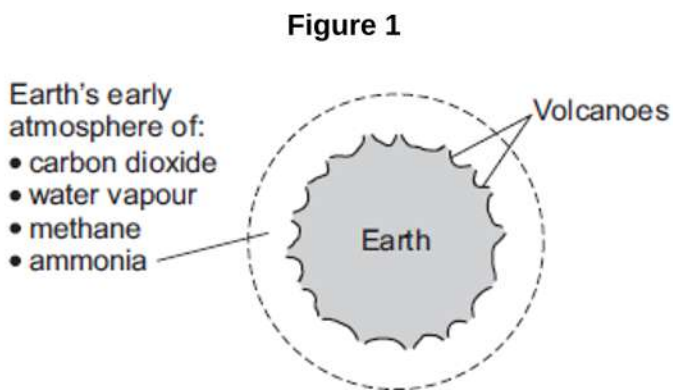




1. This question is about the Earth and its atmosphere.

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



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.

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?

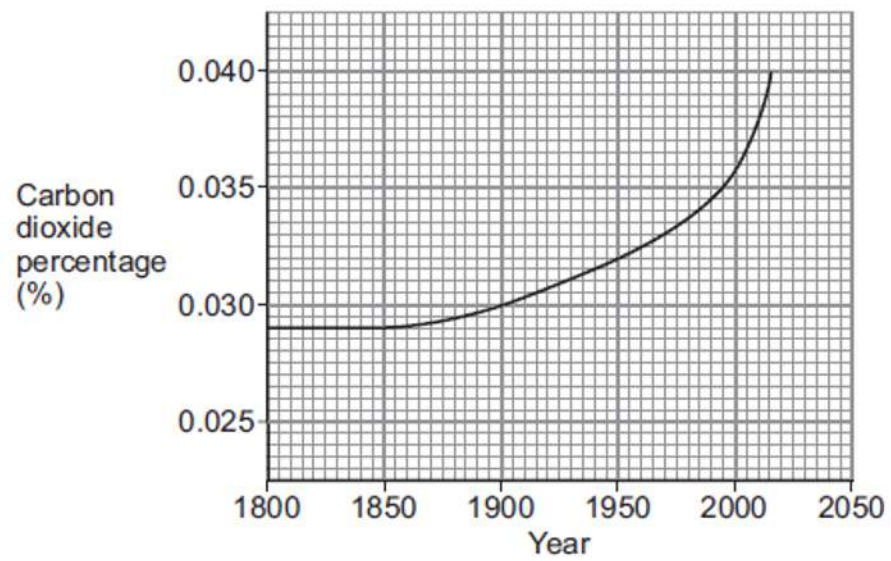
Tick (✓) **one** box.

- 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



(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)

2.

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

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

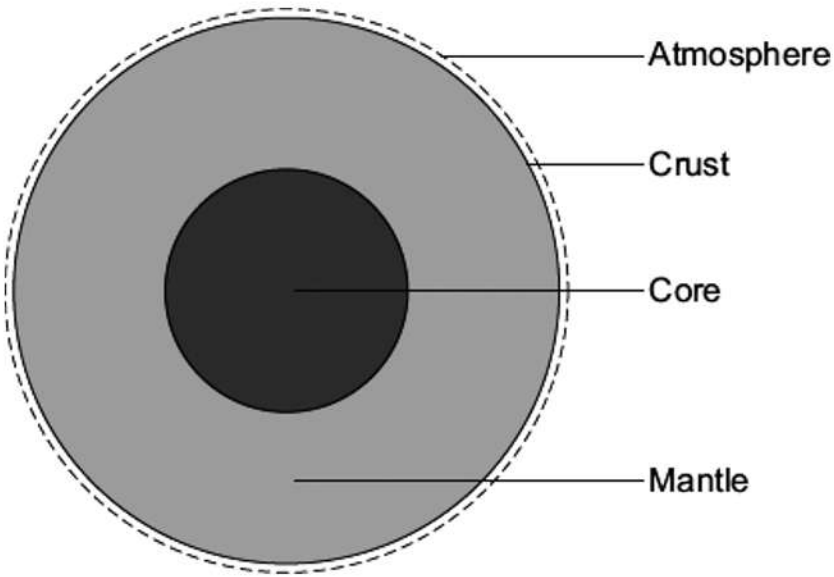
Suggest **one** reason why there are many theories.

(1)



3.

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?

(2)

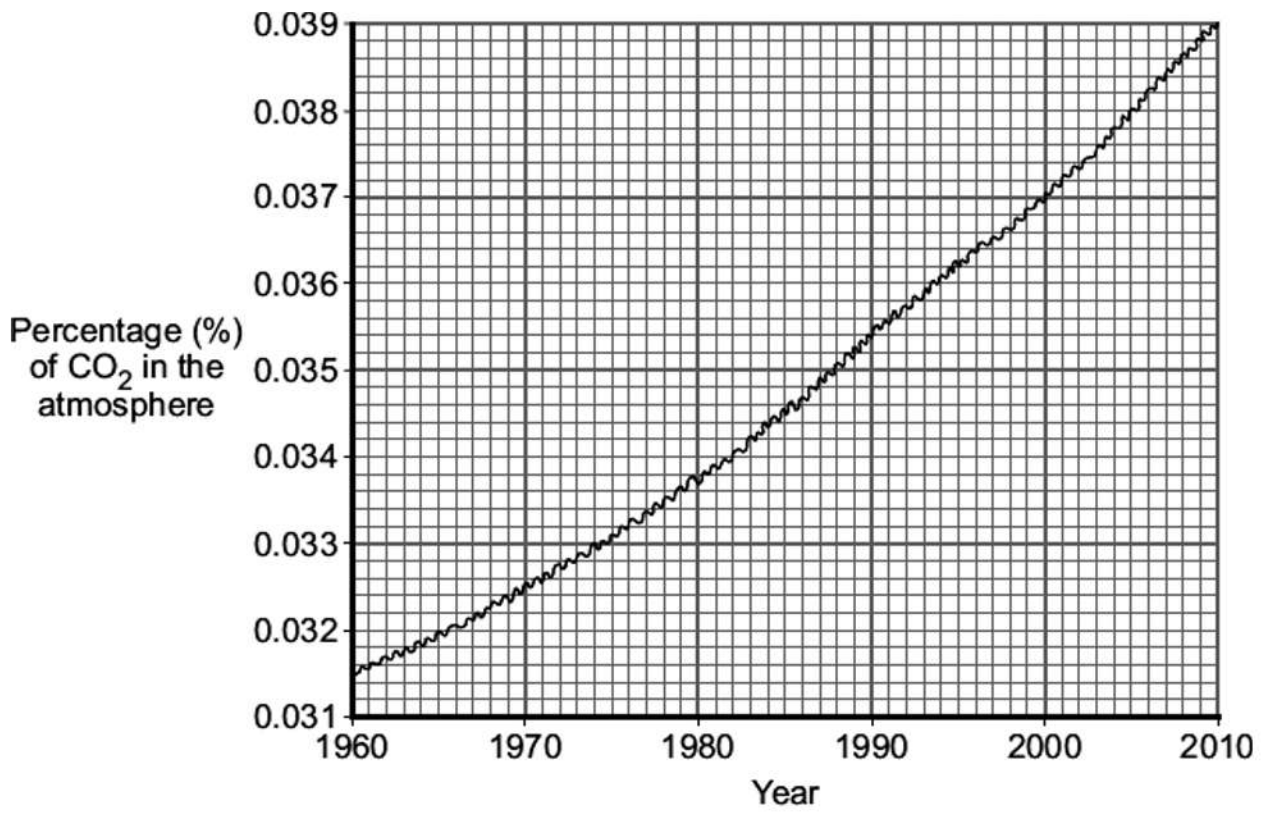
(ii) About 60 million years ago a large meteorite hit the Earth. This meteorite heated limestone in the Earth's crust causing the release of large amounts of carbon dioxide.

Explain how carbon dioxide is released from limestone.

(2)



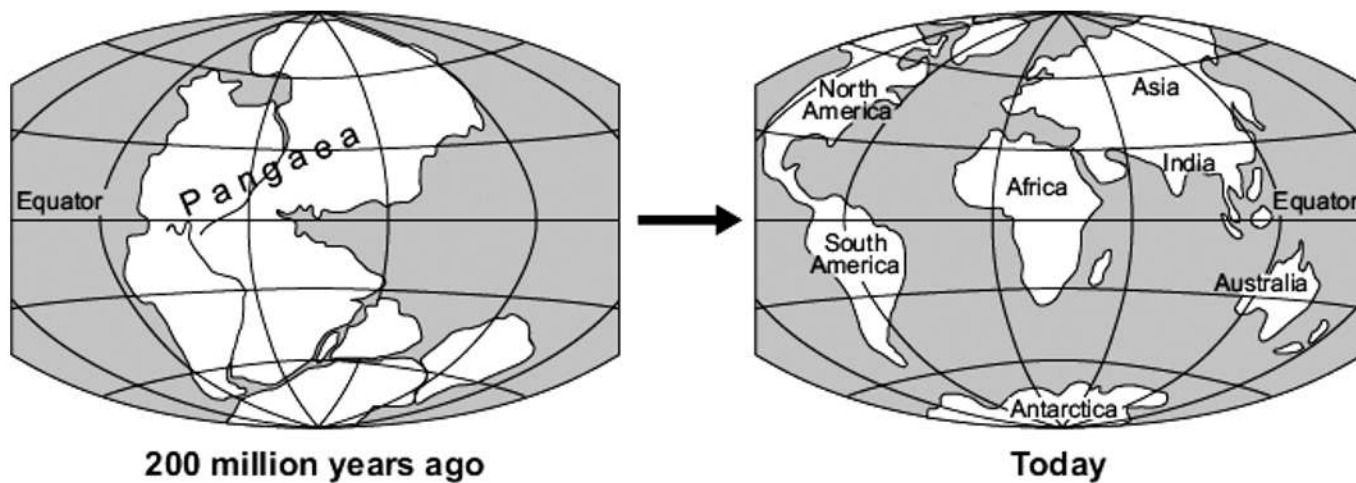
(b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



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.



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.

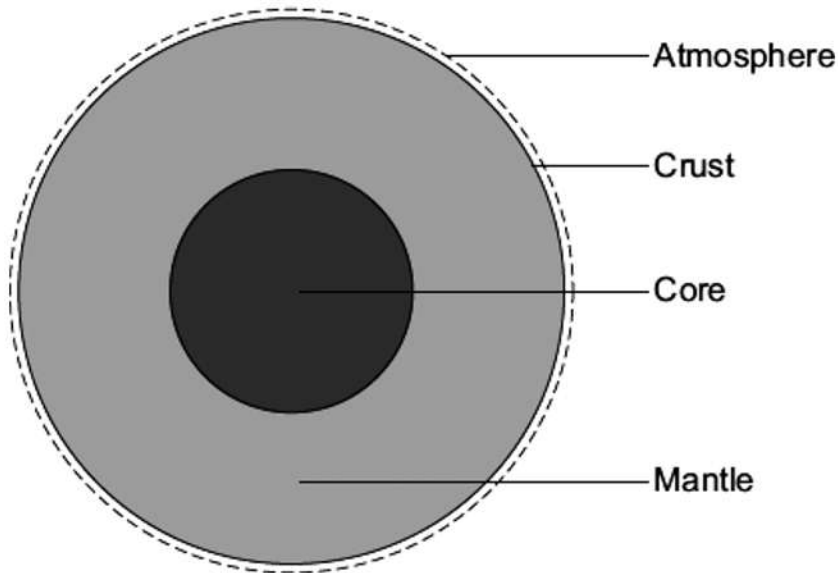
- (i) Suggest why most scientists in 1915 could not accept Wegener's idea of *continental drift*.

(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.

(3)
(Total 11 marks)



4.

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 $-23\text{ }^{\circ}\text{C}$		Average surface temperature $15\text{ }^{\circ}\text{C}$	

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 $^{\circ}\text{C}$
Nitrogen	95	-196
Methane	5	-164
Average surface temperature $-178\text{ }^{\circ}\text{C}$		

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

(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)

5.

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 $100\text{ }^\circ\text{C}$ 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 $100\text{ }^\circ\text{C}$.

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)

6.

(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.

(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?

(3)
(Total 9 marks)