



Exampro GCSE Chemistry

C1 Chapter 7 higher

Name:

Class:

Author:

Date:

Time: 62

Marks: 62

Comments:

Q1. 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.

.....

(1)

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

Suggest **three** reasons why.

- 1
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-
- 2
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-
- 3
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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)

Q2. 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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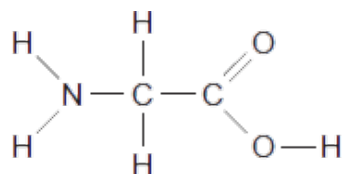
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(2)

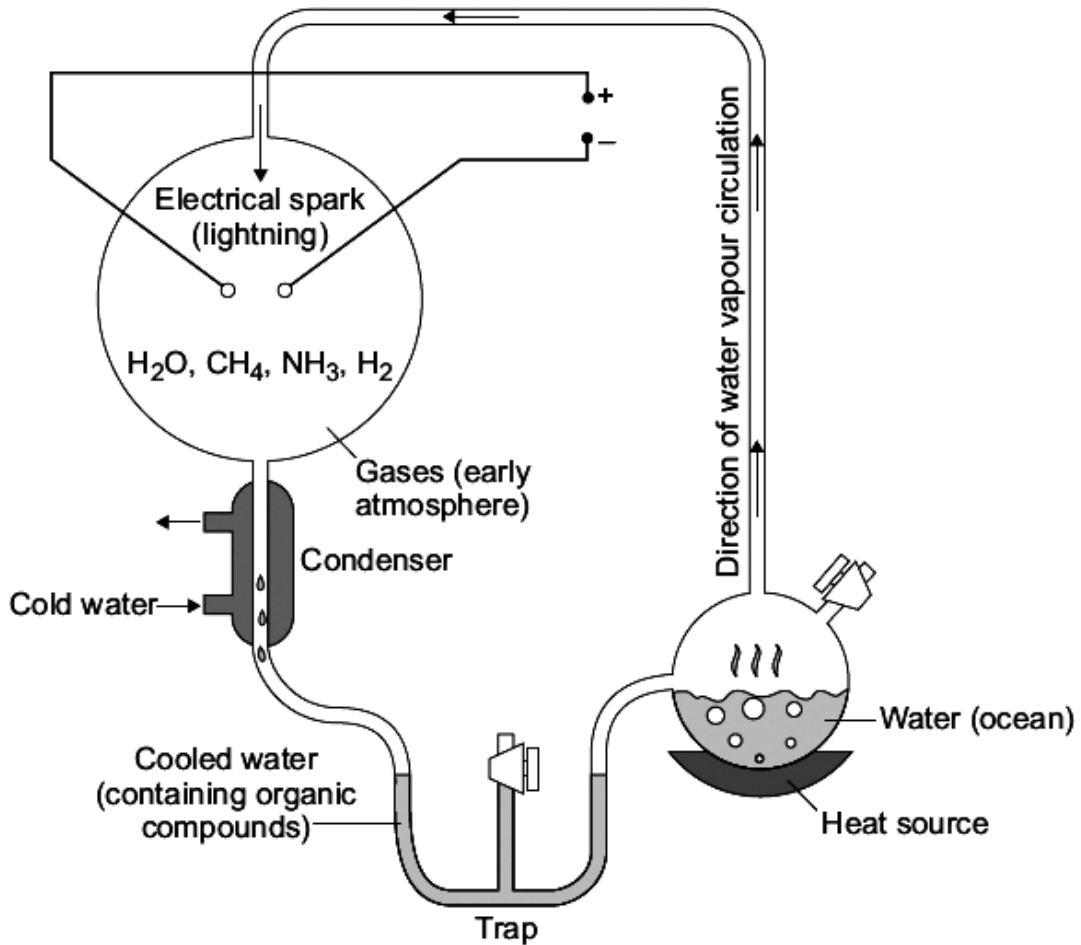
(b) In the 1950s two scientists, Miller and Urey, investigated the origin of life on Earth. Miller and Urey used the gases that they believed were in the Earth's early atmosphere and used water to represent the oceans. The gases they used were methane (CH₄), ammonia (NH₃) and hydrogen (H₂). A continuous 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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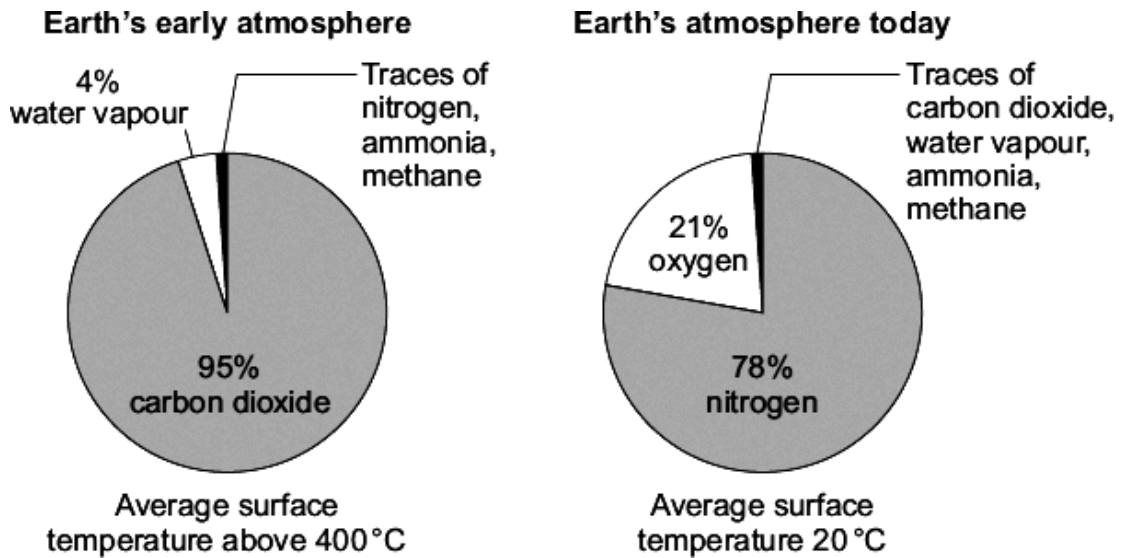
(2)

(Total 5 marks)

Q3. (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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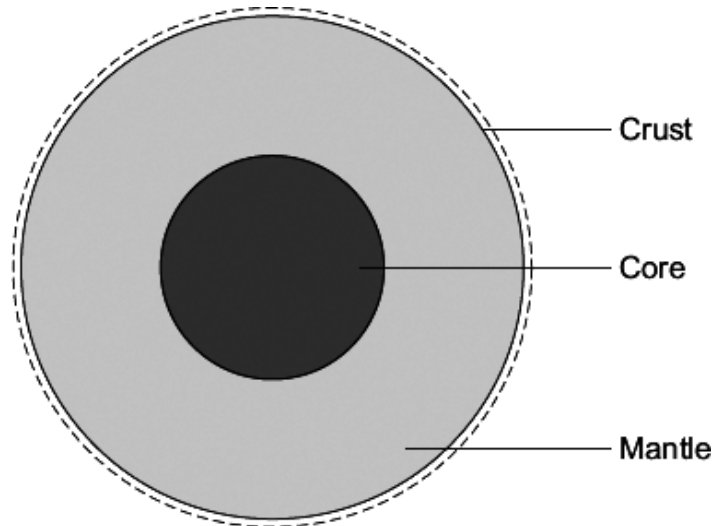
(2)

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

1
.....
2
.....

(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)

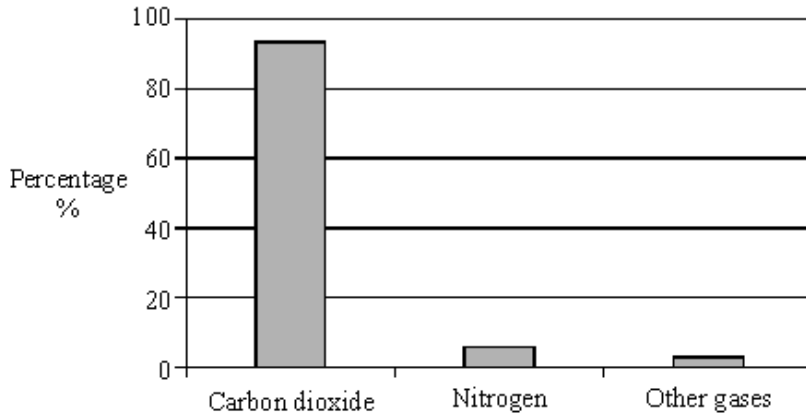
(ii) How can the 'controversial' theory be used to explain why the Earth's tectonic plates move?

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(3)

(Total 8 marks)

Q4. 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.

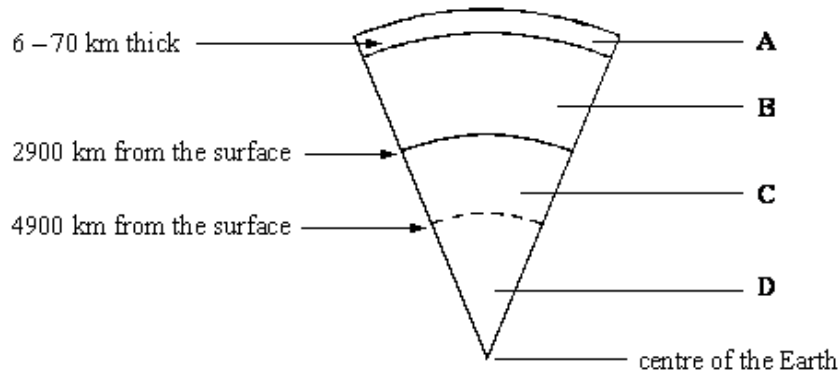
Explain why.

-
-
-
-

(2)

(Total 5 marks)

Q5. 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**.

.....

(1)

(Total 3 marks)

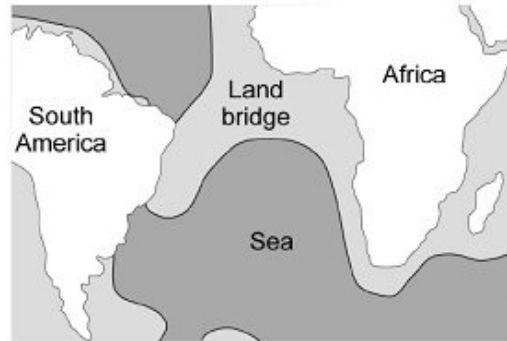
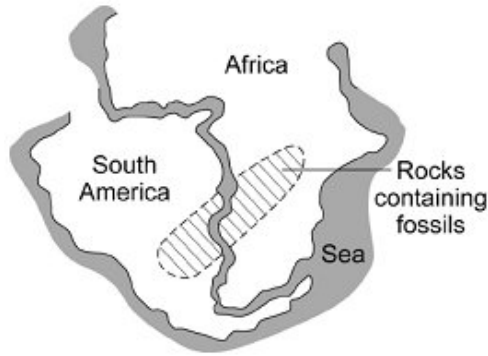
Q6. Evidence shows that the Earth formed from a molten ball of rocks and minerals.

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 hypothesis 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)

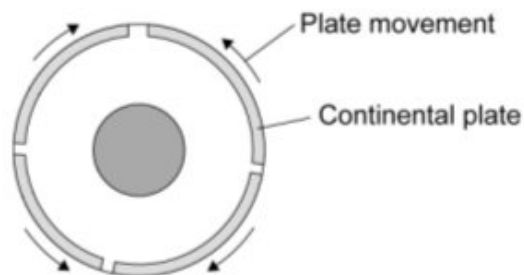
(ii) Suggest why, in 1920, other scientists thought that Wegener's hypothesis was wrong.

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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)

Q7. Air is a mixture of gases and contains various pollutants. The gases are useful and can be separated by fractional distillation of liquid air. The table gives information about some of the gases in air.

Name of gas	Formula	Melting point in °C	Boiling point in °C
Helium	He	-272.2	-269.0
Oxygen	O ₂	-219.0	-183.0
Nitrogen	N ₂	-210.0	-195.9
Argon	Ar	-189.0	-185.9
Carbon dioxide	CO ₂	-78.5	-78.5
Water vapour	H ₂ O	0.0	100.0

To separate these gases:

- the air is filtered
- water is removed first
- carbon dioxide is then removed by absorption
- the gases remaining are compressed and cooled to -200 °C.

- (a) The air is filtered before the gases are separated.

Suggest why.

.....
.....

(1)

- (b) Water vapour and carbon dioxide are removed before the gases are compressed and cooled.

Use the information in the table to suggest why.

.....
.....
.....
.....

(2)

- (c) After the water and carbon dioxide have been removed, which gas stays liquid over the greatest temperature range?

.....

(1)

- (d) After the water and carbon dioxide have been removed, the four gases that are left are compressed and cooled to $-200\text{ }^{\circ}\text{C}$.

- (i) Which gas does **not** liquefy?

.....

(1)

- (ii) The three liquefied gases are then allowed to warm up.

Give the order in which the three liquefied gases would vaporise.

1st

2nd

3rd

(1)

(Total 6 marks)

Q8. The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was formed.

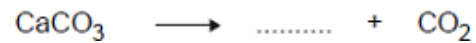
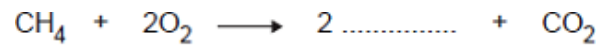
The amount of carbon dioxide continues to change because of human activities.

- (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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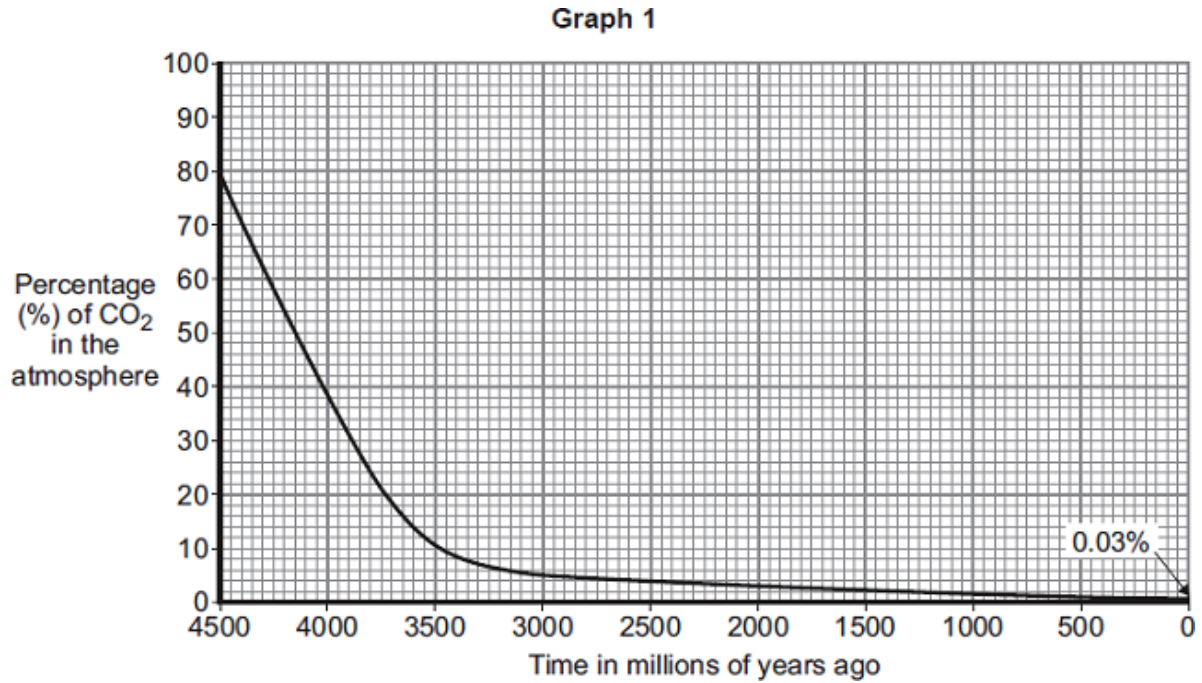
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(2)

- (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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.....

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(2)

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

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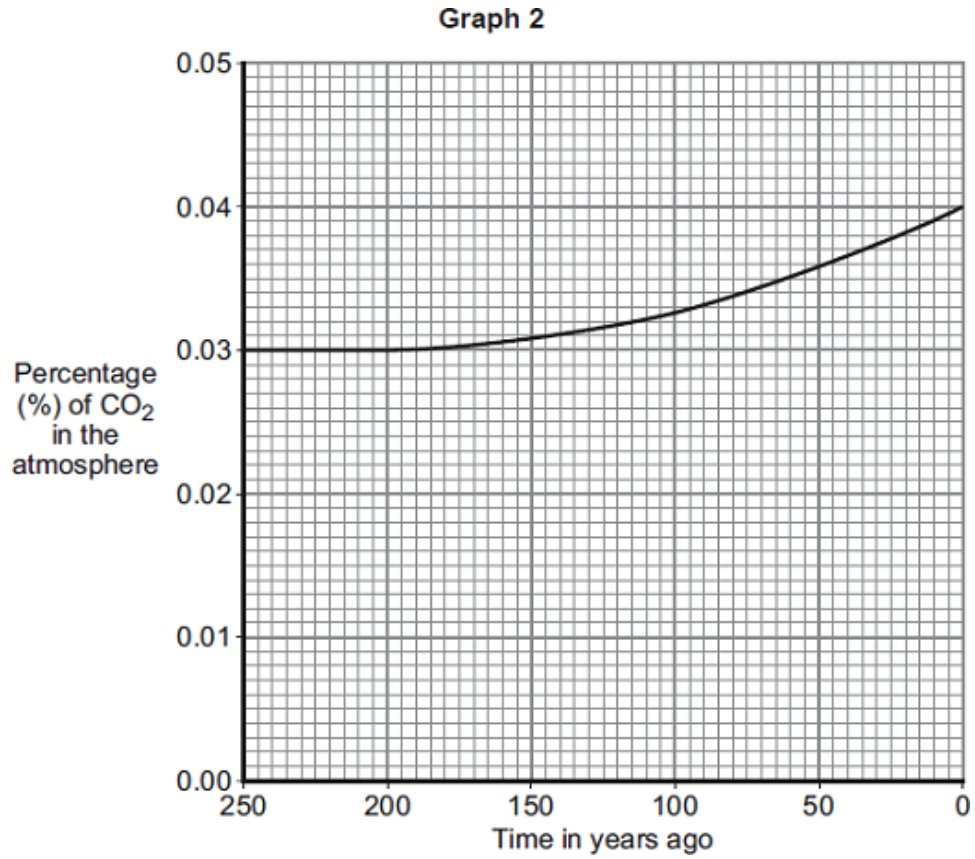
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(2)

- (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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.....

(2)
(Total 10 marks)

Q9. The table shows some properties of gases in dry air

Gas in dry air	Density in kg/m ³	Melting point in °C	Boiling point in °C	Percentage (%) in air
Nitrogen	1.2506	-210	-196	78.08
Oxygen	1.4290	-219	-183	20.95
Carbon dioxide	1.977	-57	-57	0.033
Helium	0.1785	-272	-269	0.00052
Neon	0.8999	-249	-246	0.0019
Argon	1.7837	-189	-186	0.934
Krypton	3.74	-157	-153	0.00011
Xenon	5.86	-112	-108	0.0000087

- (a) In 1895, Lord Rayleigh isolated nitrogen from dry air by removing the other known gases, oxygen and carbon dioxide.
He then discovered that nitrogen from dry air had a different density to pure nitrogen produced from chemical reactions.
He concluded that nitrogen extracted from dry air was mixed with another gas.
The density of nitrogen extracted from dry air was higher than the density of pure nitrogen.

Use the information above to explain why.

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.....

(2)

- (b) Gases from the air are separated to provide raw materials used in many different industrial processes.

Steps in dry air separation:

Step 1: Filter to remove solid particles

Step 2: Remove carbon dioxide

Step 3: Cool the remaining air to $-200\text{ }^{\circ}\text{C}$

Step 4: Separate by allowing the liquefied gases to warm up.

- (i) Carbon dioxide is removed before the air is cooled to $-200\text{ }^{\circ}\text{C}$.

Suggest **one** reason why.

.....
.....

(1)

- (ii) Which two gases do **not** condense when the remaining air is cooled to $-200\text{ }^{\circ}\text{C}$?

.....and

(1)

- (iii) Two gases in air do **not** separate completely when the liquefied gases are allowed to warm up.

Name these **two** gases and give a reason for your answer.

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.....
.....
.....

(2)

(Total 6 marks)

Q10. 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.

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.....

(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)

- M1.** (a) (i) 6-8
accept any value in the range 6-8 1
- (ii) any **three** from:
- there are many earthquakes predicted by scientists each year
allow scientists / predictions have been wrong
 - expense / inconvenience / panic caused by government / people taking action
 - most / some earthquakes do little or no damage
 - scientists do not know what is happening below the crust
ignore lack of evidence
 - scientists cannot (accurately) predict where the earthquake will occur
 - scientists cannot (accurately) predict when the earthquake will occur
allow earthquakes are random
 - scientists cannot (accurately) predict the strength of the earthquake
If none of the last 3 points have been awarded then 'scientists cannot accurately predict earthquakes' gains 1 mark 3
- (b) (i) continents were once joined together
or continents breaking up / separating / fitted like a jigsaw
allow crust / plate for continent
accept there was a supercontinent / Pangaea 1
- so the continents are moving
accept continents not in fixed positions
allow continents move apart for 2 marks
if no other mark awarded allow continents drift apart for 1 mark 1
- (ii) convection currents (in the mantle)
allow credit for both marking points if given in (b)(i)
accept movement / flow (in the mantle) 1
- caused by heat **or**
- caused by radioactive processes
ignore chemical reactions 1

[8]

M2. (a) any **two** from:

- carbon dioxide dissolves in water/oceans
- marine organisms use (dissolved) carbon dioxide to form their shells/skeletons
or
limestone was formed from the shells/skeleton of marine organisms
accept carbon dioxide became locked up in sedimentary rocks/carbonates/limestone
or
precipitation or formation of insoluble carbonates
- plants / algae photosynthesise/ absorb/use carbon dioxide
accept remains of plants/algae/ marine organisms contain locked up carbon dioxide/carbon in the form of fossil fuels
*do **not** accept plants use carbon dioxide for respiration*

2

(b) (i) because these gases/molecules contain the elements / atoms in amino acids
or the gases / they contain carbon, hydrogen and nitrogen
ignore oxygen

1

(ii) *ignore small-scale / timescale*
ignore references to water/oceans or other theories

any **two** from:

- nobody knows what was in the Earth's early atmosphere
accept these gases / hydrogen / methane / ammonia may not have been in the Earth's early atmosphere
accept carbon dioxide / nitrogen may have been in the Earth's early atmosphere
accept reference to Venus' present atmosphere
ignore concentration of gases
- there may not have been (continuous) lightning
- Miller and Urey selected only the gases needed to produce amino acids

2

[5]

M3. (a) (i) *it = water vapour*

condensed

accept temperature went below 100°C / boiling point of water
allow cooled to form liquid / water / rain
*do **not** accept evaporated*

1

formed the oceans / seas

ignore rain

accept (water vapour) cooled and formed the ocean / sea for 2 marks

1

(ii) any **two** from:

ignore oxygen / nitrogen increased

ignore reference to volcanoes / respiration

- used by (green) plants / algae
accept photosynthesis / plants give out oxygen
- changed into oxygen
- dissolved in oceans / seas
accept (locked up) in shells / skeletons (of animals)
- (locked up) in carbonates / sedimentary rocks
- (locked up) in fossil fuels / named fossil fuel

2

- (b) (i) cannot get to / reach / drill to / see the core
accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface
accept it is (too) hot / radioactive
ignore lack of evidence unqualified

1

(ii) any **three** from:

- heat / energy released
- from radioactive decay / processes
accept radioactivity / nuclear reactions
- (causing) convection currents
- in the mantle

3

[8]

M4. (a) any **three** from:

accept reverse answers if unambiguous

*do **not** accept just different throughout*

3

less / little / not much carbon dioxide **or** give a %age < 1%

more / a lot of nitrogen **or** give 78-80%

(more) / (some) oxygen or give a %age 20-21%

*do **not** accept more "other gases"*

references to pollutant gases in general **or** named examples
e.g. CO, SO₂, NO, NOX etc.

more / some water (vapour)

some / 1% argon
ignore other noble gases

ozone (layer) on earth

(b) any **two** from:

removed carbon dioxide
*ignore reference to respiration /
photosynthesis unless qualified*

released oxygen

caused carbon from carbon dioxide to
become locked in sedimentary rocks

the oxygen they produced reacted with
methane and ammonia

produced nitrogen (must be linked to fourth point)
*accept correct word / symbol equation for photosynthesis for 2
marks*
converted / changed CO₂ to oxygen for 2 marks

2

[5]

M5. (a) Layer A = crust / tectonic plates / (**not** named type of rock)
Layer B = mantle / magma
each for 1 mark

2

(b) Layer C is liquid / molten (accept mostly liquid) but layer D is solid
Layer D is more dense than layer C. / accept they have different densities
Layer D is hotter than layer C. / accept they have different temperatures
(Do not accept hardness / viscosity)
any one for 1 mark

1

[3]

M6. (a) (i) the continents of South America and Africa would
have fitted together like a jigsaw

1

there are matching / similar rocks / fossils on the
continents of South America and Africa

1

(ii) other scientists thought that continents are fixed / cannot float **or** Wegener had no evidence to prove that continents can move
allow Wegener was not respected by other scientists / PhD in astronomy

1

and that a land bridge could explain the matching / similar rocks / fossils on the continents of South America and Africa

1

(b) radioactive

1

mantle

1

words must be in the order shown

[6]

M7. (a) to remove solid / dust particles

1

(b) because at $-200\text{ }^{\circ}\text{C}$ both (water and carbon dioxide) are solids

1

this would therefore block pipes / equipment

1

(c) oxygen

1

(d) (i) helium

1

(ii) nitrogen > argon > oxygen

1

[6]

M8. (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]

M9. (a) because the nitrogen from dry air contained noble/Group 0 gases
ignore other gases

or

(because the nitrogen from dry air) contained argon / krypton / xenon
ignore helium and neon

1

and three / some of these gases, (argon, krypton, xenon) have a greater density than nitrogen

ignore helium and neon

or

and argon / krypton / xenon has a greater density than nitrogen

1

(b) (i) carbon dioxide would form / is a solid
accept carbon dioxide freezes or its freezing point is > -200°C
ignore melting point

or

(solid) carbon dioxide would block pipes

1

(ii) helium **(and)** neon
both needed for 1 mark
accept He and Ne

1

(iii) argon **(and)** oxygen
accept Ar and O₂

1

because there is only a difference of 3°C in their boiling points
accept because they have boiling points that are almost the same

1

[6]

M10.

(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) $C_n H_{2n}$

1

[5]

