



Changes in the earth and its atmosphere

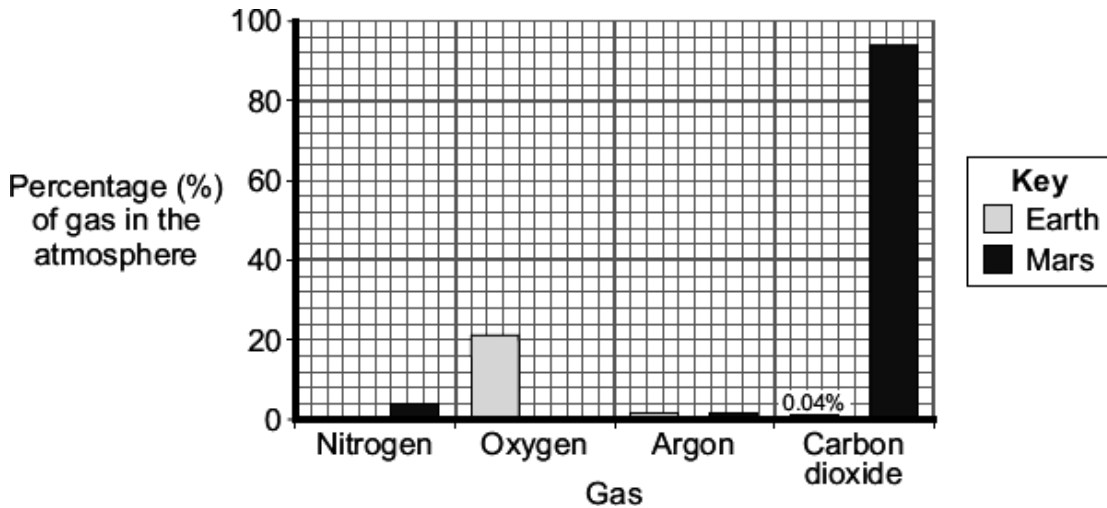


99 minutes



99 marks

Q1. 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)

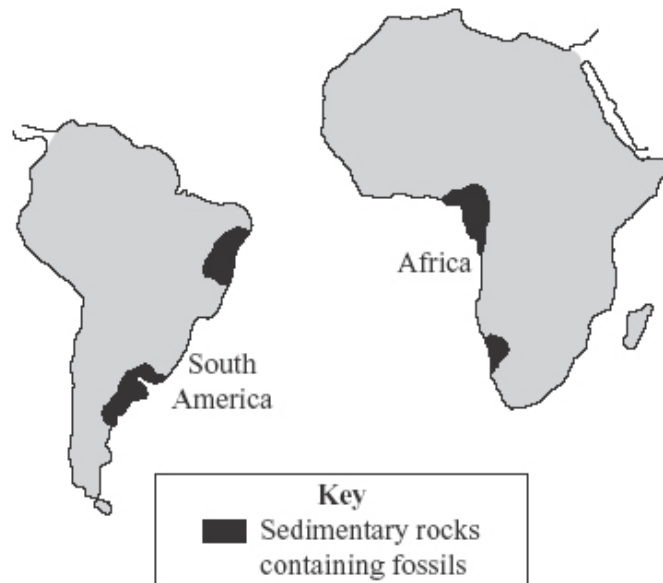
Q2. (a) Two hundred years ago, scientists thought that the Earth was about 400 million years old. This estimate came from the idea that the centre of the Earth was still molten. More recently, measurement of radioactivity in rocks has shown that the Earth is much older than 400 million years.

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

.....
.....

(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.

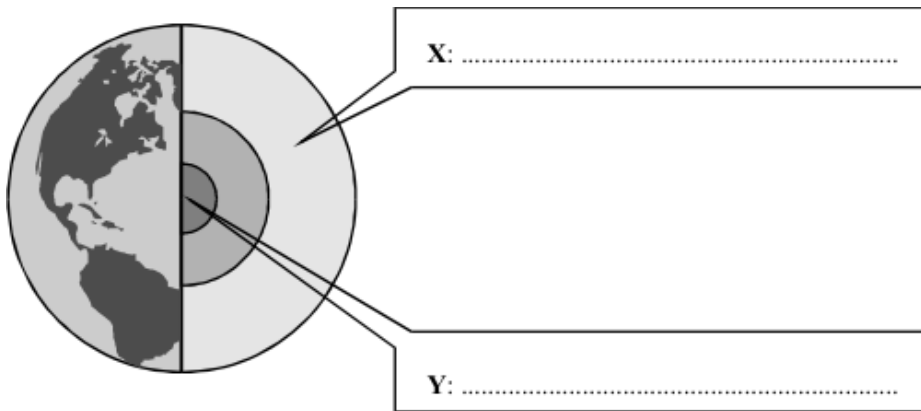
Give **two** pieces of evidence that have helped to convince these scientists that the tectonic plates are moving.

- 1
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- 2
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(2)

(Total 5 marks)

Q3. (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.

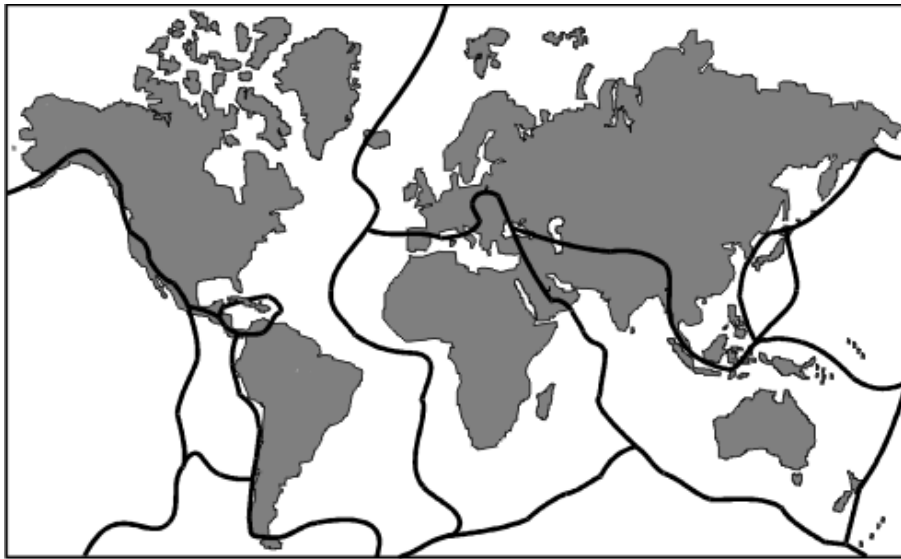


How could scientists use the idea of a land bridge to explain the evidence put forward by Wegener?

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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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.....

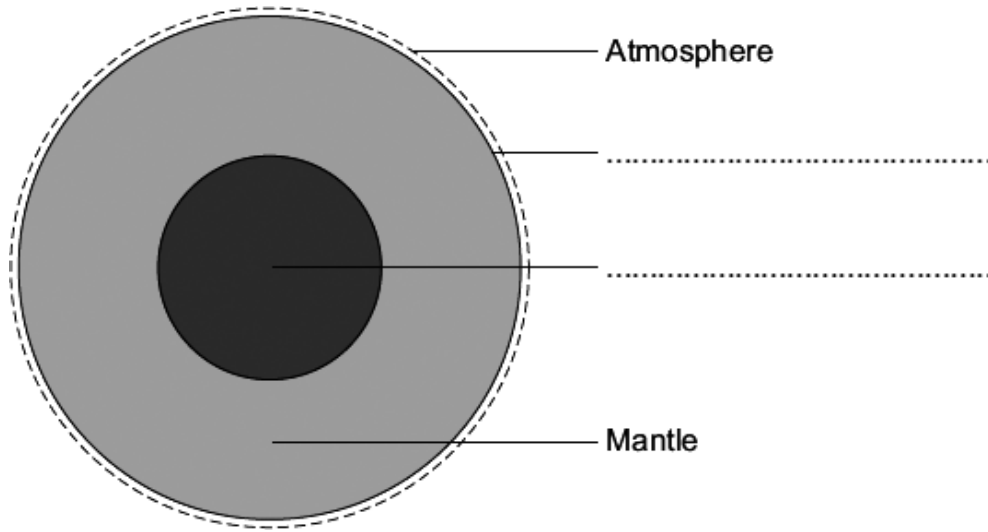
(1)

(Total 9 marks)

Q4. 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.

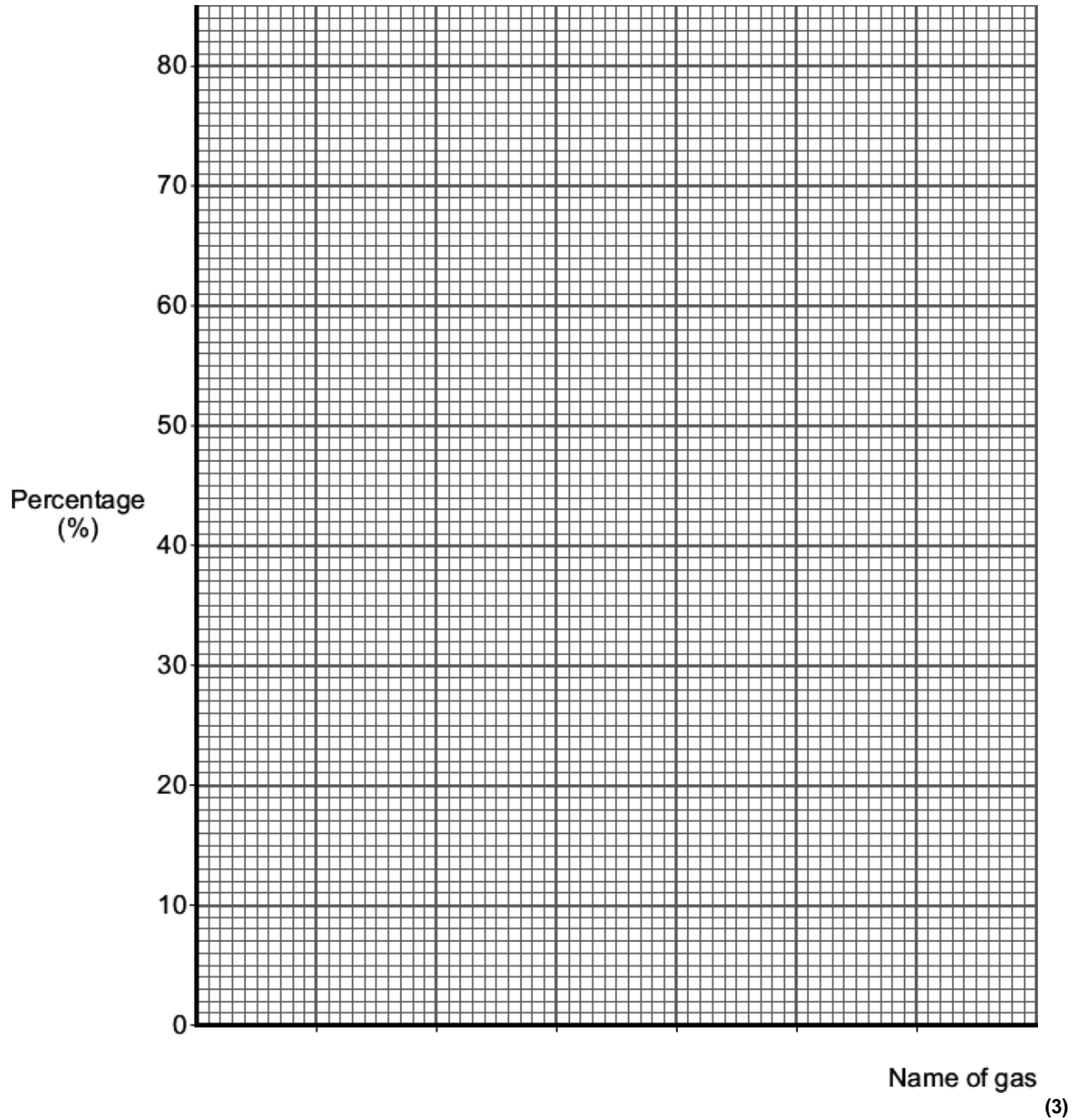


(2)

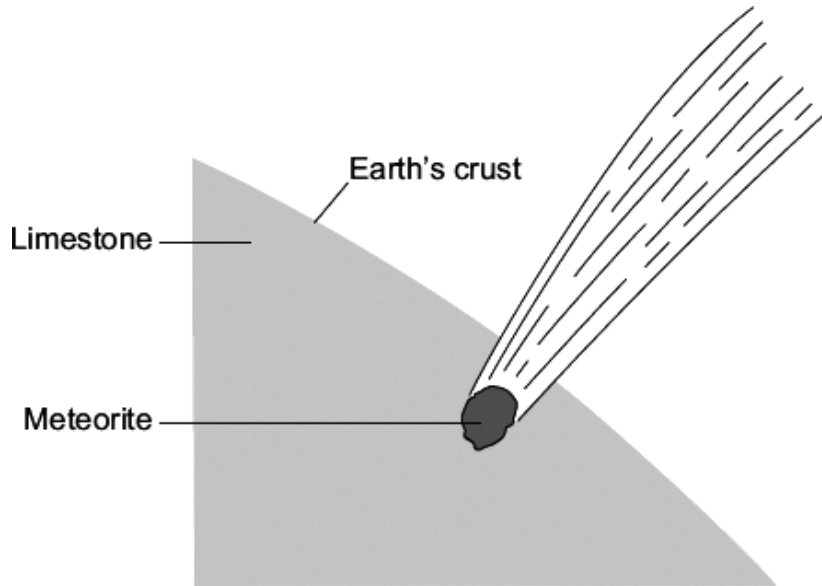
(b) The data in the table shows the percentages of the gases in the Earth's atmosphere.

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)

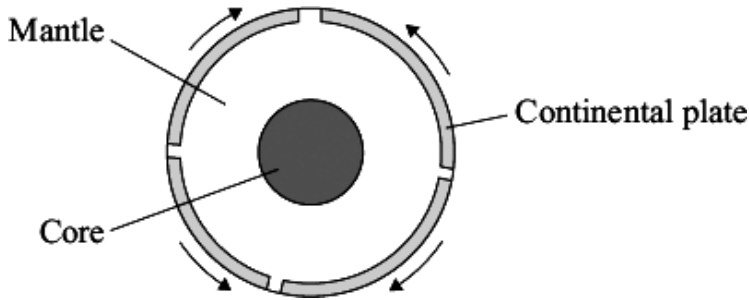
- (ii) More carbon dioxide in the Earth's atmosphere causes

acid rain.
global dimming.
global warming.

(1)

(Total 7 marks)

Q5. In 1915 Wegener proposed his idea of continental drift. About 50 years later the theory of plate tectonics was developed and this confirmed his idea.



(a) Give **one** reason why Wegener's idea was not accepted in 1915.

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(1)

(b) The theory of plate tectonics is used to explain why earthquakes occur.

Explain how earthquakes occur.

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(2)

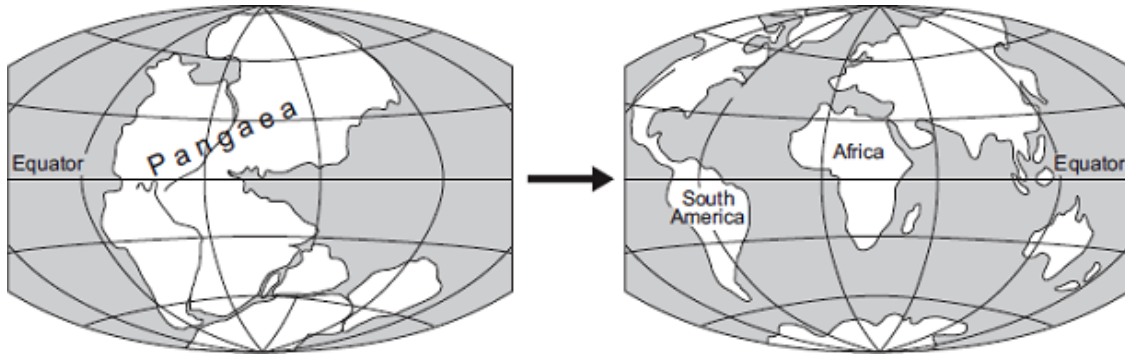
(c) Suggest why it is difficult to predict when an earthquake will occur.

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.....
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(1)

(Total 4 marks)

Q6. In 1912 Wegener suggested his theory of continental drift.



In 1912, many scientists did not accept Wegener's theory because he could not explain:

- how Pangaea had split into continents
 - how the continents had moved apart.
- (a) Wegener used evidence to support his theory.

Give **two** pieces of evidence Wegener used.

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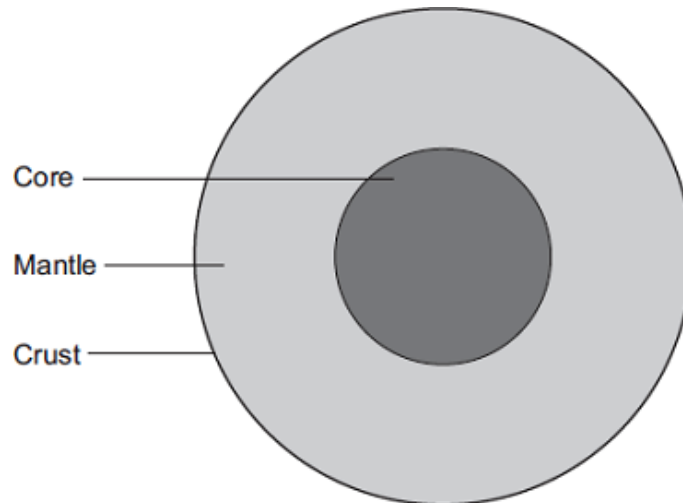
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(2)

(b) Scientists have discovered that the Earth is made up of layers.



Complete the sentences by writing **one** word in each space.

Scientists now accept Wegener's theory because they know that the Earth's and upper part of the mantle are cracked into tectonic plates.

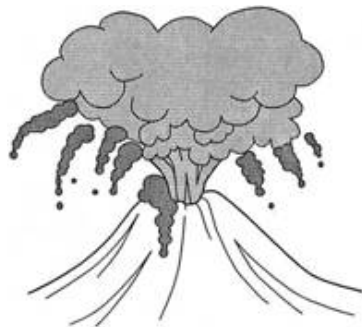
The tectonic plates move at relative speeds of a few centimetres per year because of convection currents in the Earth's

These convection currents are driven by released from natural radioactivity.

A volcanic eruption or an can happen at the boundaries between tectonic plates.

(4)
(Total 6 marks)

Q7. (a) During the first billion years of the Earth's existence, there were many active volcanoes. The volcanoes released the gases that formed the early atmosphere.



Describe how volcanoes caused the oceans to be formed.

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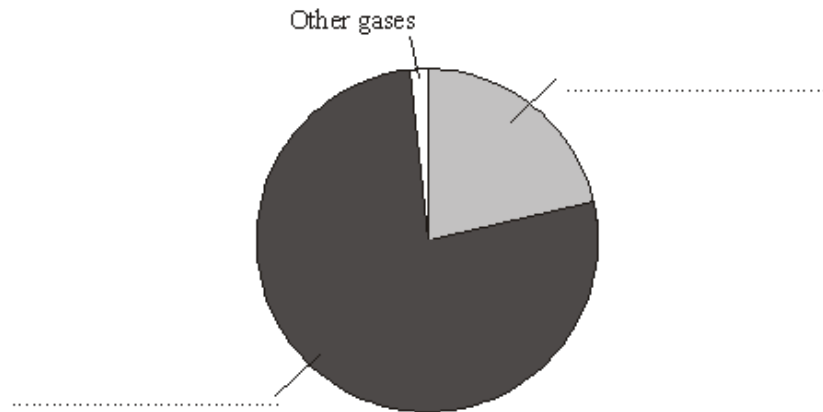
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(2)

(b) The atmosphere on Earth today is very different from the early atmosphere.

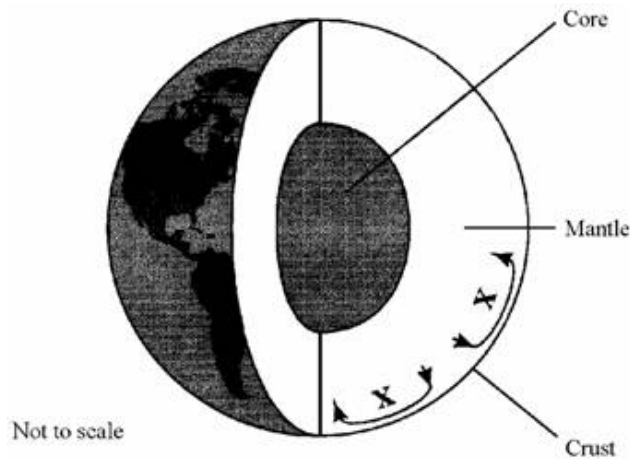
The pie chart shows the amounts of different gases in the air today. Choose gases from the box to label the pie chart.

argon	carbon dioxide	hydrogen	nitrogen	oxygen
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(2)
(Total 4 marks)

Q8. The diagram shows a view of the inside of the Earth.



Adapted from Physics for You (1996) by Keith Johnson, Nelson Thornes

(a) The curved lines marked **X** show two of the slow currents in the mantle.

(i) What sort of currents are these?

.....

(1)

(ii) How do these currents occur and what is their energy source?

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(3)

(b) Movements of the plates of the Earth's crust can result in earthquakes.

Give **two** other geological results of these movements.

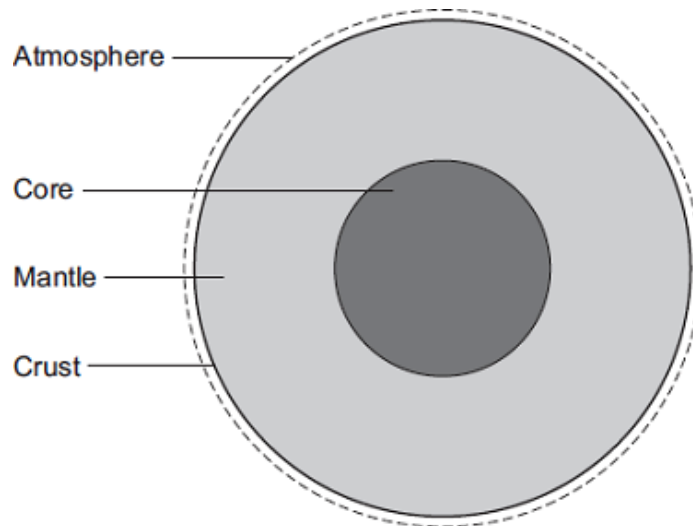
1

2

(2)

(Total 6 marks)

Q9. The diagram shows the layers in and around the Earth.



(a) Use the diagram above to help you to answer this question.

Draw **one** line from each statement to its correct layer.

Statement	Layer
There are mountain ranges.	atmosphere
There are convection currents that cause earthquakes.	core
There is a mixture of gases.	crust
	mantle

(3)

- (b) Iceland has many volcanoes.
Scientists are monitoring a volcano in Iceland, called Katla.



There has been an increase in the number of small earthquakes (tremors) around Katla.

- (i) Draw a ring around the correct answer to complete the sentence.

Iceland has volcanoes because it

has low temperatures.

is an island.

is on a tectonic plate boundary.

(1)

- (ii) People do not know when Katla will next erupt.

Tick (✓) the correct reason why.

Reason	Tick (✓)
Small earthquakes (tremors) near the volcano are happening more often.	
The last two eruptions happened a long time ago in October 1918 and in May 1860.	
Scientists cannot accurately predict when volcanic eruptions will occur.	

(1)

- (c) Previous eruptions of Katla produced large amounts of solid ash particles and sulfur dioxide.

Use the correct answer to complete each sentence

acid rain	earthquakes	global dimming	global warming
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An environmental impact caused by solid ash particles is

An environmental impact caused by sulfur dioxide is

(2)
(Total 7 marks)

- Q10.** Billions of years ago, the Earth's early atmosphere was probably like the atmosphere of Venus today.

The table shows a comparison of the atmospheres of the Earth and Venus today.

Name of gas	Percentage composition of atmosphere	
	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

- (a) Use the names of gases from the table to complete the sentences.

(i) In the Earth's atmosphere today, the main gas is

(1)

(ii) In the Earth's atmosphere billions of years ago, the main gas was

.....

(1)

- (b) (i) Scientists do **not** know the accurate composition of the Earth's early atmosphere. Suggest why.

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(1)

(ii) Use information from the table to answer this question.

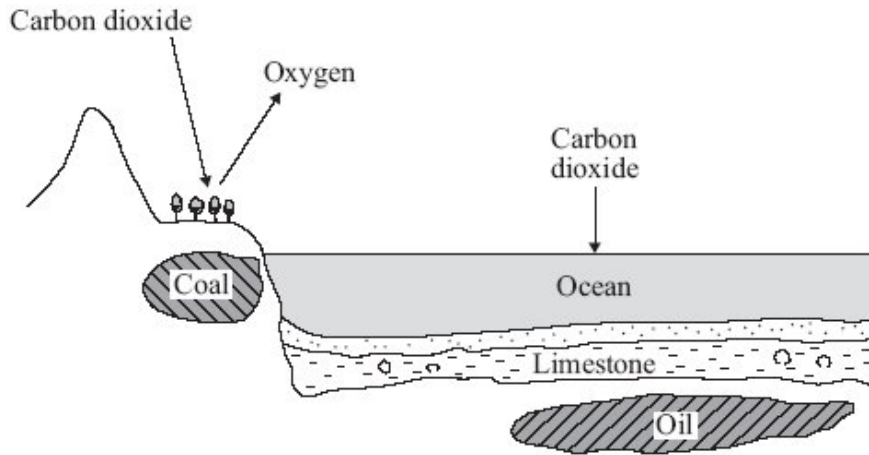
Water vapour is present in the atmospheres of the Earth and Venus today.
The Earth's surface is mainly covered by water.

Suggest why there is no water on the surface of Venus.

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.....

(1)

(c) The diagram shows how carbon dioxide is removed from the Earth's atmosphere.



Describe what happened to the carbon dioxide in the Earth's early atmosphere.
Use the diagram to help you.

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(3)
(Total 7 marks)

Q11. 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.

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.....

(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.

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(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.

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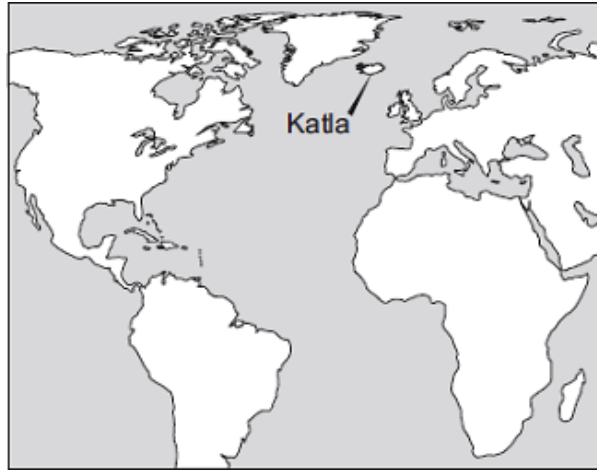
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(3)

(Total 8 marks)

Q12. 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?

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

(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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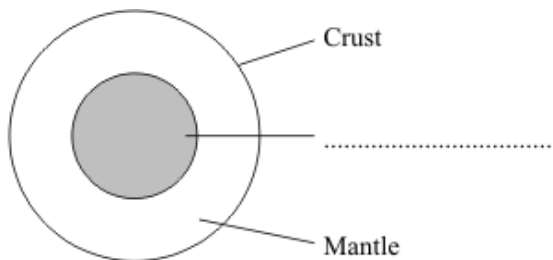
(3)
(Total 7 marks)

Q13. Earthquakes are common in certain places on Earth.

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

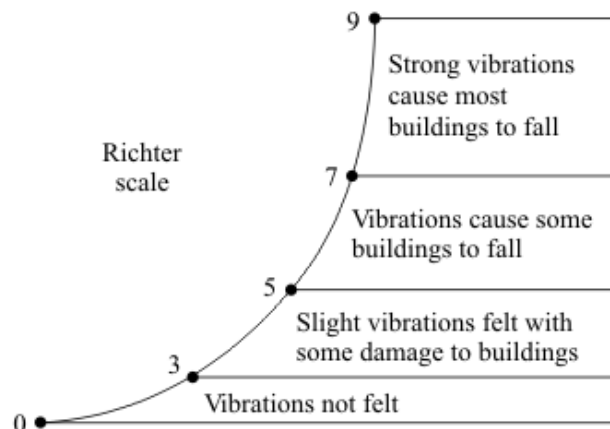
Choose one word from the box to complete the label on the diagram.

atmosphere	core	plate
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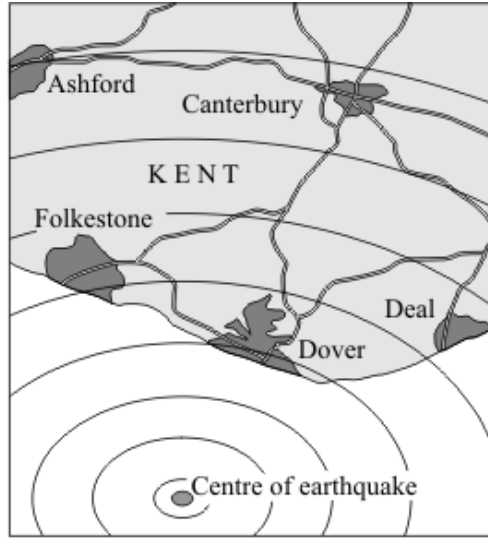


(1)

(b) In 1935 C.F. Richter designed a scale for comparing the size of earthquakes.



A newspaper reported that an earthquake off the coast of Kent had caused plaster to come down from ceilings, house tiles to loosen and church bells to ring.



(i) Earthquakes happen often in the UK.

Suggest why most of these earthquakes are **not** reported in the newspapers.

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.....

(1)

(ii) Draw a ring around the number which best shows the size of the earthquake in Kent.

1 4 6 8

(1)

(iii) State what causes earthquakes.

.....
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(1)

(iv) Why were people living in Kent **not** warned about this earthquake?

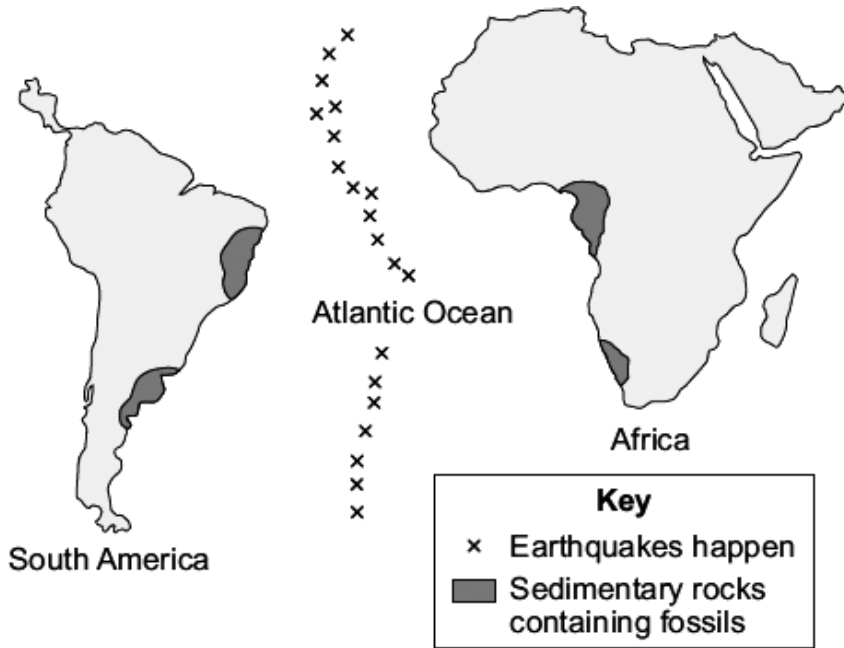
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(1)

(Total 5 marks)

Q14. 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)

Q15. For 200 million years the proportions of the different gases in the atmosphere have been much the same as today. Over the past 150 years the amount of carbon dioxide in the atmosphere has increased from 0.03% to 0.04%.

(a) Describe how carbon dioxide is released into the atmosphere:

(i) by human and industrial activity;

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.....
.....

(2)

(ii) from carbonate rocks by geological activity.

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(2)

(b) Explain how the seas and oceans can decrease the amount of carbon dioxide in the atmosphere.

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(3)

(c) (i) Give **one** reason why the amount of carbon dioxide in the atmosphere is increasing gradually.

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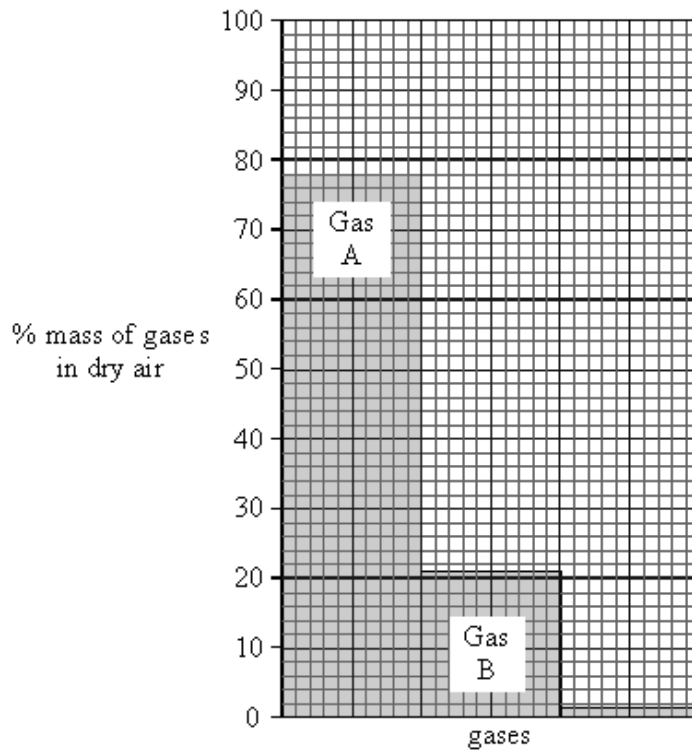
(1)

- (ii) Give **one** effect that increasing levels of carbon dioxide in the atmosphere may have on the environment.

.....
.....

(1)
(Total 9 marks)

- Q16.** 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)

- M1.** (a) bar drawn correctly 78 – 80 (%) 1
- (b) (i) (Mars has) no (green / living) plants / trees 1
- (ii) (argon) is unreactive / inert 1
accept argon is a noble gas
ignore it is in Group 0
- (c) (the amount of carbon dioxide has decreased because it has been) absorbed / used by (green / living) plants / trees **or** used for photosynthesis 1
accept dissolved / absorbed by oceans or locked up in fossil fuels / carbonate rocks
- (d) the eruption of volcanoes 1
- [5]**

- M2.** (a) radioactivity (keeps the core hot) 1
accept half-life of radioactive elements has proved the Earth is older than 400 million years
accept the Earth is not cooling
*do **not** accept fossil / rock evidence*
- (b) any **two** from: 2
- the shapes of the two continents fit together (like a jigsaw) OWTTE\
*do **not** accept the continents / they are the same shape*
 - the same type of rocks have been found
accept 'rocks match'
 - the same fossils have been found
accept 'fossils match'
 - rising magma rising through a gap under the Atlantic

(c) any **two** from:

- earthquakes
accept seismic waves
- volcanoes
- idea of distance between America and Europe / Africa is increasing e.g. continental drift
- oceanic ridges
accept ocean floor spreading
- formation of (new) mountain ranges
accept fold mountains or mountains increasing in height
- formation of (new) islands
- magnetic stripes
- tsunamis

2

[5]

M3. (a) (i) X – mantle

1

Y – inner core

*do **not** accept solid core*

1

(ii) different to the crust or contains a lot of (heavy) metals

accept iron and nickel for metals

1

higher (average) density **or** denser

*density higher than 5500 (kg/m³) gets **2** marks*

1

(b) animals were able to move from one continent to the other

1

(when bridge broke) animals evolved differently *accept animals adapted differently*

1

(c) (i) earthquakes occur at the boundary
between plates or earthquakes occur
where plates push against each other

1

there are no plate boundaries running through Britain

1

- (ii) convection currents (in the mantle)
or heat released by (natural) radioactive processes
accept Britain is not near the edge of a plate

1

[9]

M4. (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]

M5. (a) no / insufficient evidence / proof / explanation

accept there were other theories such as a land bridge / solid crust

1

(b) (continental / tectonic) plates move

1

any **one** from:

- (caused by) convection currents (in the mantle)
- (driven by) heat (energy) released by radioactive processes / decay
- sudden (movement) / vibrations

1

(c) any **one** from:

- do not know / see / able to detect / measure what is happening below the Earth's crust
ignore cannot measure movement of plates / unpredictable
- build up of pressure between plates is randomly released
accept (movement) is random / no pattern

1

[4]

M6. (a) any **two** from:

- similar fossils in Africa and South America
ignore same plants / animals
- similar rocks in Africa and South America
- 'jigsaw fit'
allow rocks / fossils match in Africa and South America

2

(b) crust

1

mantle

1

heat / energy

1

earthquake

1

[6]

M7. (a) (i) water vapour given out from volcano

accept steam
not hydrogen and oxygen combining
to form water

1

condensed

accept rain / clouds formed just 'cools' is insufficient

1

(b) nitrogen (left) N₂
do **not** accept N 1

oxygen (right) O₂
do **not** accept O 1

[4]

M8. (a) (i) convection (currents)
accept (currents) which move the plates 1

(ii) less dense (molten) rock / magma rises / moves up
or more dense (molten) rock / magma falls / moves down 1

heat (is transferred / conducted) to the mantle / crust
(resulting from natural) radioactive processes (in the core) 1

or radioactivity
*accept radiation provided there is no
contradiction as in, for example, radiation from the Sun
or fission
do not credit fusion* 1

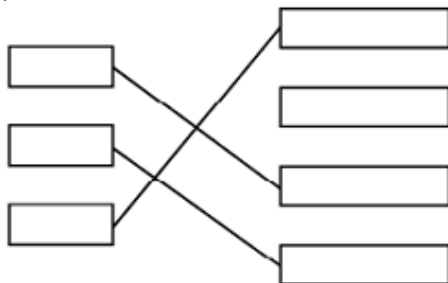
- (b) any **two** from
- (formation of fold) mountains
or deformation(s)
 - hot springs
do not credit just springs
 - (oceanic) ridges
 - (oceanic) trench(es)
 - rift(s)
 - seismic waves
 - subduction
or recycling of rocks
 - tsunami(s)
do not credit tidal waves
 - volcano(es)
or volcanic activity / sill(s) dyke(s) lava flow(s)

2

[6]

M9.

(a)



3

(b) (i) is on a tectonic plate boundary

1

(ii) scientists cannot accurately predict when volcanic eruptions will occur

1

(c) global dimming

1

acid rain

1

must be in this order

[7]

- M10.** (a) (i) nitrogen / N₂ 1
- (ii) carbon dioxide / CO₂ 1
- (b) (i) humans / scientists had not evolved
accept it was billions / millions of years ago
allow too long ago 1
- (ii) temperature is above 100°C **or** any water would evaporate / boil
accept Venus is too hot 1
- (c) any **three** from:
- used by plants
 - used for photosynthesis
accept plants take in carbon dioxide and give out oxygen for the first two bullet points ie 2 marks
 - dissolves in oceans / seas
allow absorbs into oceans / seas
 - used to form the shells / skeletons of marine organisms
 - locked up as limestone / carbonates
 - locked up as fossil fuels / oil / coal
- 3

[7]

M11. (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 / micro organisms / 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 / micro organisms / 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

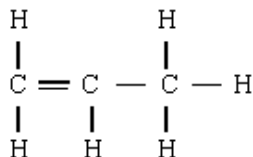
any methane that evaporates will condense

accept boils for evaporates

accept cooling and produce rain for condensing

1

(c) (i)



bonds must be displayed correctly

ignore bond angles

1

(ii) poly(propene) / polypropene / polypropylene
do not allow polypropane

any **two** from:

- double bonds open up / break / become single(*)
- propene molecules / monomers / they join / undergo addition polymerisation(*)

1

- form chains / long molecules(*)
()correct chemical equation gains 2 marks*
ignore large
using monomer incorrectly max 2 marks

2

[8]

M12. (a) (i) (Iceland is) on a boundary between (tectonic) plates
allow where tectonic plates move apart / meet / collide

1

(ii) any **one** from:

ignore tremors (small earthquakes) are random / have no pattern
ignore difficult to predict / no evidence / no proof

- not all tremors (small earthquakes) indicate that the volcano will erupt
allow these tremors (small earthquakes) may be false alarms
- scientists cannot monitor what is happening below the Earth's crust or in the Earth's mantle

1

(b) water vapour / steam released by volcanic activity

1

condensed to form the oceans

allow a description of condensing
do not accept other gases condensing

1

(c) earthquakes are caused by the sudden movement of the Earth's (tectonic) plates
ignore collision (of tectonic plates)

1

caused by convection currents in the Earth's mantle

1

caused (by the heat released) by radioactive processes (within the Earth)

1

[7]

- M13.** (a) core 1
- (b) (i) 3 or below / low on the Richter scale
accept vibrations not felt / causes no damage
ignore references to injuries 1
- (ii) 4 1
- (iii) movement of (Earth.s / tectonic) plates
allow plates collide 1
- (iv) (earthquakes) cannot be predicted / sudden / without warning / random
ignore under / in the sea 1

[5]

- M14.** (a) (i) plate boundary
allow plates moving / colliding
allow fault line / sea floor spreading
allow plate tectonics 1
- (ii) any **one** from:
 - do not know what happens below the Earth's crust
allow it's underground
 - no pattern
allow random 1
- (b) (i) any **one** from:
 - he could not explain how continents could move
allow there was no evidence / no proof / did not know about plates
 - other ideas existed (that continents were in fixed positions **or** there had been a land bridge)
allow it went against established ideas 1

(ii) any **two** from:
accept in addition modern ideas such as sea floor spreading
ignore plants / animals

- similar fossils
- similar rocks
- jigsaw fit
allow rocks match up
allow reference to super continent / pangea

2

(c) (continents move) because there are convection currents

1

in the mantle

1

caused by radioactivity

if no other mark awarded

'continents on different plates' gains 1 mark

1

[8]

M15. (a) (i) burning / breathing / respiration / fuels / food
for 1 mark each

2

(ii) 1. rock is heated / subducted (owtte) / close to magma / melted
1. rock is decomposed / carbon dioxide released through volcanoes
for 1 mark each

2

(b) carbon dioxide reacts / dissolves in sea-water / dissolves in rain water
insoluble carbonates / calcium carbonate are / is formed carbon dioxide turned into shells /
coral / limestone / chalk / sediments also soluble hydrogencarbonates (calcium /
magnesium) are formed photosynthesis by plants
any three for 1 mark each

3

(c) (i) sea unable to absorb all the extra carbon dioxide being produced
more trees being cut down / deforestation increased burning of fuels / more cars /
more industry (*not* more people)
any one for 1 mark

1

- (ii) global warming / greenhouse effect or effects such as melting ice caps / rising sea levels / climatic change / more deserts
(*not* changes to ozone layer)

for one mark

1

[9]

##

nitrogen – Gas A (or N_2) (N) = 1)

oxygen – Gas B (or O_2) (O)

for 1 mark each

[2]

