



## New Document 1

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **41 minutes**

Marks: **41 marks**

Comments:

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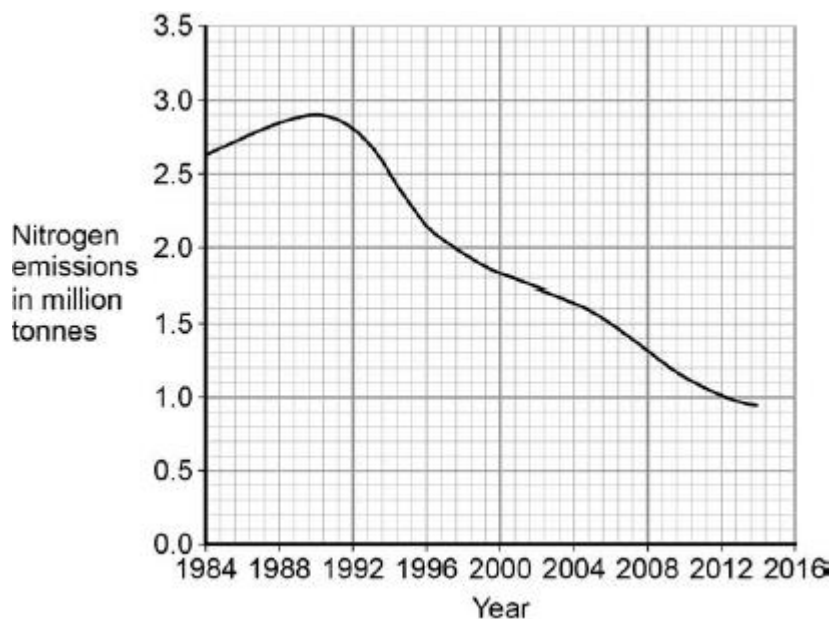
**Q1.**

Oxides of nitrogen are produced when fuels are burnt.

- (a) Write a balanced symbol equation for the production of nitrogen dioxide (NO<sub>2</sub>) from nitrogen and oxygen.

\_\_\_\_\_ (2)

- (b) The figure below gives information about emissions of oxides of nitrogen in the UK.



Calculate the percentage decrease in emissions of oxides of nitrogen from 1990 to 2014.

Give your answer to three significant figures.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Percentage decrease = \_\_\_\_\_ %

(3)

- (c) Give **one** advantage of reducing the emissions of oxides of nitrogen.

\_\_\_\_\_  
\_\_\_\_\_

(1)

(Total 6 marks)

**Q2.**

The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was

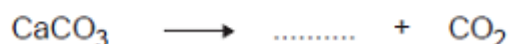
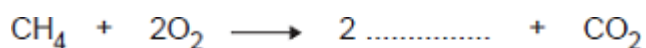
formed.

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.



(2)

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

What is *locked up* carbon dioxide?

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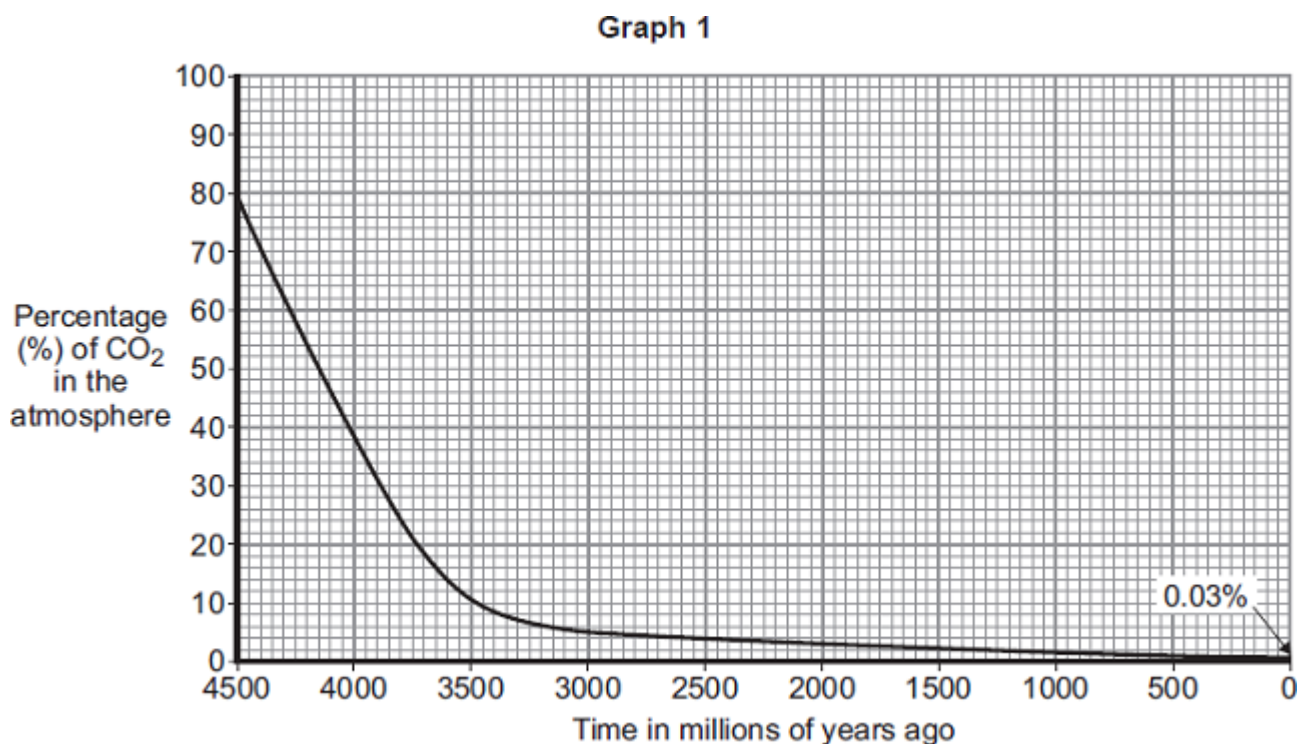
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(2)

- (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.

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(2)

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

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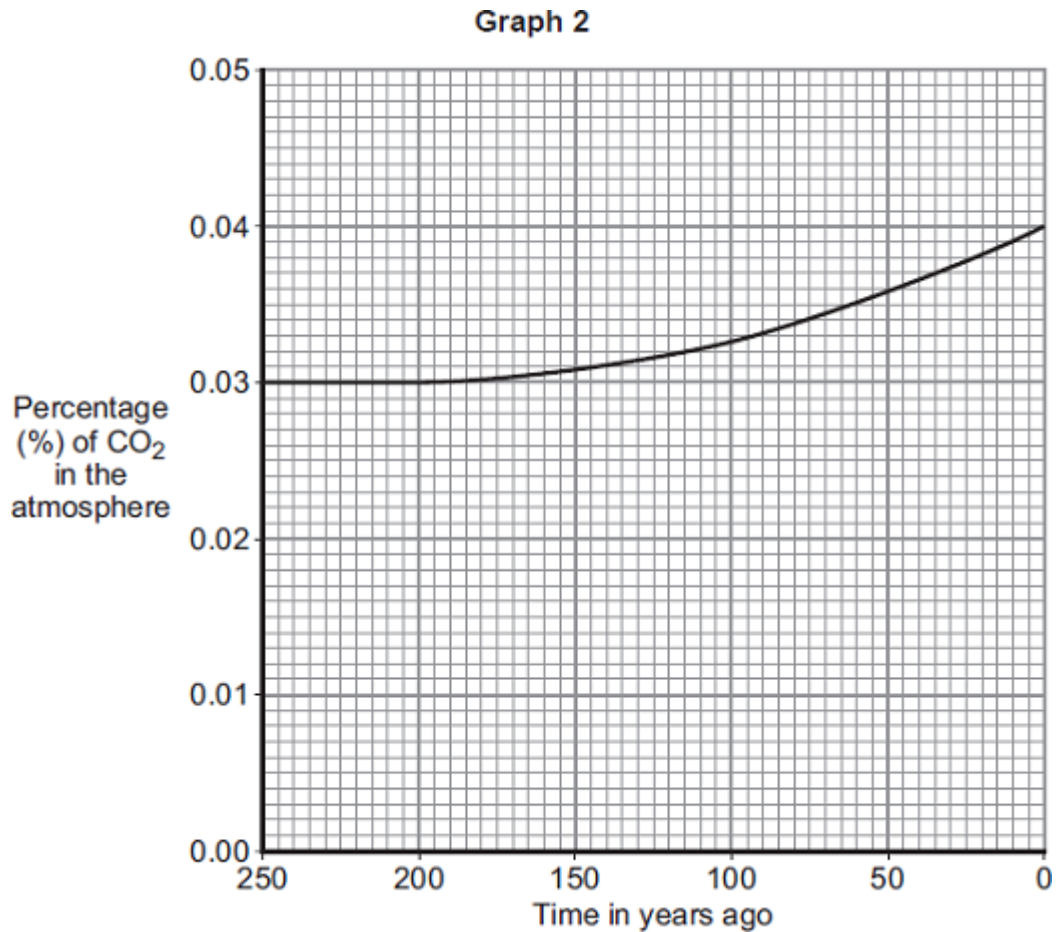
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(2)

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



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

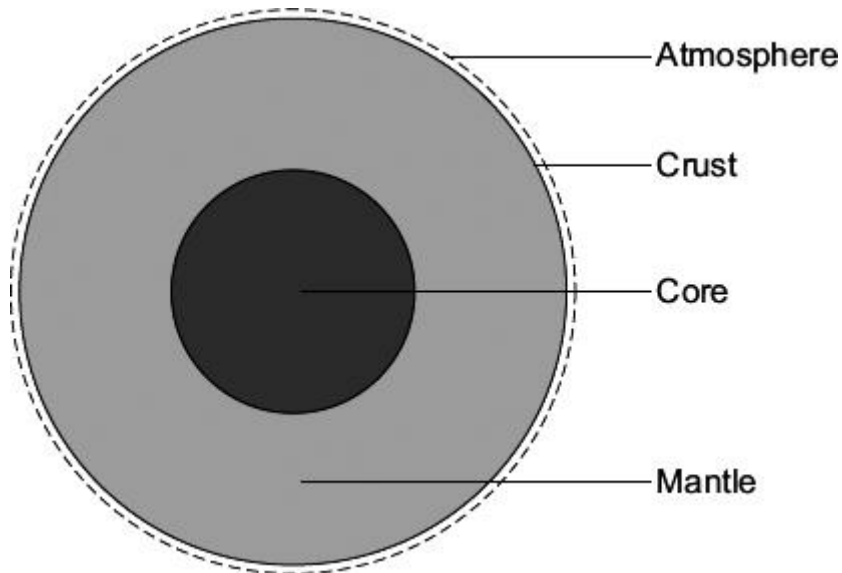
Explain your answer.

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**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.

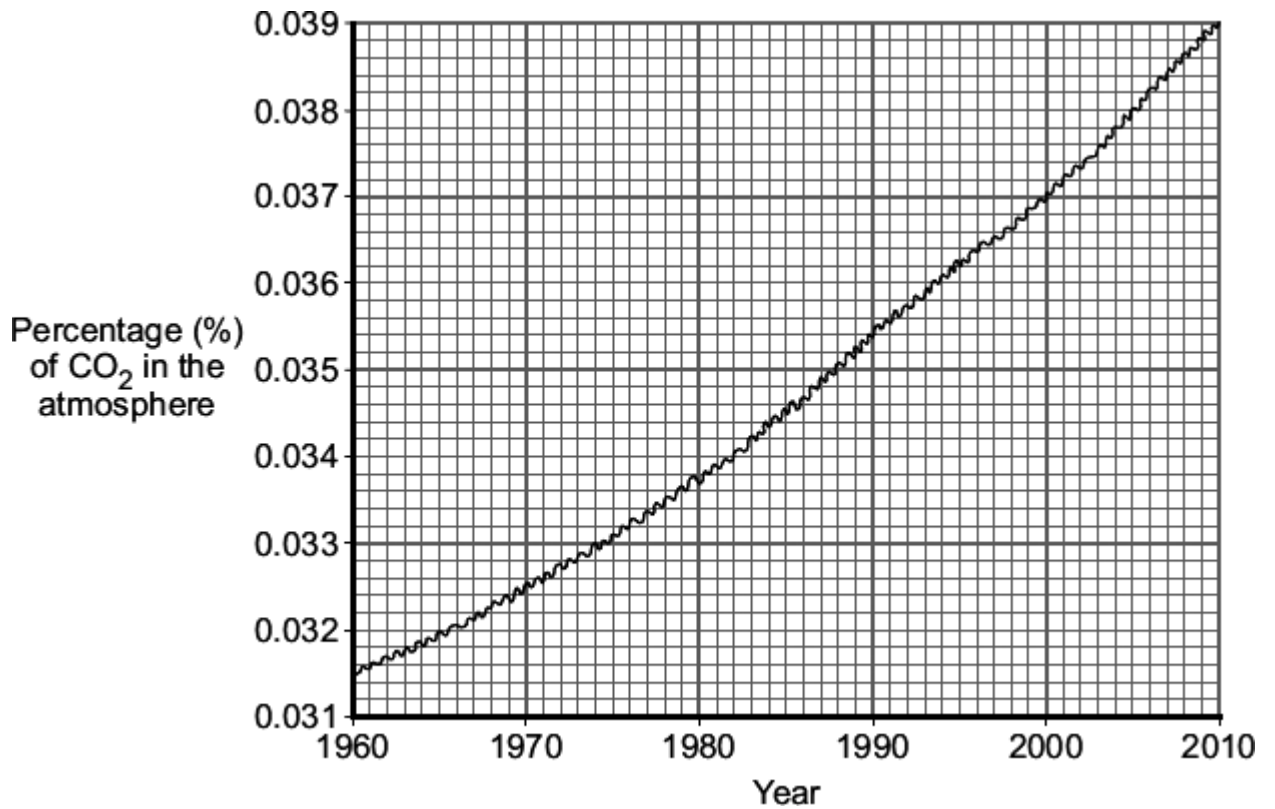
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- (b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



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

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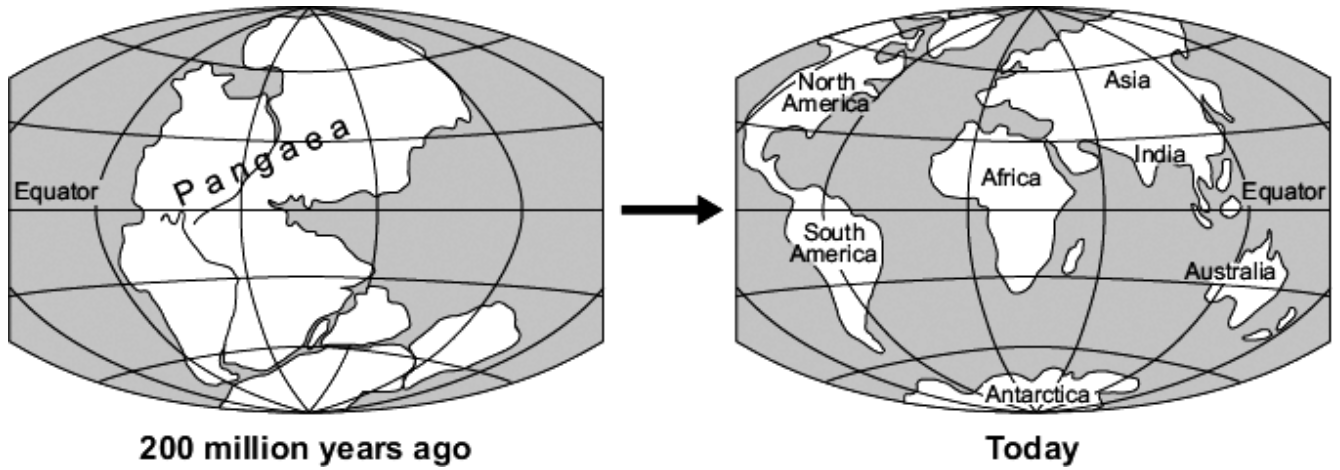
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- (c) Scientists believe that all the continents of the Earth were once joined together. The huge 'supercontinent' was called Pangaea.



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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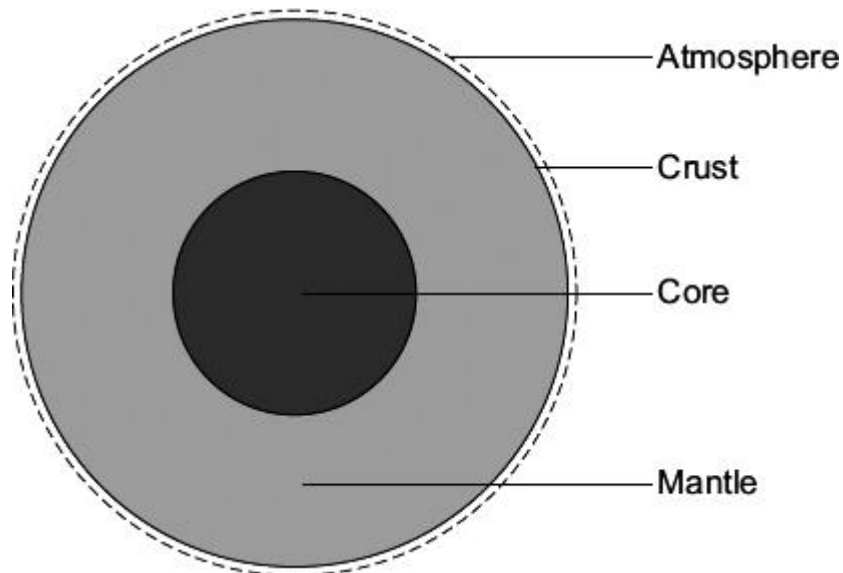


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(1)

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)

**Q4.**

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

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.

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

When it rains on Titan, it rains methane!



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

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(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.

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(1)

(Total 5 marks)

**Q5.**

- (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.

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(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)

## Mark schemes

### Q1.

- (a)  $\text{N}_2 + 2\text{O}_2 \longrightarrow 2\text{NO}_2$   
*correct formulae for reactants* 1  
*correct balancing* 1
- (b)  $2.96 - 0.98$   
*correct values read from graph* 1
- $1.98 \div 2.96 (\times 100)$   
*allow ecf from readings from graph* 1
- $= 66.9(\%)$   
*allow 66.9 shown without working for the 3 calculation marks* 1  
*incorrect number of sig. figs max 2 marks*
- (c) less acid rain **or** fewer respiratory problems in humans  
*allow improved air quality* 1

[6]

### Q2.

- (a) (i)  $\text{H}_2\text{O}$   
*must be formula* 1
- $\text{CaO}$   
*must be formula* 1
- (ii) carbon dioxide from the air / (Earth's early) atmosphere  
*it = carbon (dioxide)*  
*accept carbon dioxide from millions of years ago* 1
- formed (sedimentary) rocks **or** fossil fuels  
*ignore trapped / stored* 1
- (b) (i) decreases rapidly at first  
*it = carbon (dioxide)* 1
- then slowly **or** levels off  
*allow both marks if the description is correct using either 'rapidly' or 'slowly'*  
*allow correct use of figures for either marking point*  
*if no other mark awarded, allow  $\text{CO}_2$  decreased for 1 mark* 1

(ii) any **two** from:

*it = carbon (dioxide)*  
*accept photosynthesis*

- used by plants
- dissolved in oceans
- 'locked up' in fossil fuels **or** formed fossil fuels
- 'locked up' in rocks **or** formed rocks

2

(c) (yes)

*it = percentage of carbon (dioxide)*  
*ignore yes or no*

because the percentage of carbon dioxide is increasing

1

which causes global warming (to increase)

*allow (carbon dioxide) causes greenhouse effect/climate change*

1

**or**

(no)

because the percentage of carbon dioxide is low (1)

compared to millions of years ago (1)

*allow global warming can be caused by other factors (e.g. Sun / water vapour / methane)*

[10]

### Q3.

(a) (i) any **two** from:

- used by plants  
*allow specific plants and algae*
- used for photosynthesis  
*ignore oxygen released / respiration*
- absorbed / dissolved in oceans  
*ignore oceans formed*
- locked up in fossil fuels / limestone / sedimentary rocks

2

(ii) calcium carbonate /  $\text{CaCO}_3$

1

decomposed / thermal decomposition

*do **not** allow reaction with oxygen*  
*accept quicklime / calcium oxide produced*



1

(b) increasing ( $\text{CO}_2$  or global warming)

1

more rapid increase recently

1

carbon dioxide causes global warming

*accept greenhouse gas or*

*climate change / sea level rising*

*or ice caps melting*

*do not accept ozone layer or acid rain or global dimming*

1

(c) (i) any **one** from:

- Wegener had no evidence / proof  
*accept movement too slow to measure*
- other scientists had different ideas / views  
*accept continents / plates fixed or land bridge*
- did not respect Wegener as a scientist / geologist

1

(ii) any **three** from:

- plates (move)  
*ignore continents*
- heat energy / radioactivity (causes)
- convection currents
- in mantle

3

[11]

#### Q4.

(a) any **two** from:

*asks for cause therefore no marks for just describing the change*

*must link reason to a correct change in a gas*

**carbon dioxide has decreased due to:**

*accept idea of 'used' to indicate a decrease*

- plants / microorganisms / bacteria / vegetation / trees
- photosynthesis  
*ignore respiration*
- 'locked up' in (sedimentary) rocks / carbonates / fossil fuels
- dissolved in oceans

*ignore volcanoes*

**oxygen has increased due to:**

*accept idea of 'given out / produced'*

- plants / bacteria / microorganisms / vegetation / trees
- photosynthesis  
*ignore respiration*

**nitrogen increased due to:**

*accept idea of 'given out / produced'*

- ammonia reacted with oxygen
- bacteria / micro organisms  
*ignore (increase in) use of fossil fuels / deforestation*

2

- (b) (because methane's) boiling point is greater than the average / surface temperature **or** Titan's (average / surface) temperature is below methane's boiling point

*ignore references to nitrogen **or** water*

1

any methane that evaporates will condense

*accept boils for evaporates*

*accept cooling and produce rain for condensing*

1

- (c)  $C_nH_{2n}$

1

[5]

### Q5.

- (a) nitrogen and oxygen

*both required either order*

1

- (b) (i) any **two** from

(atmosphere) is now cooler water vapour has condensed to form sea(s) / ocean(s)

2

- (ii) any **two** from

has dissolved in / reacted with seawater has formed carbonates  
(evolution of green) plants removed by photosynthesis  
has formed fossil fuels

2

- (c) (i) 225

*accept any date in the Triassic period*

*225 – 191 (mya)*

*do not credit 190 (mya)*

1

- (ii) on different (tectonic) plates  
*or answer refers to African and South American plates* 1
- (movement) due to convection currents in the mantle 1
- due to energy / heat from the core  
*or due to radioactivity* 1