The diagram shows the layered structure of the Earth.



(i) Write in the boxes the name of layer **X** and the name of layer **Y**.

(2)

(ii) The overall density of the Earth is about 5500 kg/m^3. The average density of the rocks in the Earth's crust is about 2800 kg/m^3. What does this suggest about the material that makes up the lower layers of the Earth?

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(2)

(b) In 1915, the scientist Alfred Wegener suggested that Africa and South America had once been joined but had since drifted apart. Evidence for his theory came from the animal fossils found in the two continents. The fossils are almost the same, although animals now living in Africa and South America are different. Other scientists did not agree with Wegener and suggested that a land bridge had once joined the two continents.

How could scientists use the idea of a land bridge to explain the evidence put forward by Wegener?

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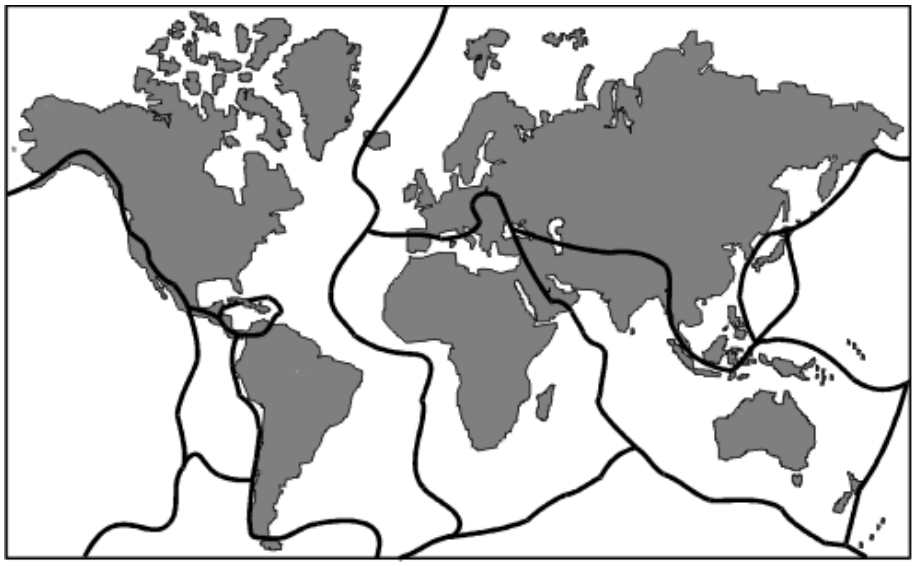
(2)

(c) Scientists now think that the outer layer of the Earth is cracked into a number of large pieces called tectonic plates. The tectonic plates are moving very slowly. The lines on the diagram show the boundaries between the major tectonic plates.



(i) Explain why there are no major earthquakes in Britain.

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(2)

(ii) What is causing the tectonic plates to move?

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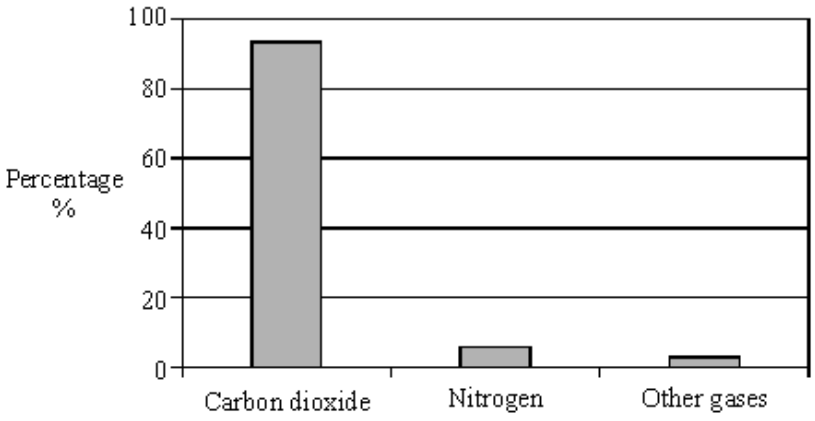
(1)

(Total 9 marks)

Q5. 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 .....

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2 .....

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3 .....

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(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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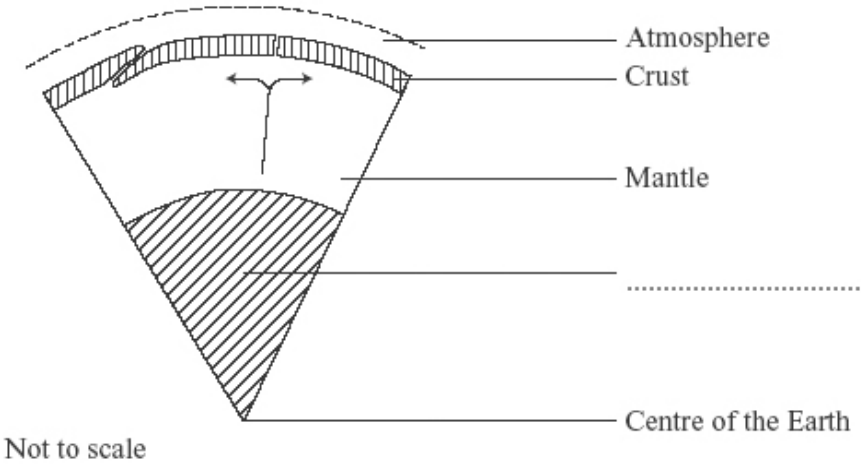
(2)
(Total 5 marks)

Q6. 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.



Not to scale

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

(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.

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(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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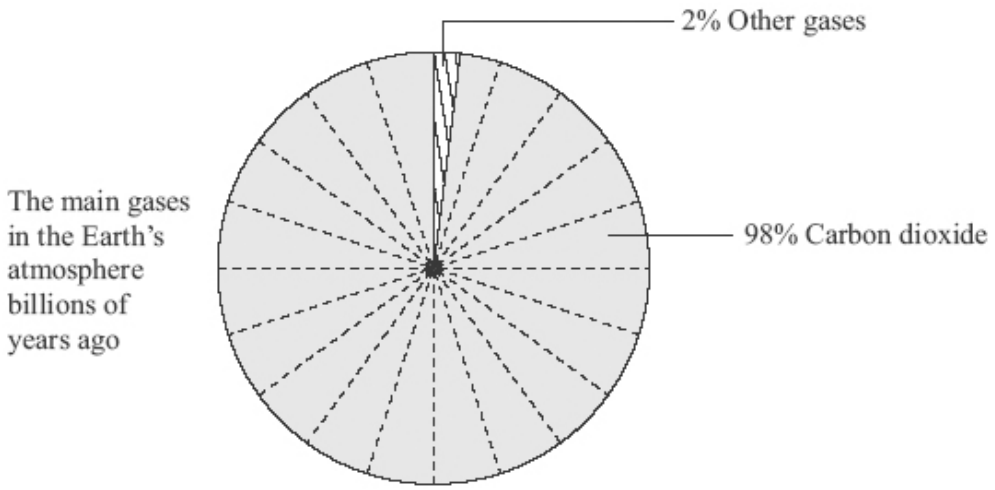
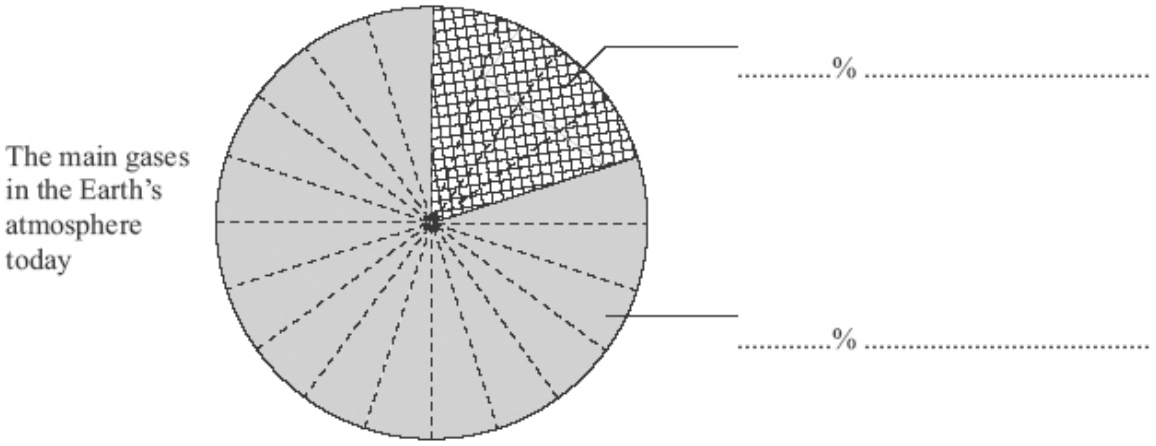
(4)

(Total 10 marks)

Q7. Life on Earth would not exist without the atmosphere. Billions of years ago the composition of the Earth's atmosphere was very different from the composition today.



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



(2)

(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?

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(1)

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

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(1)

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

Complete the word equation for this reaction.

methane + ... → carbon dioxide + ...

(2)

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

Explain why.

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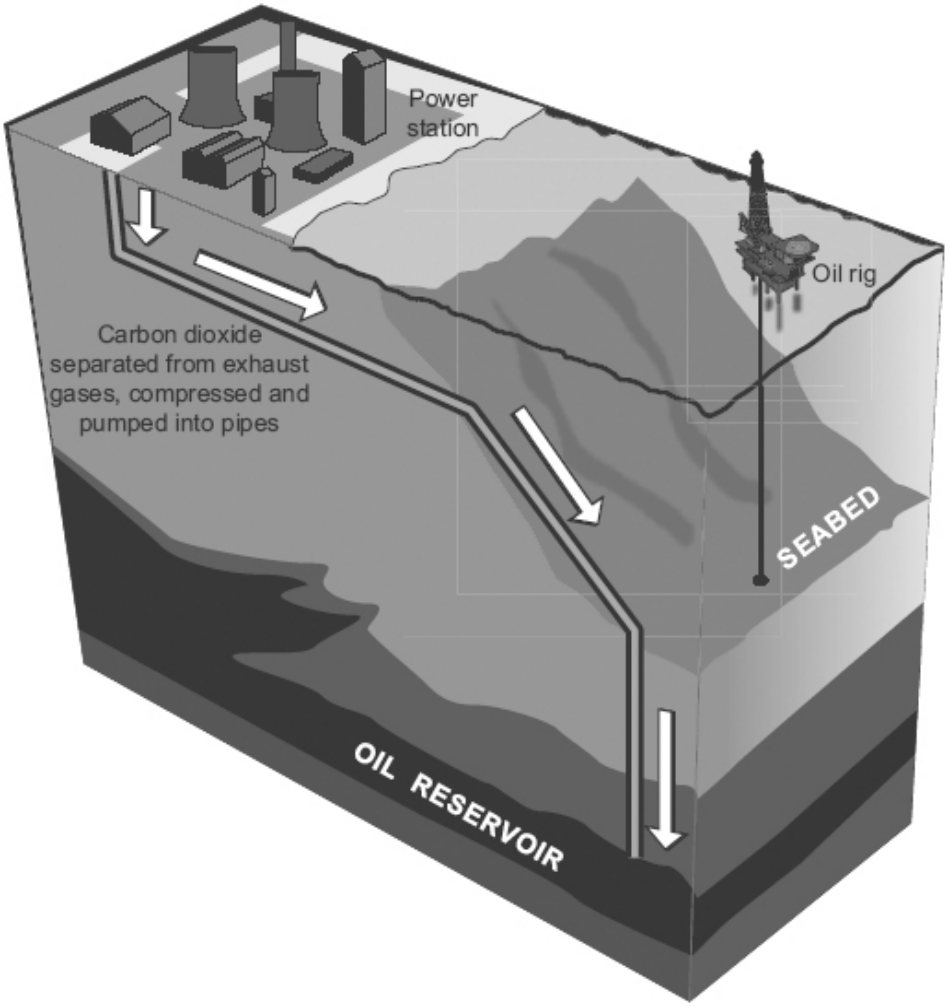
(2)

(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)

Q8. (a) Two hundred years ago, scientists thought that the Earth was about 400 million years old. This estimate came from the idea that the centre of the Earth was still molten. More recently, measurement of radioactivity in rocks has shown that the Earth is much older than 400 million years.

Suggest **one** reason why scientists now know that the Earth is much older than 400 million years.

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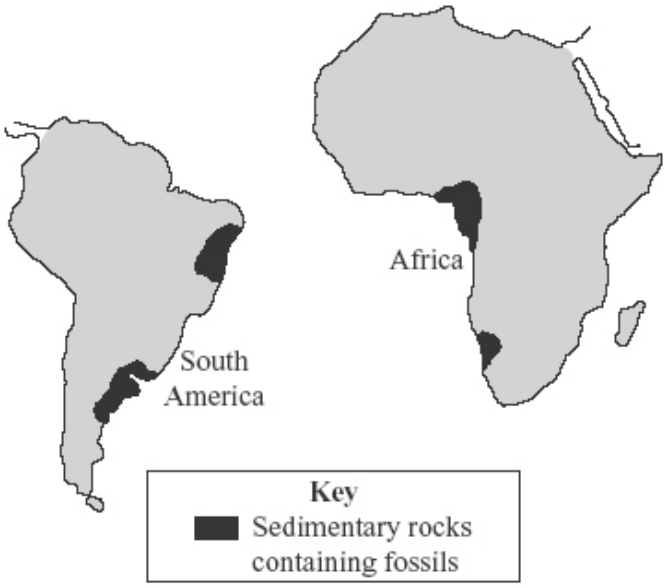
(1)

(b) About one hundred years ago there was a scientist called Alfred Wegener. He found evidence that the continents, such as South America and Africa, had once been joined and then drifted apart.



Use the diagram to suggest **two** pieces of evidence that could be used to show that the continents had once been joined.

1 .....

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2 .....

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(2)

(c) About fifty years ago, new evidence convinced scientists that the Earth's crust is made up of tectonic plates that are moving very slowly.

Give **two** pieces of evidence that have helped to convince these scientists that the tectonic plates are moving.

1 .....

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2 .....

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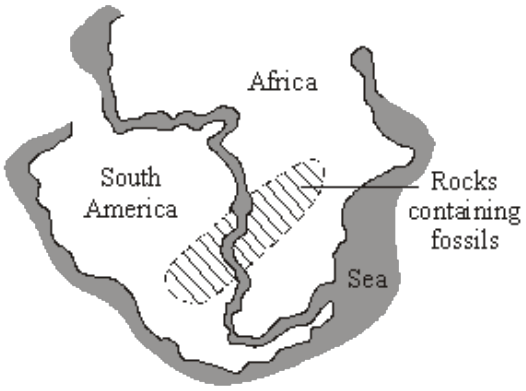
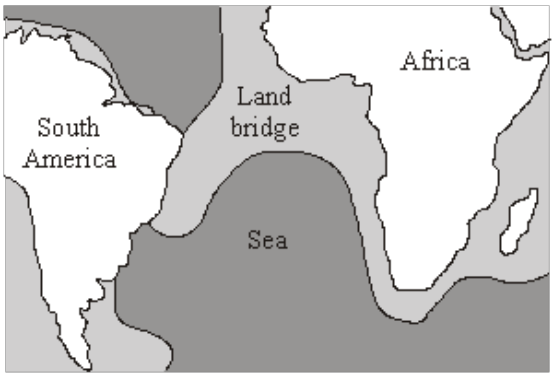
(2)
(Total 5 marks)

Q9. A map of the world shows that the outline of South America looks as if it would fit into the west coast of Africa.

- Alfred Wegener in 1920 suggested his idea that the continents had been joined together but then slowly drifted apart.



- Other scientists in 1920 said that the continents were fixed on solid Earth and had been joined by a land bridge.



Modern South American animals are different from modern African animals.

Most fossils of animals found in South America and Africa are exactly the same.

(a) Consider the information above.

(i) What evidence gave Wegener the idea that the continents of South America and Africa had been joined?

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(1)

(ii) Suggest **two** reasons why the other scientists in 1920 thought that Wegener was wrong.

1 .....

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2 .....

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(2)

(b) Complete the sentences by writing in the correct words.

Recent evidence has supported Wegener's idea.

The Earth's ..... and the upper part of the mantle are now thought to be composed of tectonic plates.

Heat released by radioactive processes causes convection currents within the Earth's ..... These convection currents cause the plates to move a few centimetres per .....

(3)

(Total 6 marks)

Q10. 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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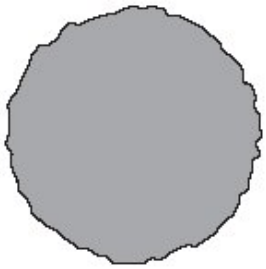
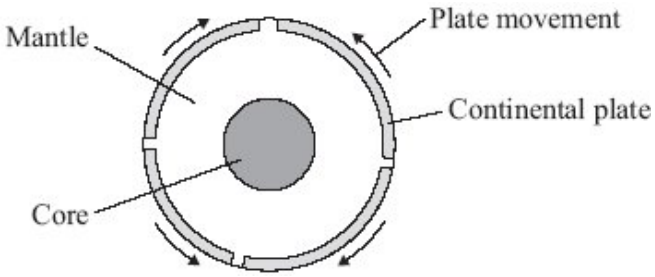
(2)

(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)

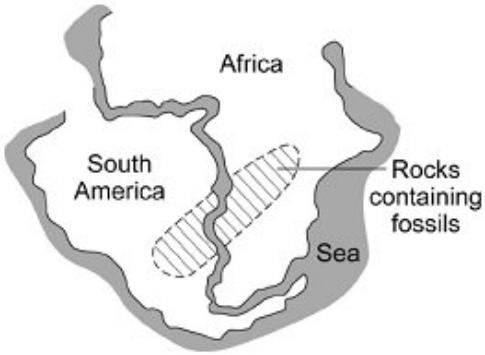
Q11. Evidence shows that the Earth formed from a molten ball of rocks and minerals.

Before 1900 many scientists thought that the Earth's mountains and continents formed in fixed positions when the molten ball of rocks and minerals cooled and wrinkled.

(a) In 1912 Alfred Wegener suggested his hypothesis of continental drift.

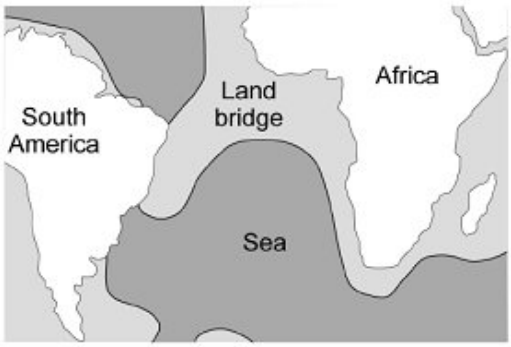
The areas of rocks shown on **Map 1** contain fossils of the same type of animals.

Today animals in Africa are different from animals in South America.



Map 1

Wegener suggested his hypthesis that all of the continents, including Africa and South America, had been joined together but then drifted slowly apart.



Map 2

In 1920 other scientists stated that all of the continents were in fixed positions, including Africa and South America, and that they had once been joined together by a land bridge.

(i) Use the information to suggest **two** pieces of evidence that may have led Wegener to propose his hypothesis that continents move.

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(2)

(ii) Suggest why, in 1920, other scientists thought that Wegener's hypothesis was wrong.

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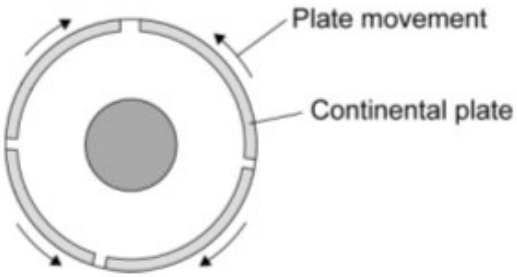
(2)

(b) In 1962 scientists produced the theory of plate tectonics.

The theory of plate tectonics supported Wegener's hypothesis that continents move.



Tectonic plates move a few centimetres a year.

Complete the sentences about what causes the movement of the Earth's tectonic plates.

Deep inside the Earth ..... processes release large

amounts of energy. These processes heat up the substances in the Earth's

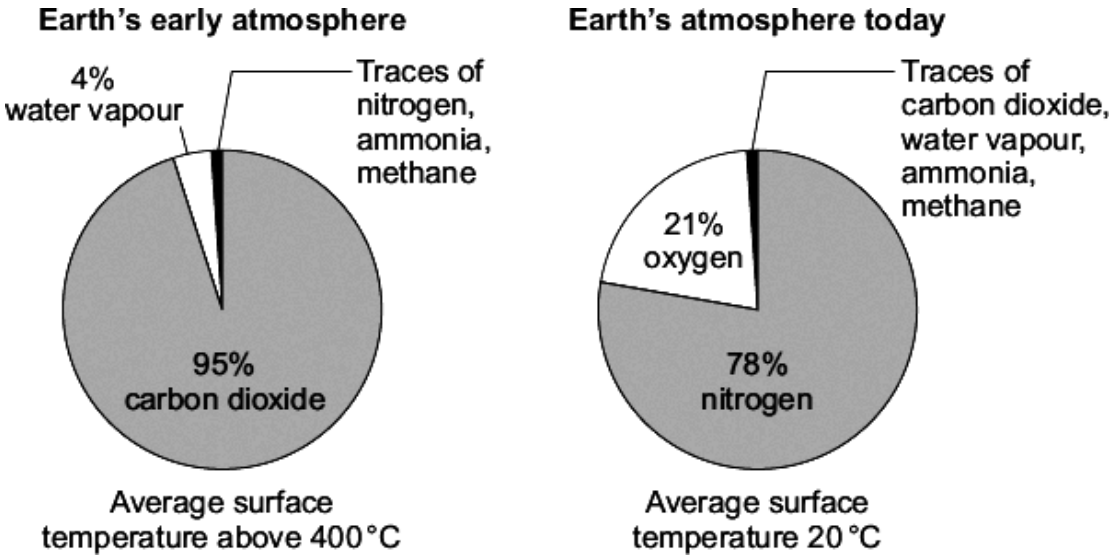
..... producing convection currents.

(2)
(Total 6 marks)

Q12. (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 .....

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2 .....

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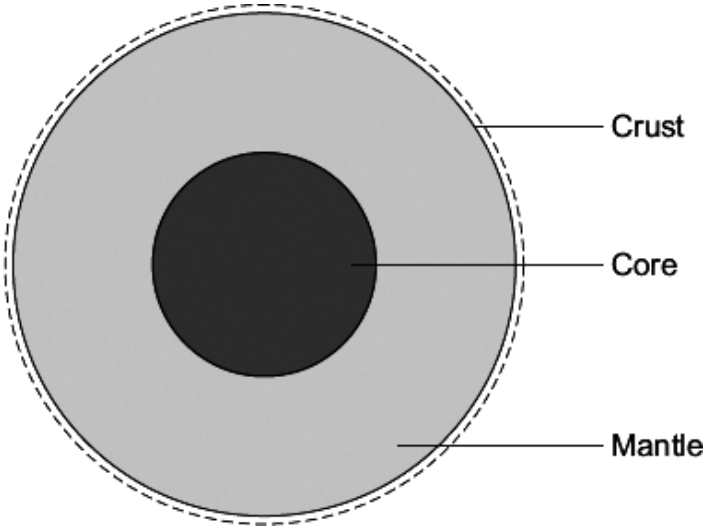
(2)

(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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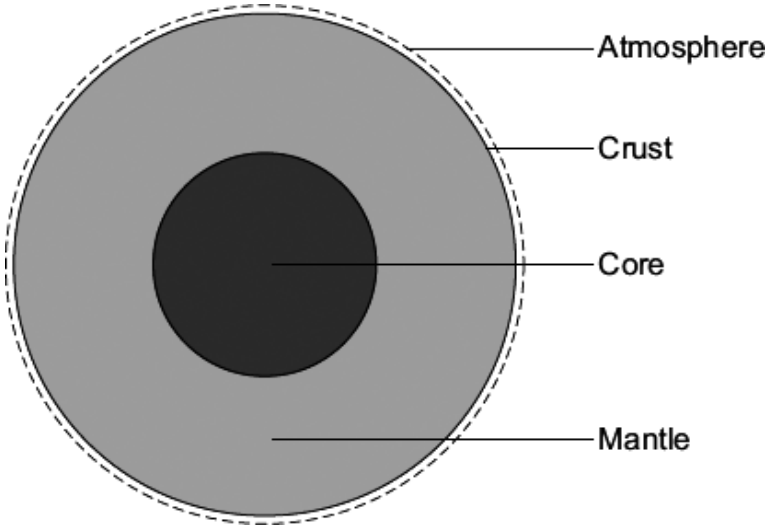
(3)
(Total 8 marks)

Q13. 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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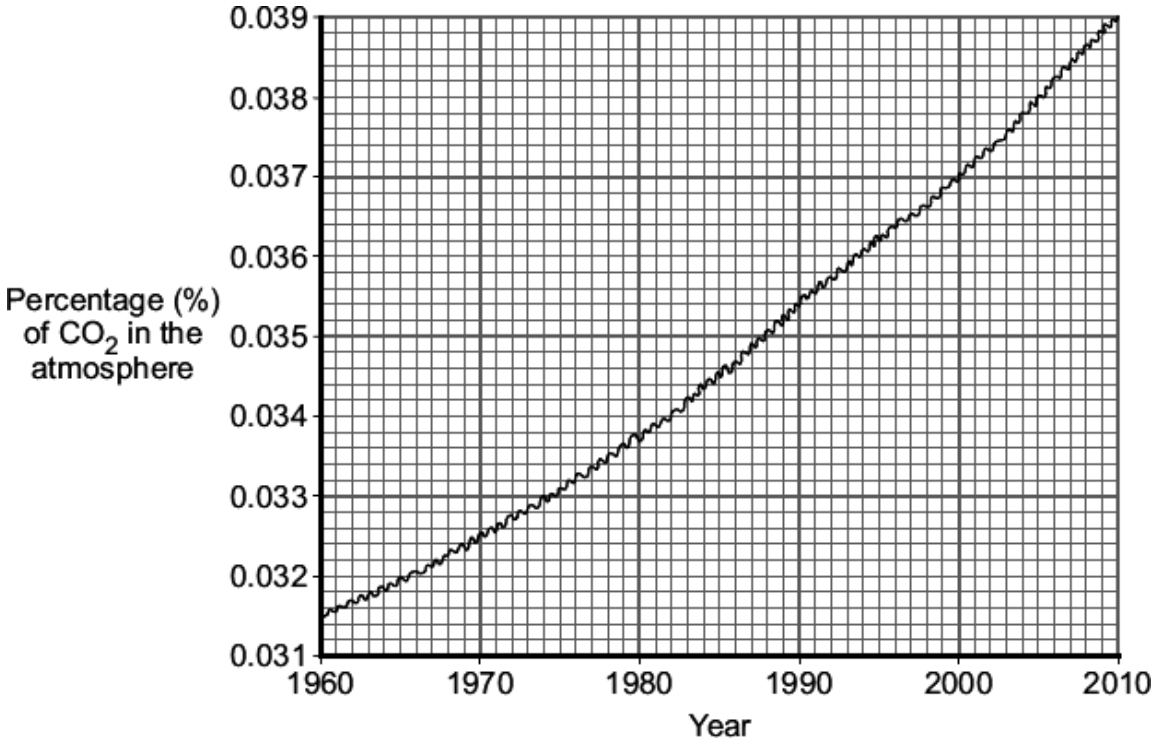
(2)

(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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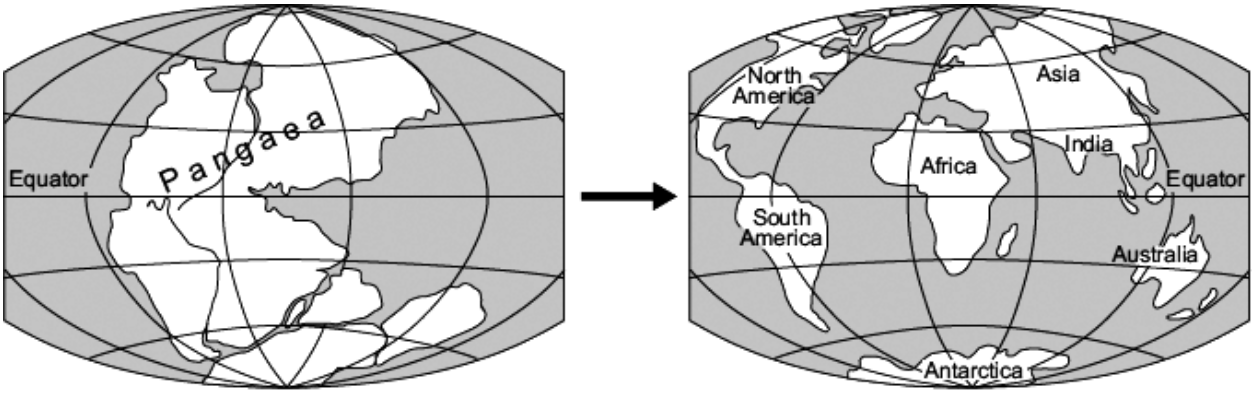
(3)

(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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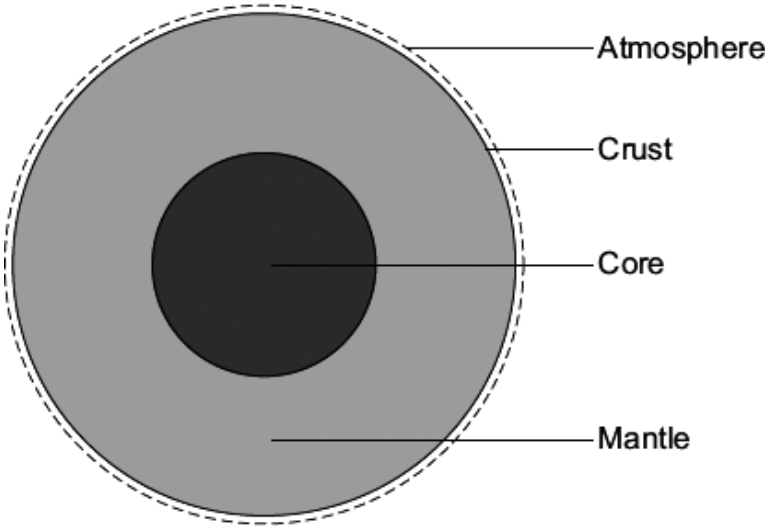
(1

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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(3)

(Total 11 marks)

Q14. Venus is often compared to the Earth. The Earth's early atmosphere was mainly carbon dioxide like the atmosphere of Venus today.

Atmosphere of Earth today		Atmosphere of Venus today	
Gas	**Percentage (%)**	**Gas**	**Percentage (%)**
Nitrogen	78	Nitrogen	3.5
Oxygen	21	Oxygen	A trace
Carbon dioxide	0.04	Carbon dioxide	96

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

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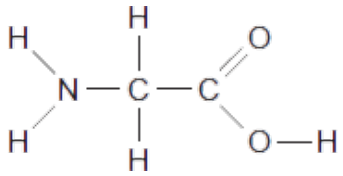
(2)

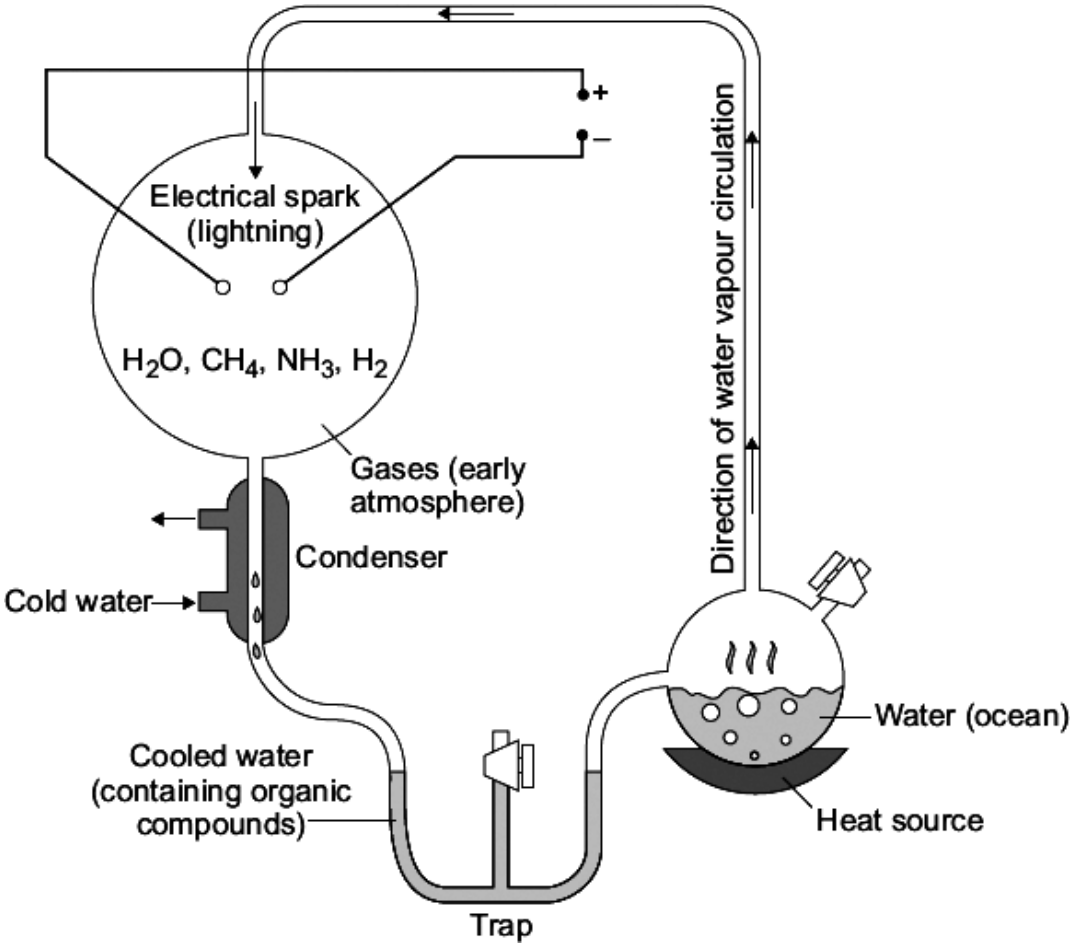
(b) In the 1950s two scientists, Miller and Urey, investigated the origin of life on Earth.
Miller and Urey used the gases that they believed were in the Earth's early atmosphere and used water to represent the oceans.
The gases they used were methane (CH_4), ammonia (NH_3) and hydrogen (H_2).
A continuous electrical spark was used to simulate lightning storms.

After one week the Miller-Urey experiment had produced amino acids.
Amino acids are essential to life.

The simplest amino acid is glycine (aminoethanoic acid).



The apparatus used in the Miller-Urey experiment is shown in the diagram.



Use the information above and in the diagram to answer these questions.

(i) Miller and Urey used methane, ammonia and hydrogen for the Earth's early atmosphere.

Suggest why.

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(1)

(ii) The experiment provides only weak evidence of how amino acids formed on Earth.

Suggest **two** reasons why.

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(2)

(Total 5 marks)

Q15. 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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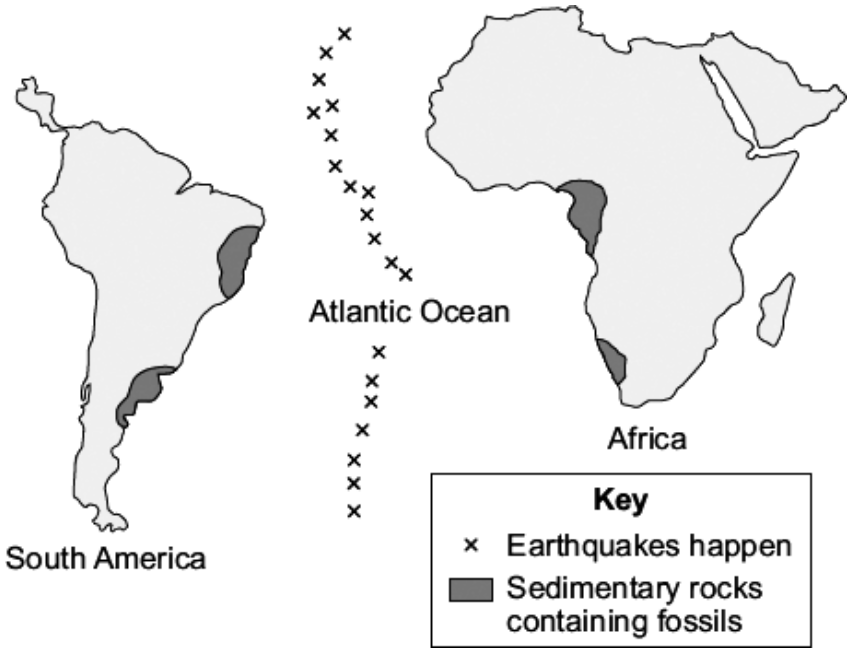
(4)
(Total 10 marks)

Q16. Earthquakes happen in some places on Earth.

The diagram shows some of these places that are between the continents of South America and Africa.



(a) (i) Why do earthquakes happen in the places shown on the diagram?

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(1)

(ii) Scientists cannot predict when earthquakes will happen.
Suggest why.

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(1)

(b) In 1915, Alfred Wegener proposed the idea of continental drift.
He suggested that South America and Africa had once been joined.
Most scientists in 1915 did not accept his idea.

(i) In 1915, Wegener's idea was **not** accepted by most scientists.
Suggest **one** reason why.

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(1)

(ii) Use the information in the diagram to suggest **two** pieces of evidence that led to Wegener's idea being accepted by most scientists.

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(2)

(c) Explain, in as much detail as you can, what is causing the continents of South America and Africa to move further apart.

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(3)
(Total 8 marks)

Q17. There are about 500 000 earthquakes every year. On 12 January 2010 there was an earthquake near Port-au-Prince in Haiti. Many buildings were destroyed causing the deaths of thousands of people. The earthquake did not come as a surprise to scientists who predicted the earthquake a week earlier. The Government and people ignored the prediction.

By Photo Marco Dormino/ The United Nations United Nations Development Programme [CC-BY-2.0], via Wikimedia Commons

The Richter scale is used to compare the size of earthquakes.

Richter scale value	Effect of earthquake
Less than 2	People do not feel the earthquake.
2 – 4	People feel the earthquake but the earthquake rarely causes damage to buildings.
4 – 5	People feel the earthquake and the earthquake causes minor damage to a few buildings.
5 – 6	Shaking of the ground and major damage to some buildings.
6 – 8	Violent shaking of the ground and many buildings destroyed.
8 – 10	Very violent shaking of the ground and most buildings destroyed.

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

(i) Suggest the Richter scale value for the earthquake that happened near Port-au-Prince in Haiti.

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(1)

(ii) Governments and people often ignore scientists' predictions of an earthquake.

Suggest **three** reasons why.

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(3)

(b) During the twentieth century many scientists proposed ideas about the cause of earthquakes and about the Earth's crust.
In 1912 Alfred Wegener proposed his idea of '*continental drift* '.
In 1930 Arthur Holmes suggested his idea of '*mantle dynamics*'.

(i) What did Wegener mean by '*continental drift*'?

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(2)

(ii) Holmes' idea of '*mantle dynamics*' provided an explanation for Wegener's idea of '*continental drift*'.

Suggest what '*mantle dynamics*' is and state what causes '*mantle dynamics*'.

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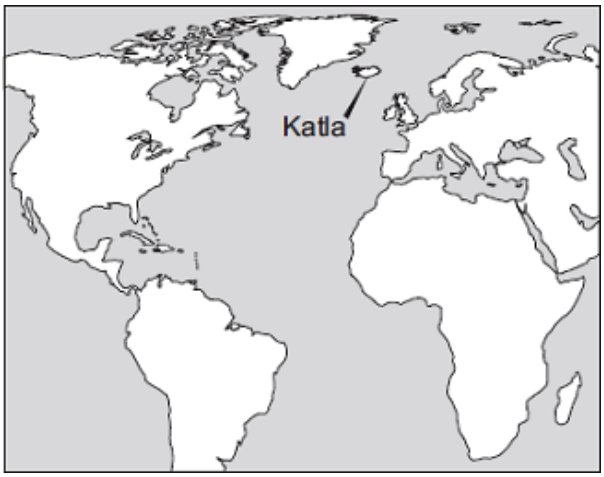
(2)
(Total 8 marks)

Q18. Iceland has many volcanoes.

(a) Scientists are monitoring a volcano in Iceland, called Katla.
There has been an increase in the number of tremors (small earthquakes) in this area.



(i) Why does Iceland have volcanoes?

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(1)

(ii) Scientists predict that Katla may erupt soon.
However, scientists do **not** know exactly when Katla will erupt.

Suggest **one** reason why.

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(1)

(b) During the first billion years of the Earth's existence its surface was covered with volcanoes.

Describe how this volcanic activity led to the formation of oceans.

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(2)

(c) The Earth has about 500 000 earthquakes each year.

Describe how activity within the Earth results in earthquakes.

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(3)
(Total 7 marks)