

Name: _____

Chemical Analysis part 1 AQA Triple Chemistry

Class: _____

Date: _____

Time: **65 minutes**

Marks: **65 marks**

Comments:

1.

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.

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.

(2)

(Total 6 marks)

2.

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!

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 (C₂H₄) and propene (C₃H₆) from methane in Titan's atmosphere.

State the general formula for alkenes.

(1)

(Total 5 marks)

3.

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

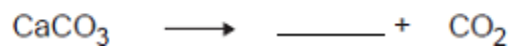
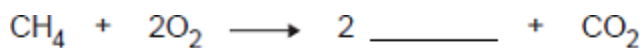
The amount of carbon dioxide continues to change because of human activities.

- (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.



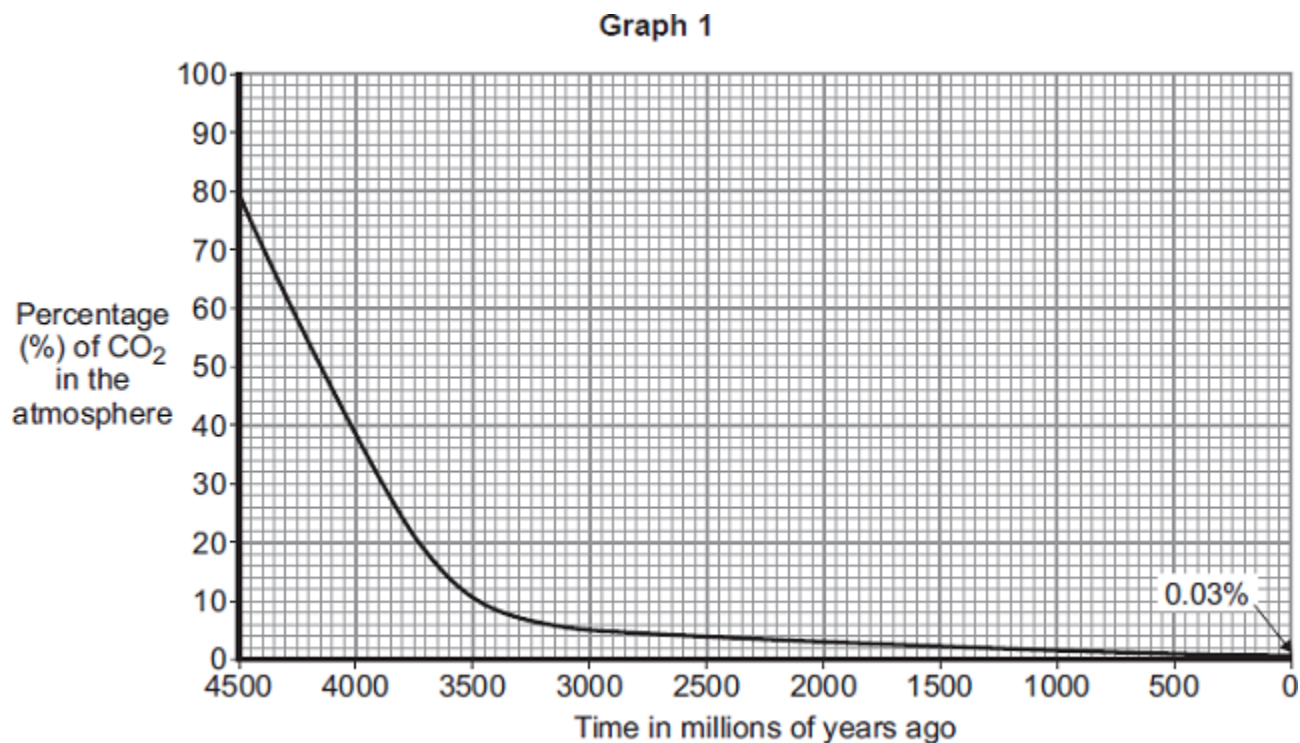
(2)

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

What is *locked up* carbon dioxide?

(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.

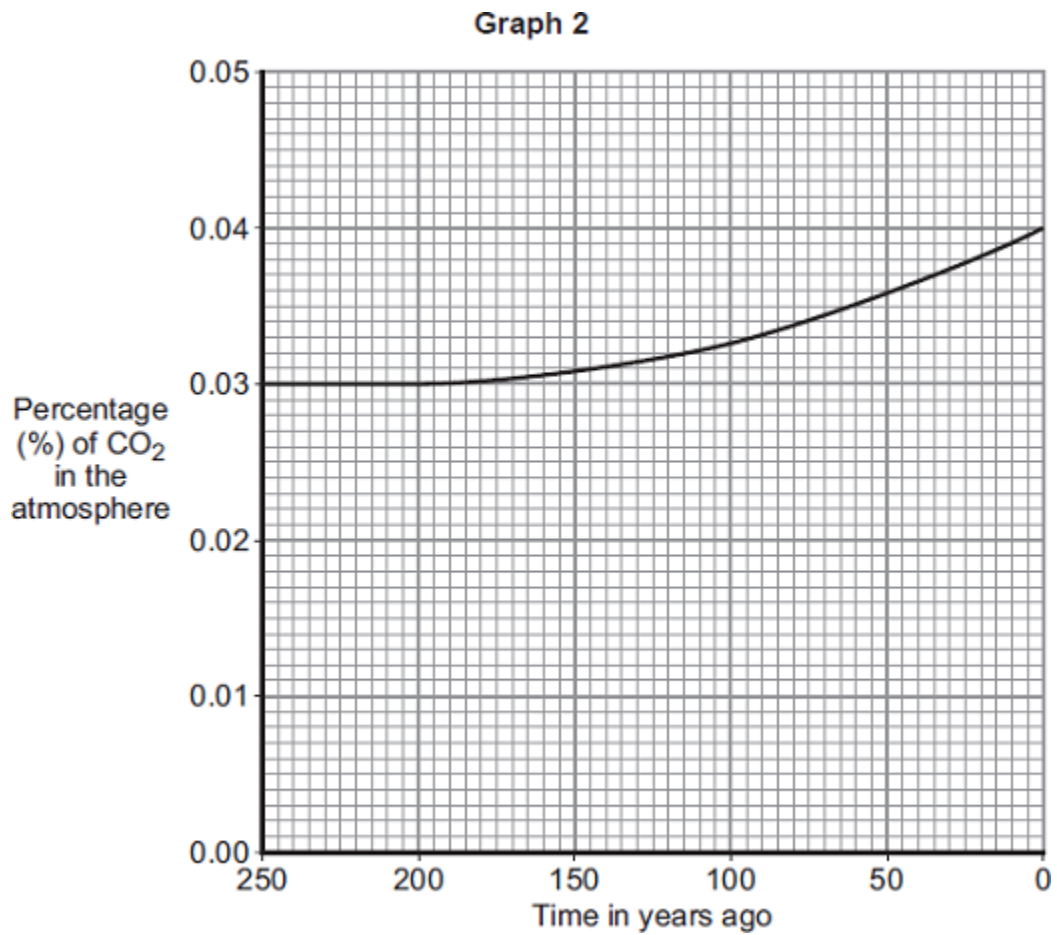
- (i) Describe how the percentage of carbon dioxide has changed in the last 4500 million years.

(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.



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

Explain your answer.

(2)
(Total 10 marks)

4.

A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol		Air	
Alkane	Formula	Gas	Percentage (%)
hexane	C ₆ H ₁₄	nitrogen	78
heptane		oxygen	21
octane	C ₈ H ₁₈	carbon dioxide	0.035
nonane	C ₉ H ₂₀	Small amounts of other gases and water vapour	
decane	C ₁₀ H ₂₂		

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

(i) Give the formula for heptane

(1)

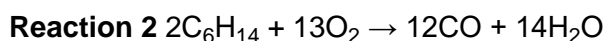
(ii) Complete the general formula of alkanes.
n = number of carbon atoms



(1)

(b) Alkanes in petrol burn in air.

The equations represent two reactions of hexane burning in air.



Reaction 2 produces a different carbon compound to **Reaction 1**.

(i) Name the carbon compound produced in **Reaction 2**.

(1)

(ii) Give a reason why the carbon compounds produced are different.

(1)

(c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

(i) What is the percentage of the other gases in the table?

(1)

(ii) What is the name of the compound that makes up most of the other gases?

(1)

(iii) Give a reason why sulfur dioxide is produced in a petrol engine.

(1)

(iv) State how nitrogen oxides are produced in a petrol engine.

(2)

- (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

(2)

(Total 11 marks)

5.

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.

(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.

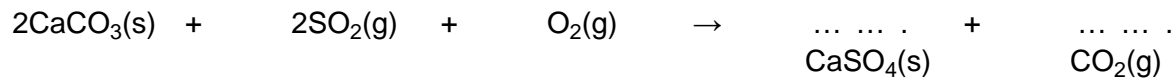
Name **three** elements that are in this coal.

(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.



(1)

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

increases atmospheric pollution

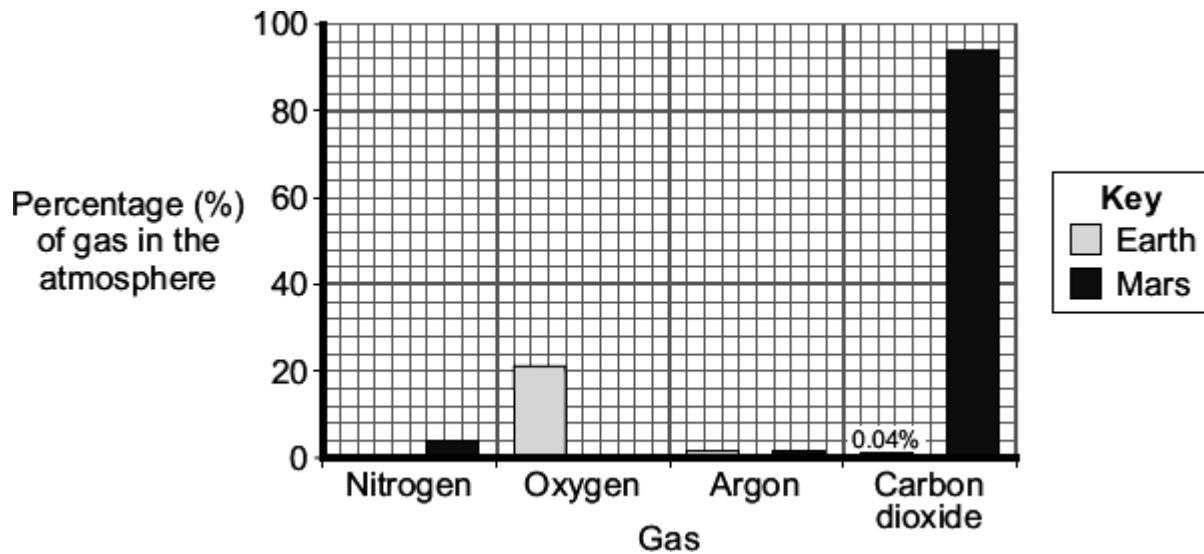
decreases atmospheric pollution.

(4)

(Total 10 marks)

6.

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.

(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

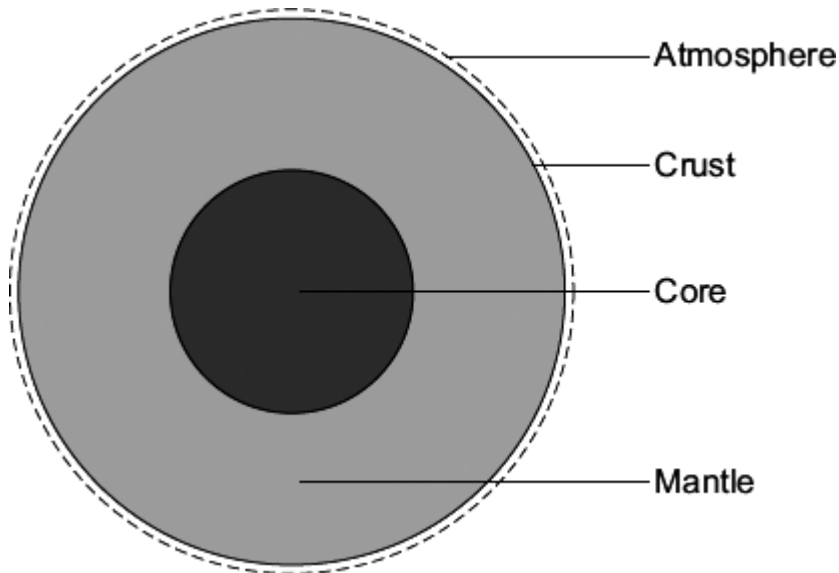
- burning fossil fuels.
- the formation of oceans.
- the eruption of volcanoes.

(1)

(Total 5 marks)

7.

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?

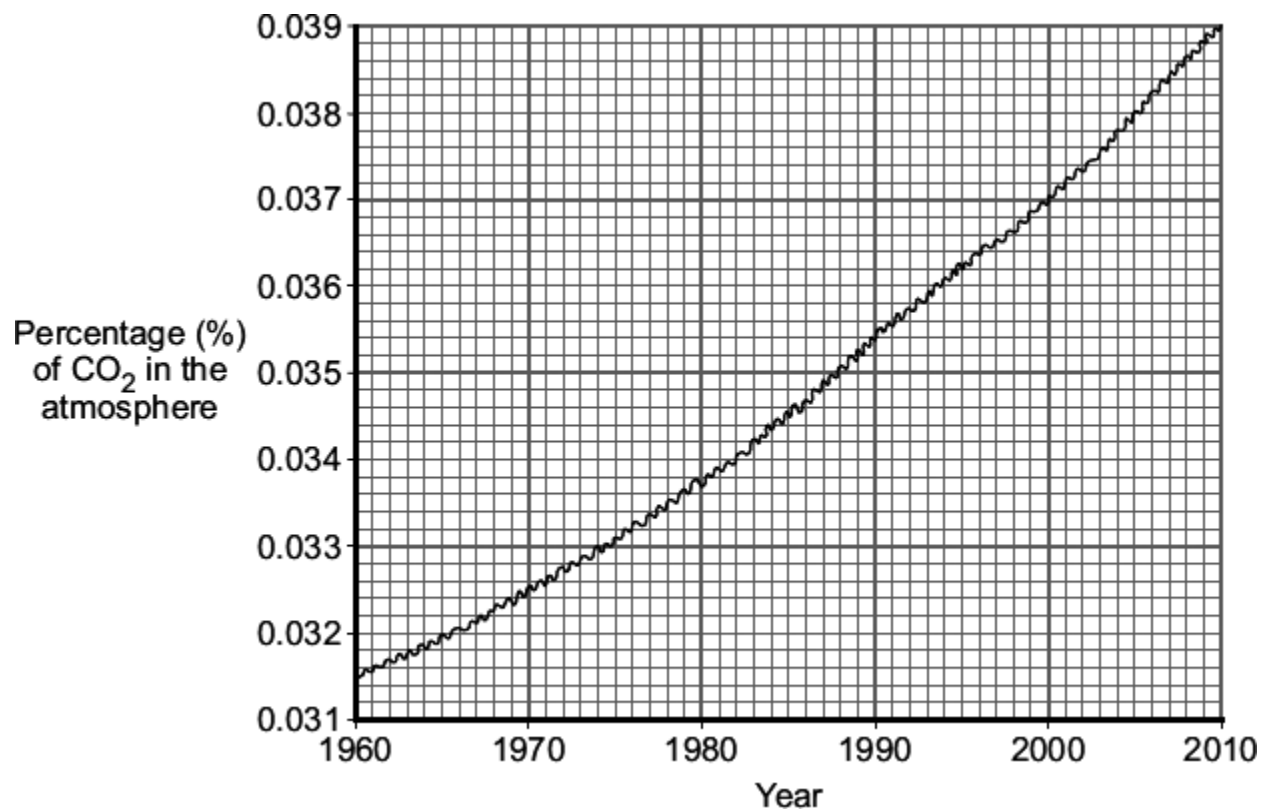
(2)

- (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)

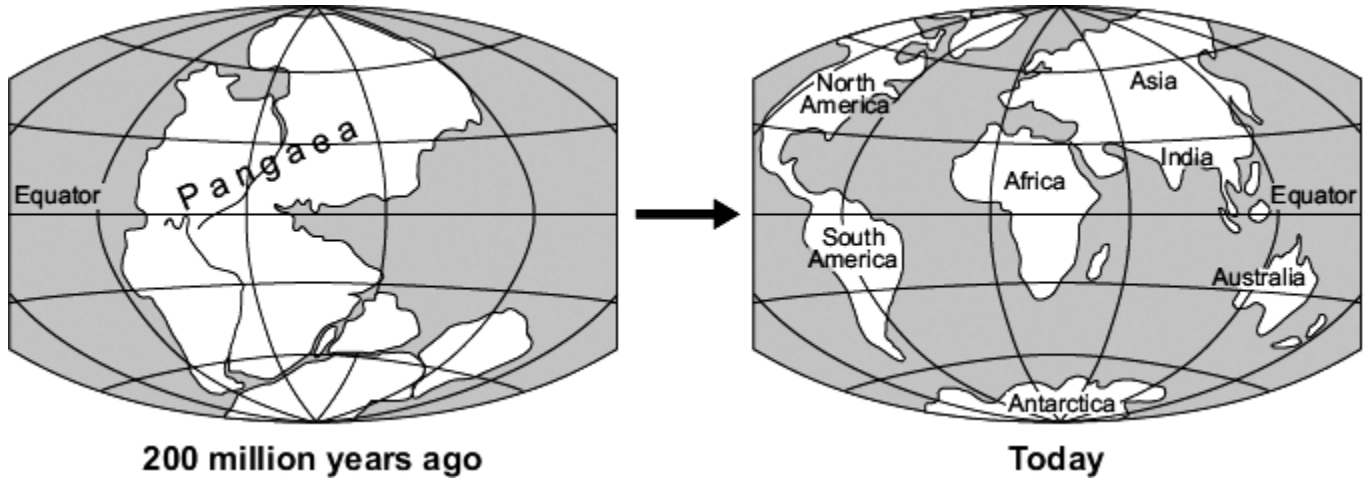
- (b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



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.



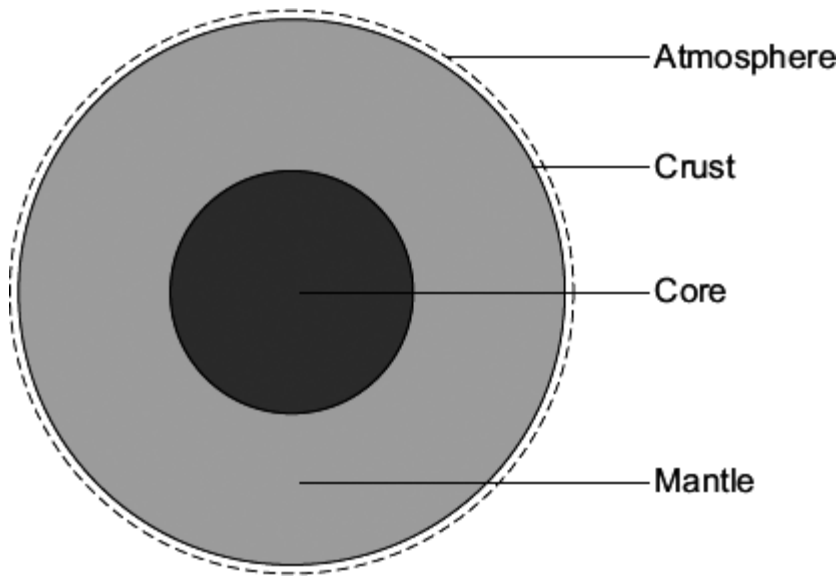
In 1915, Alfred Wegener had an idea that the change shown in the diagram was caused by *continental drift*. Most scientists could not accept his idea.

- (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.



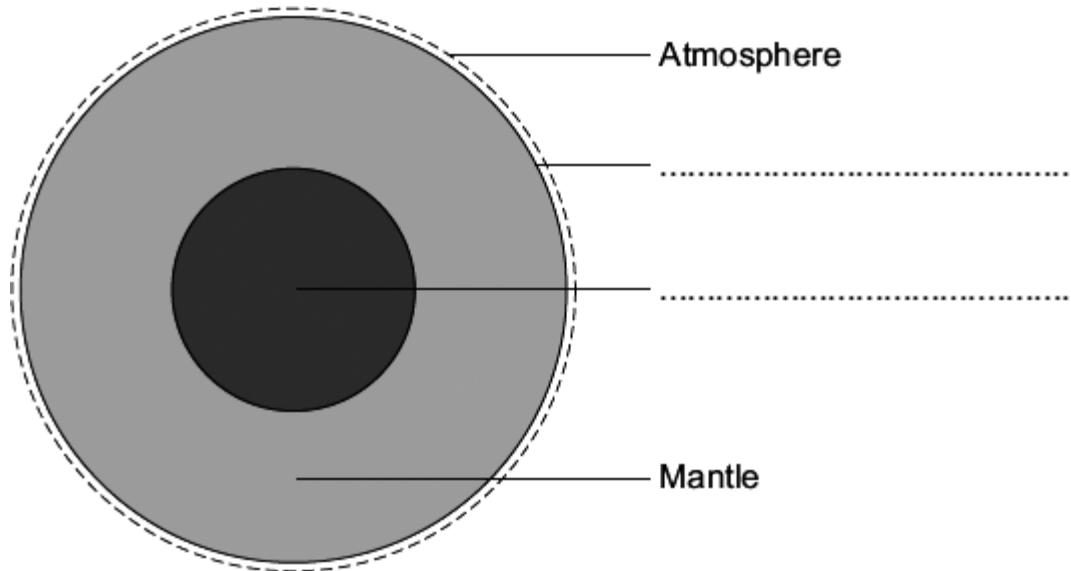
- (ii) Use this information and your knowledge and understanding to explain how continents move.

(3)
(Total 11 marks)

8. 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.

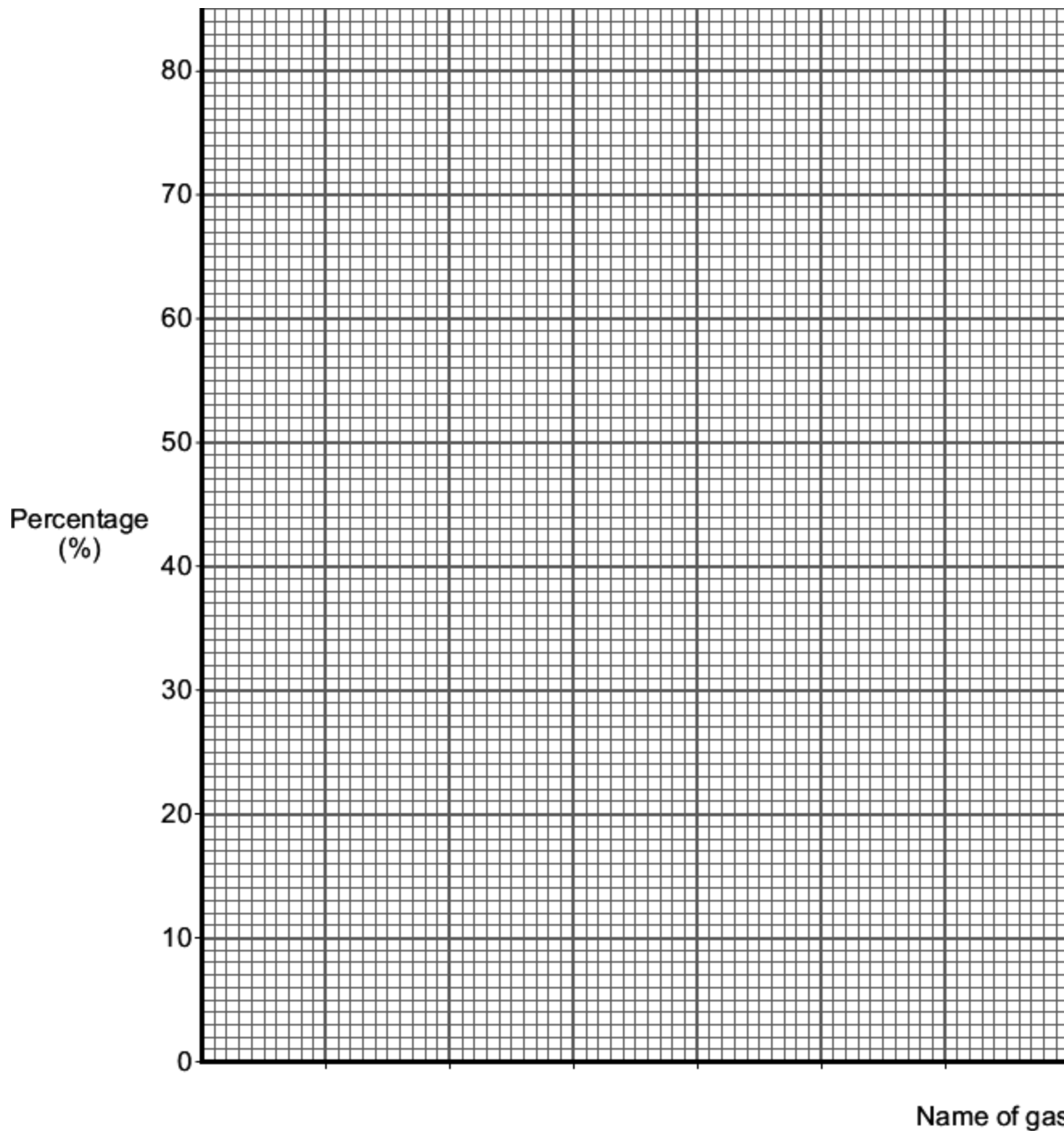


(2)

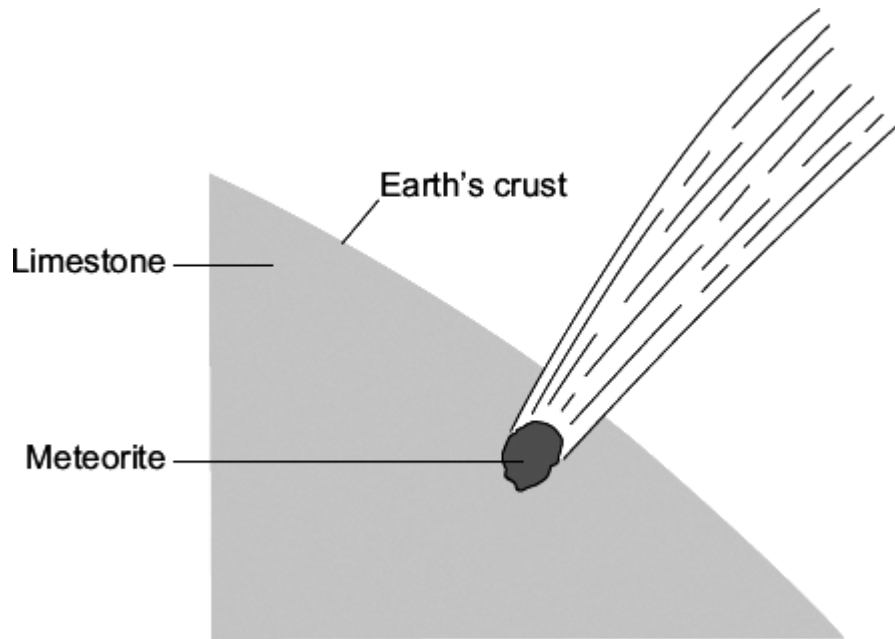
(b) The data in the table shows the percentages of the gases in the Earth's atmosphere.

Name of gas	Percentage (%) of gas
Nitrogen	78
Oxygen	21
Other gases	1

Present the data in the table on the grid below.



- (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.



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)

Mark schemes

1.	(a)	argon / Ar	1
	(b)	(i) 0	1
		(ii) unreactive	1
	(c)	(i) 94.96(%)	1
		(ii) any two from:	
		• plants or photosynthesis	
		• absorbed in oceans / seas	
		<i>allow oceans store or take in or dissolve carbon dioxide</i>	
		• <u>locked</u> up in (sedimentary) rocks	
		• <u>locked</u> up in fossil fuels	
			2
			[6]

2.

(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]

3.

(a) (i) H_2O

must be formula

1

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 CO₂ 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]

4.

- (a) (i) C_7H_{16}
mark answer line first
answer may be given in the table 1
- (ii) C_nH_{2n+2} 1
- (b) (i) carbon monoxide
do not accept carbon oxide
do not accept water
ignore CO 1
- (ii) because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)
*allow because there is less / insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) **or** $19O_2$ (in reaction 1) **and** $13O_2$ (in reaction 2)*
ignore air 1
- (c) (i) 15 (%)
ignore units 1
- (ii) water (vapour)/steam
allow H_2O / OH_2 / hydrogen oxide 1
- (iii) sulfur in petrol / crude oil (reacts with oxygen)
it = sulfur dioxide 1
- (ii) because nitrogen **and** oxygen (are in the air and) react
*allow nitrogen **and** oxygen burn*
*accept nitrogen + oxygen \rightarrow nitrogen oxide **or** symbol equation*
ignore air 1

at high temperature (inside a petrol engine)

allow heat / hot (engine)

1

(d) because carbon dioxide / it causes global warming **or**

*allow because carbon dioxide / it causes greenhouse effect /
climate change*

1

because carbon dioxide / it has an impact on oceans

because this carbon dioxide / carbon / it was 'locked up' (in fossil fuels) **or**

because the percentage/amount of carbon dioxide / it in the atmosphere is increasing

1

[11]

5.

(a) carbon dioxide decreased (by plants / trees)

allow plants / trees absorbed carbon dioxide

1

oxygen increased (by plants / trees)

allow plants / trees released oxygen

if neither of these marks awarded

allow plants / trees

photosynthesise for 1 mark

1

because coal 'locks up' / traps / stores carbon dioxide / carbon

allow trees 'locked up' carbon dioxide / carbon

1

(b) carbon / C

hydrogen / H

sulfur / S

all 3 correct 2 marks

1 or 2 correct 1 mark

allow H₂

ignore oxygen

2

(c) (i) 2 2

balancing must be correct

*do **not** accept changed formulae*

1

(ii) increases atmospheric pollution

carbon dioxide / CO₂ released

1

from the (thermal) decomposition of calcium carbonate **or**

accept causes global warming or CO₂ is a greenhouse gas

description of this decomposition **or** equation

ignore sulfur dioxide and effects in this part

1

decreases atmospheric pollution

sulfur dioxide / SO₂ is removed

accept less acid rain produced

1

by reaction with calcium oxide **or** calcium carbonate

accept neutralisation or forms calcium sulfate

1

[10]

6.

(a) bar drawn correctly 78 – 80 (%)

1

(b) (i) (Mars has) no (green / living) plants / trees

1

(ii) (argon) is unreactive / inert

accept argon is a noble gas

ignore it is in Group 0

1

(c) (the amount of carbon dioxide has decreased because it has been) absorbed / used by (green / living) plants / trees **or** used for photosynthesis

accept dissolved / absorbed by oceans or locked up in fossil fuels / carbonate rocks

1

(d) the eruption of volcanoes

1

[5]

7.

(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 / CaCO_3

1

decomposed / thermal decomposition

do not allow reaction with oxygen

accept quicklime / calcium oxide produced

$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ gains 2 marks

1

(b) increasing (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]

8.

(a) crust

ignore Earth's

1

core

ignore inner and/or outer

1

(b) bar chart

1

all heights are correct

accept correctly plotted points

1

all labels are correct for nitrogen, oxygen and other / argon

1

(c) (i) decomposed

1

(ii) global warming

1

[7]