Atmosphere 5

Name: _____

Class: _____

Date: _____

Time: **69 minutes**

Marks: **69 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 (C_2H_4) and propene (C_3H_6) 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.

$$CH_4 + 2O_2 \longrightarrow 2 \text{ \_\_\_\_\_} + CO_2$$

$$CaCO_3 \longrightarrow \text{\_\_\_\_\_} + CO_2$$

(2)

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

What is *locked up* carbon dioxide?

_____

_____

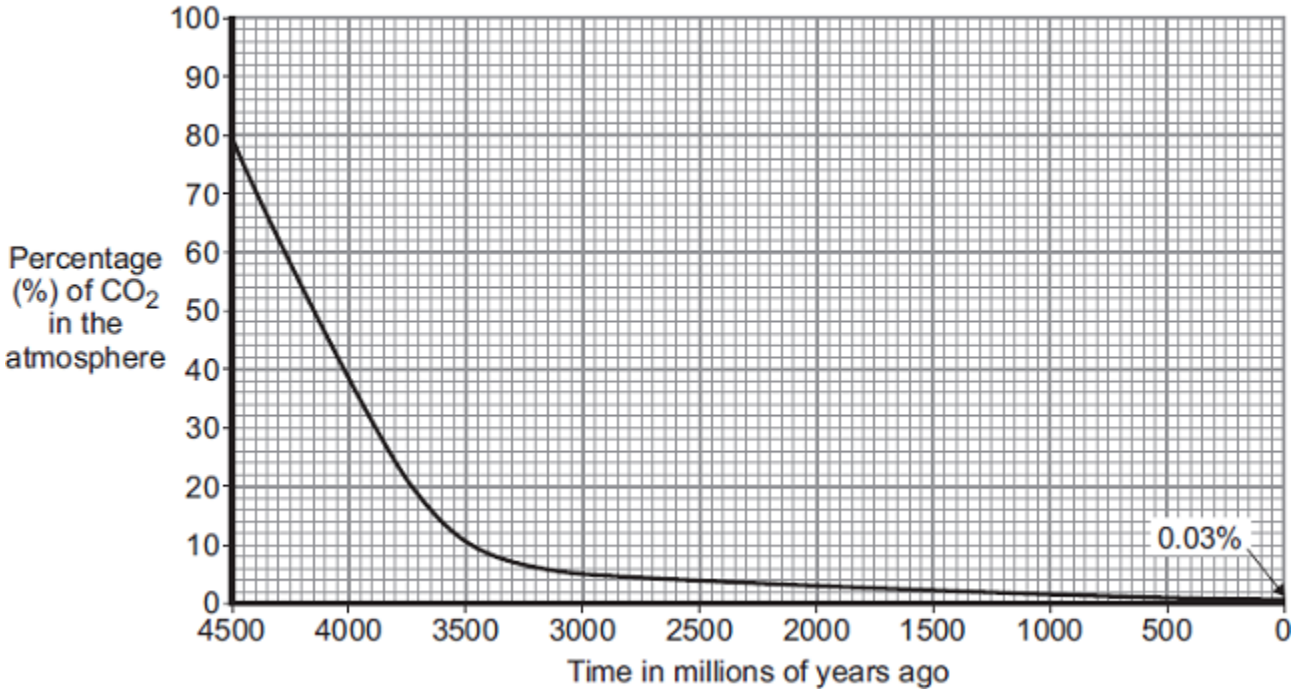
_____

_____

(2)

(b) **Graph 1** shows how the percentage of carbon dioxide in the atmosphere changed in the last 4500 million years.

Graph 1



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.

_____

_____

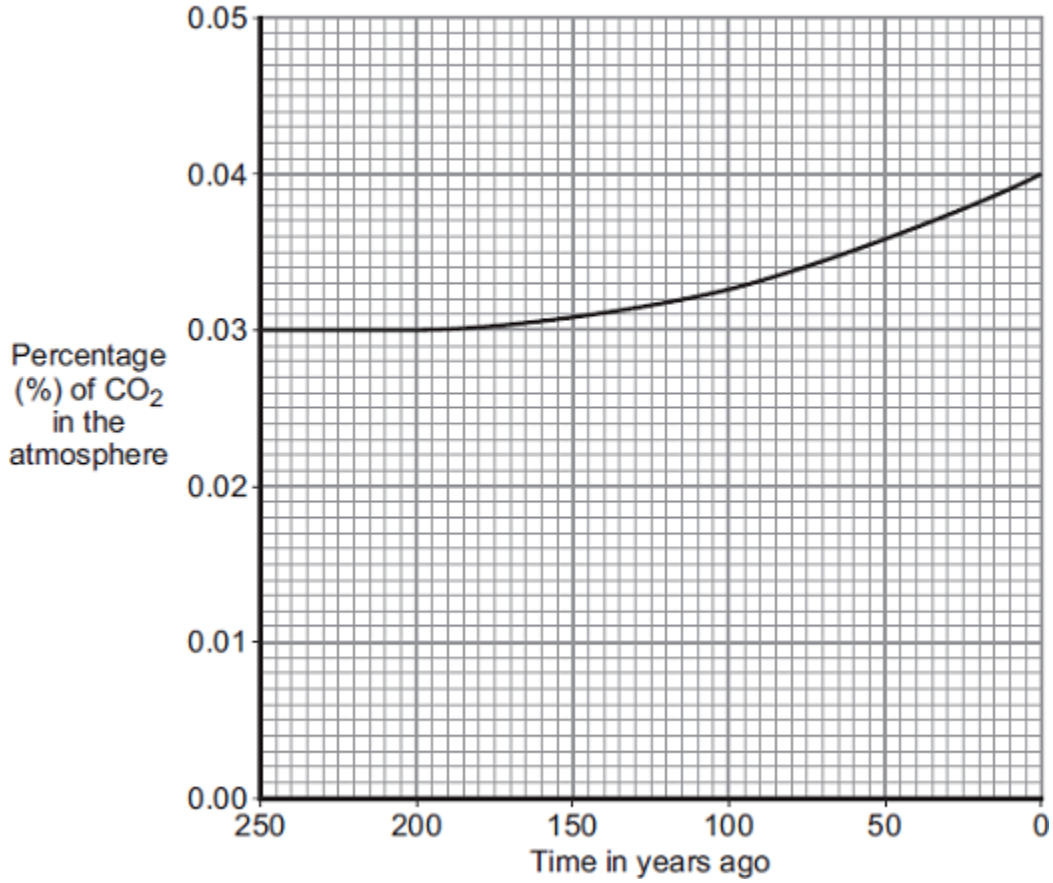
_____

_____

(2)

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

Graph 2



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

Explain your answer.

_____

_____

_____

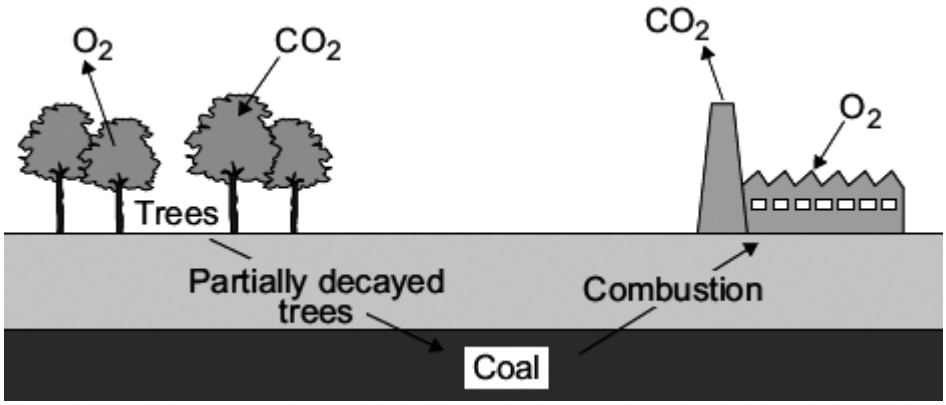
_____

(2)

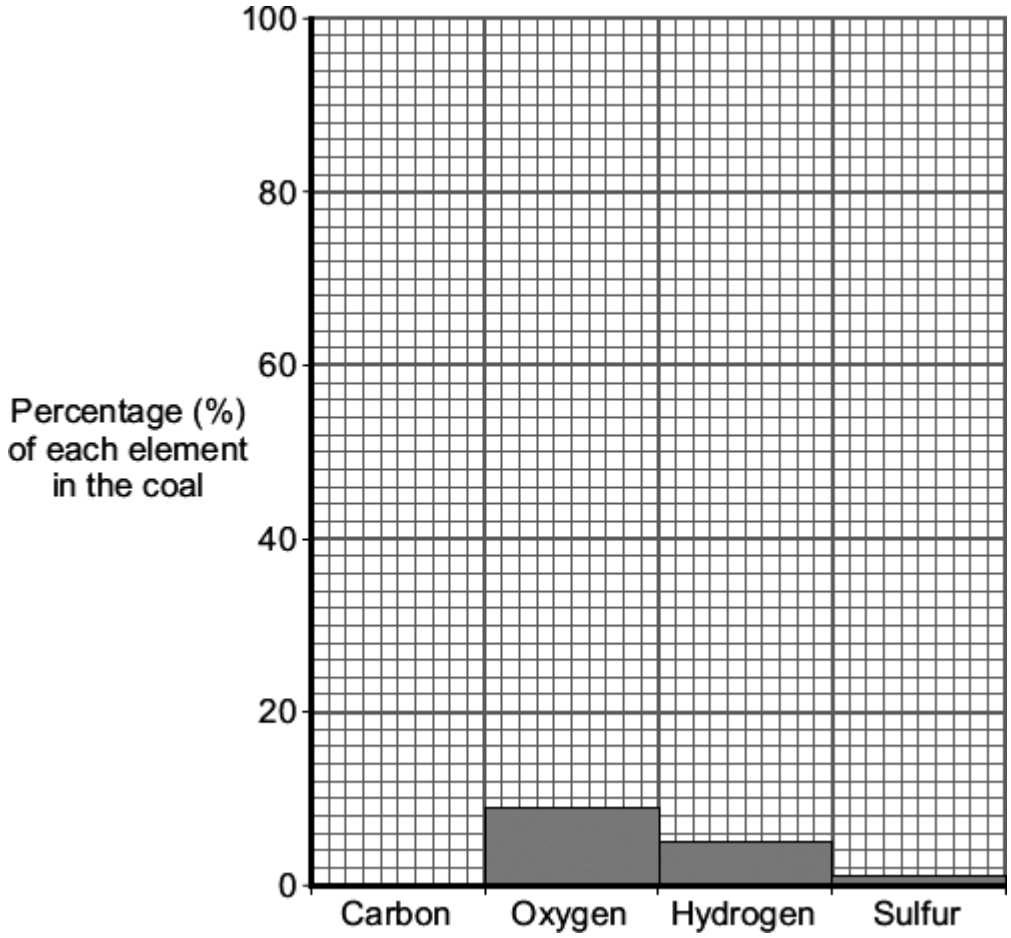
(Tota 10 marks)

4. About 3000 million years ago carbon dioxide was one of the main gases in the Earth's early 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.	Today coal is burned in power stations to release the energy needed by industry.



(a) The bar chart shows the percentage of some of the elements in this coal.



(i) This coal contains 85 % carbon. Draw the bar for carbon on the chart.

(1)

(ii) Coal is burned in the atmosphere to release energy.
Two of the products of burning coal are shown.

Draw **one** line from each product to its environmental impact.

Product	Environmental impact
Sulfur dioxide	Acid rain
Carbon particles	Global dimming
	Global warming

(2)

(b) Use the information above and your knowledge and understanding to answer these questions.

(i) How did the formation of coal decrease the amount of carbon dioxide in the Earth's early atmosphere?

_____

_____

(1)

(ii) How does burning coal affect the amount of carbon dioxide in the Earth's atmosphere?
Explain your answer.

_____

_____

_____

_____

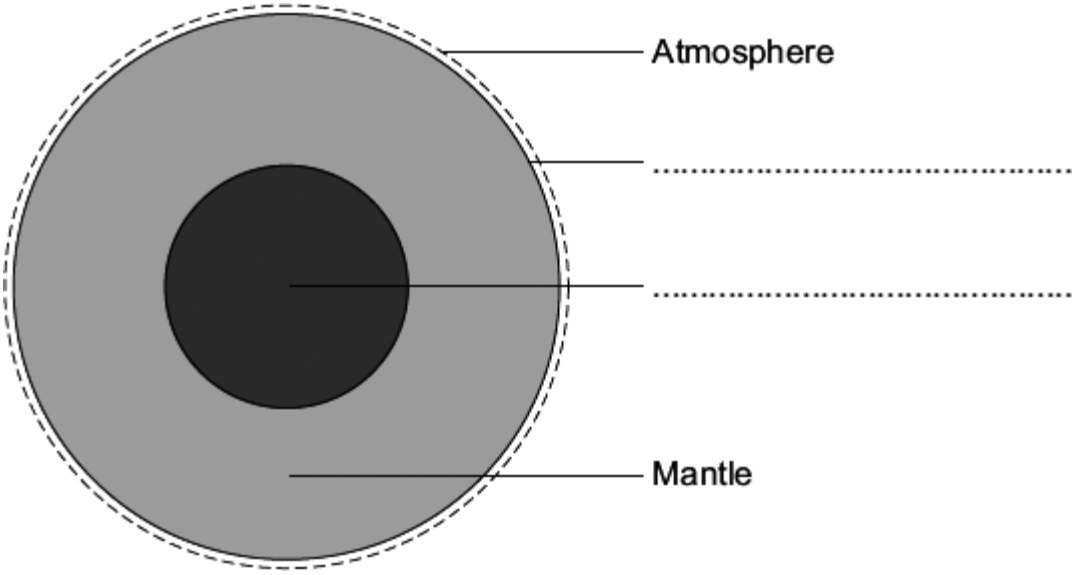
(2)

(Total 6 marks)

5. 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.

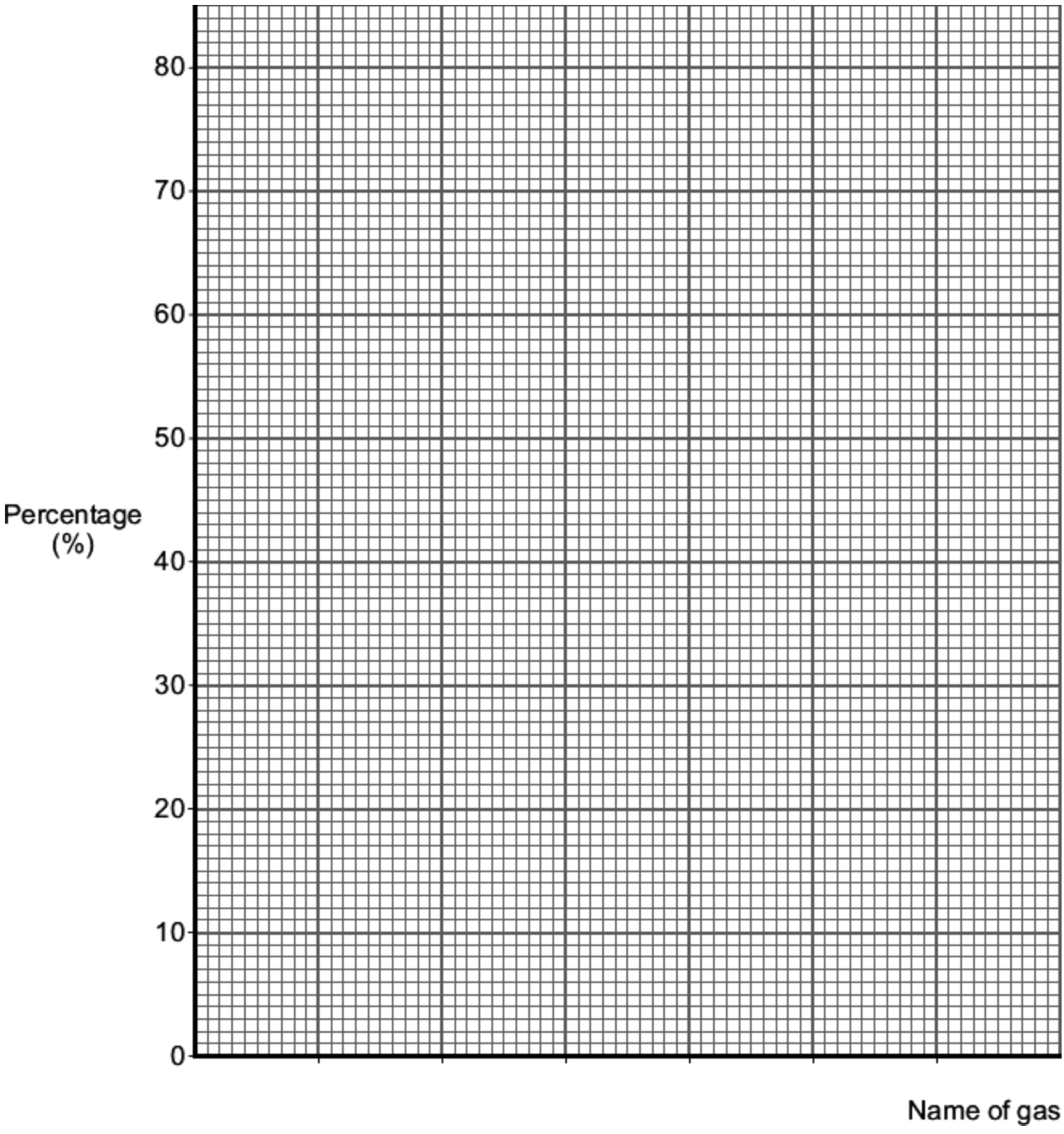


(2)

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

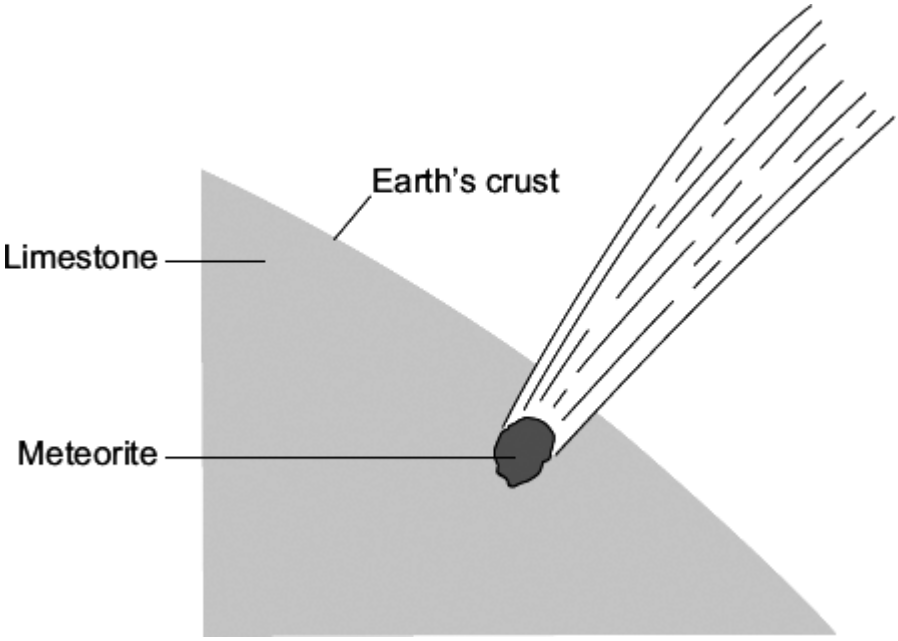
Name of gas	Percentage (%) of gas
Nitrogen	78
Oxygen	21
Other gases	1

Present the data in the table on the grid below.



(3)

(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)

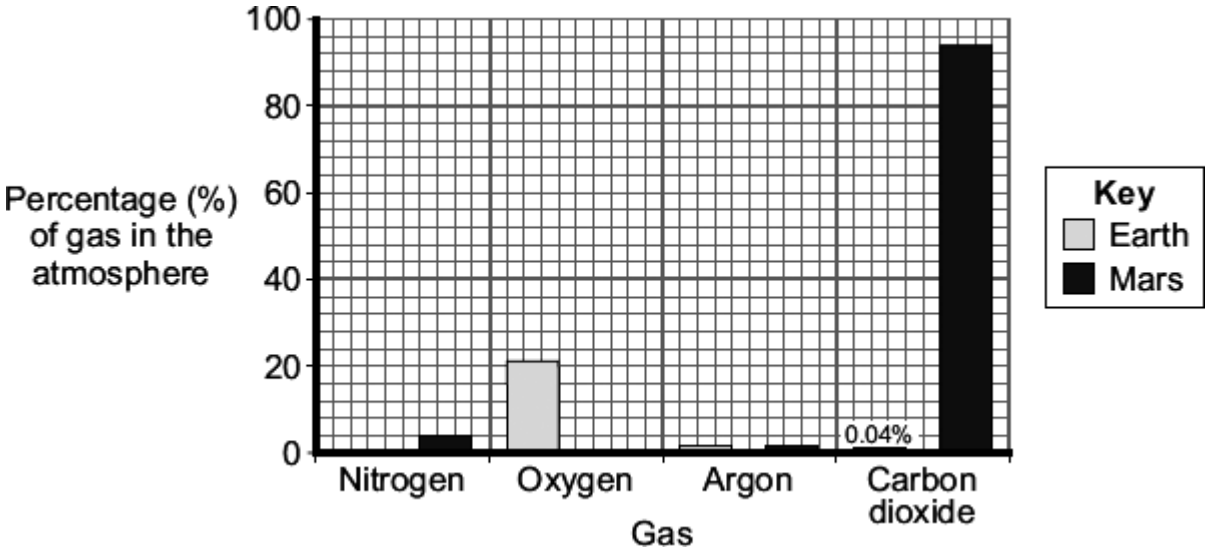
(ii) More carbon dioxide in the Earth's atmosphere causes

acid rain.
global dimming.
global warming.

(1)

(Total 7 marks)

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

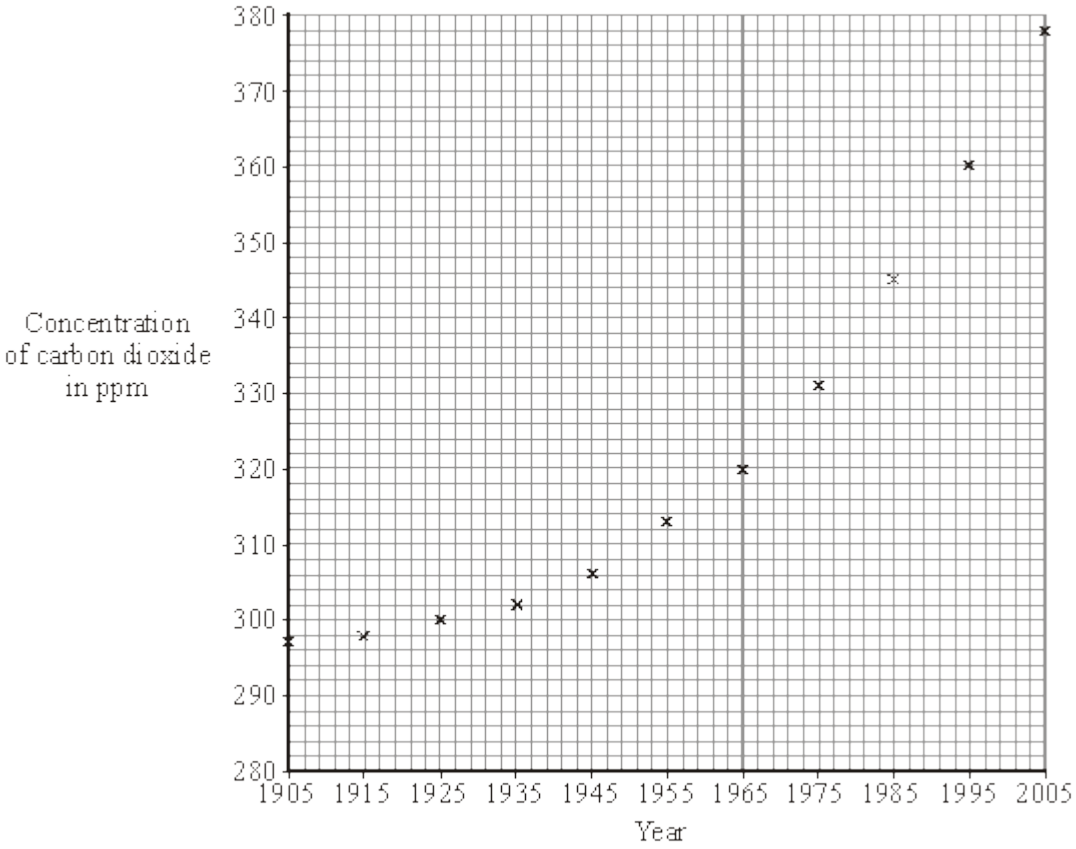
made by

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

(1)

(Total 5 marks)

7. Global warming is thought to be happening because of the increased burning of fossil fuels. The concentration of carbon dioxide in the air from 1905 to 2005 has been calculated.



(a) Draw a line of best fit for these points.

(1)

(b) (i) What was the concentration of carbon dioxide in 1955?

_____ ppm

(1)

(ii) In what year did the concentration of carbon dioxide reach 350 ppm?

_____

(1)

(c) Use the graph to describe, in as much detail as you can, what happened to the concentration of carbon dioxide from 1905 to 2005.

_____

_____

_____

_____

(2)

(Total 5 marks)

8. 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.

	Percentage composition of atmosphere	
Name of gas	**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 ºC	460 ºC

(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.

_____

_____

(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.

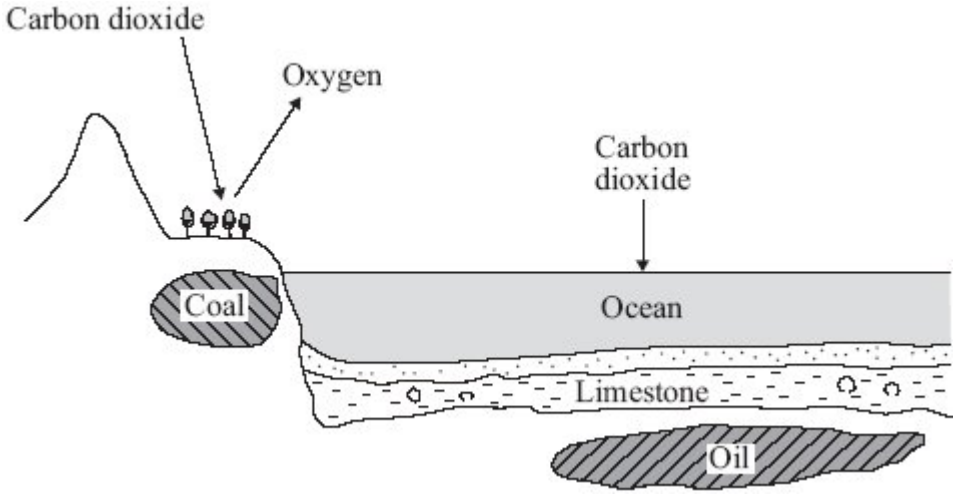
Suggest why there is no water on the surface of Venus.

_____

_____

(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.

_____

_____

_____

_____

_____

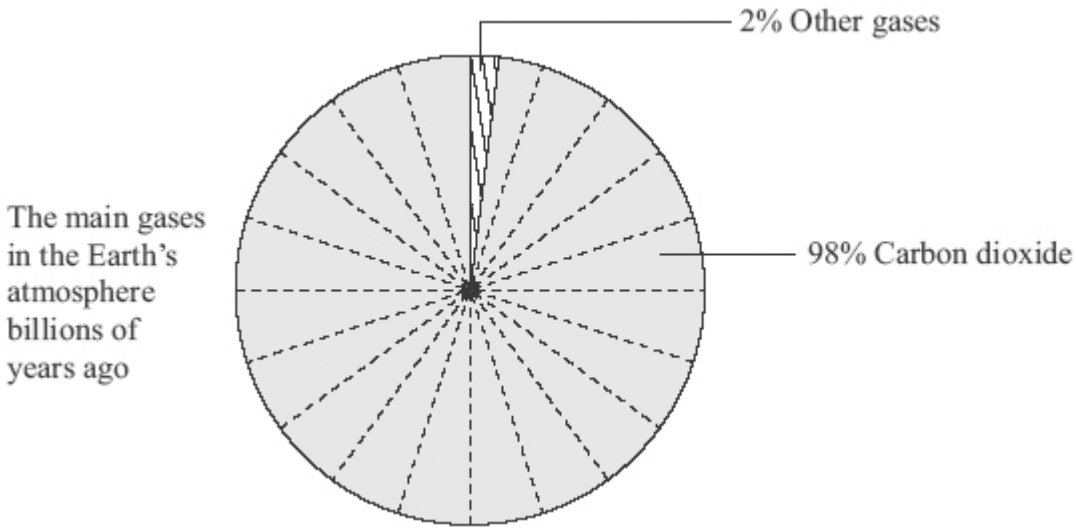
_____

_____

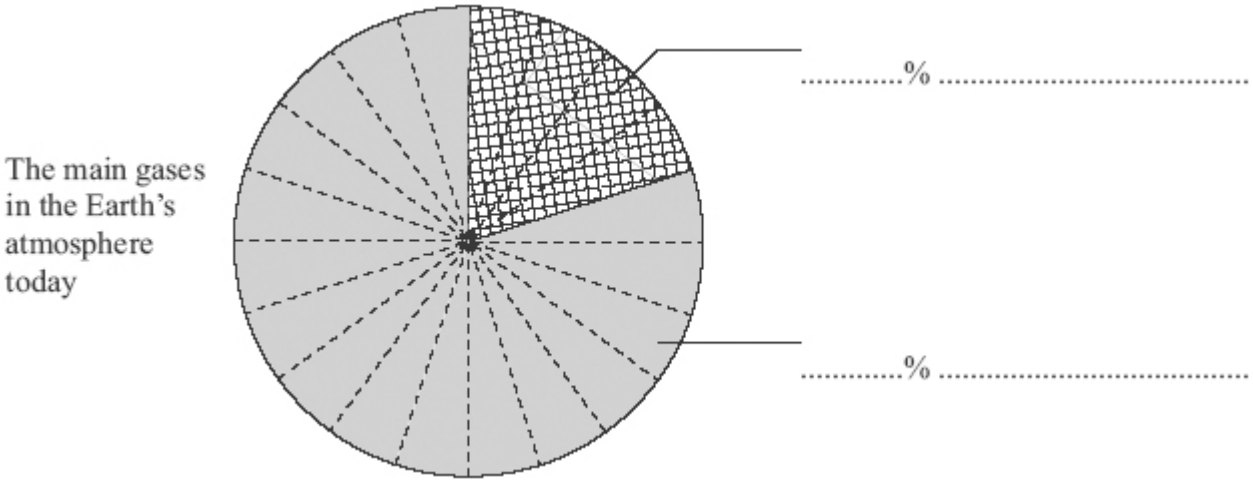
(3)

(Total 7 marks)

9. Life on Earth would not exist without the atmosphere. Billions of years ago the composition of the Earth's atmosphere was very different from the composition today.



(a) Label the pie chart below to show the percentages and names of the two main gases in the Earth's atmosphere today.



(2)

(b) There is evidence that the composition of the Earth's atmosphere is still changing. One possible reason is that many power stations generate electricity by burning fossil fuels such as coal, oil or natural gas. Sulfur dioxide, SO_2, is produced when coal burns in air.

(i) What environmental problem does sulfur dioxide cause?

_____

_____

(1)

(ii) How could this environmental problem be reduced in coal-fired power stations?

_____

_____

(1)

(iii) Gas-fired power stations burn methane, CH_4, in air.

Complete the word equation for this reaction.

methane + _____ → carbon dioxide + _____

(2)

(c) Excess carbon dioxide should be prevented from entering the atmosphere.

Explain why.

_____

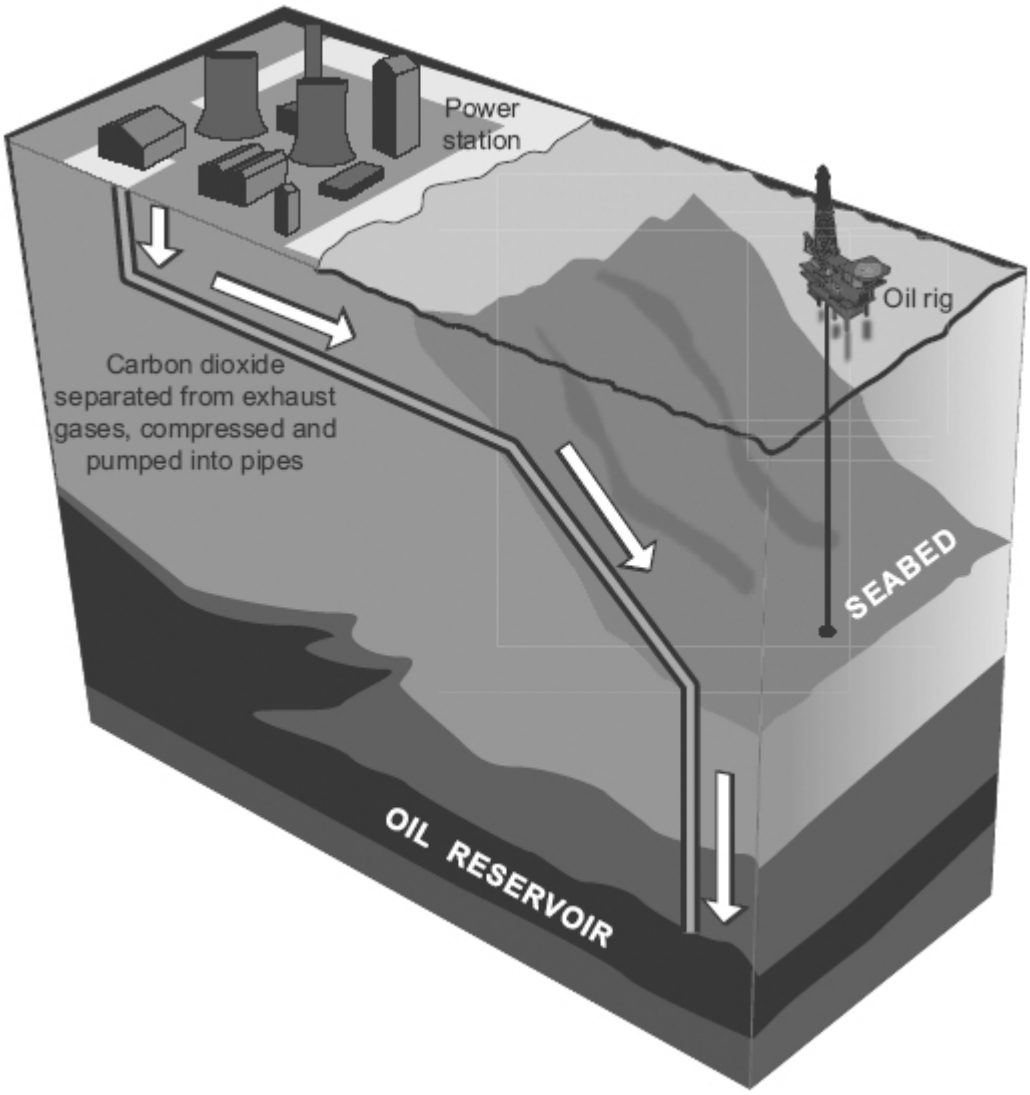
_____

_____

_____

(2)

(d) Carbon dioxide is produced when fossil fuels burn in power stations. The diagram represents one idea to prevent excess carbon dioxide from entering the atmosphere.



Use the diagram to explain how carbon dioxide can be prevented from entering the atmosphere.

_____

_____

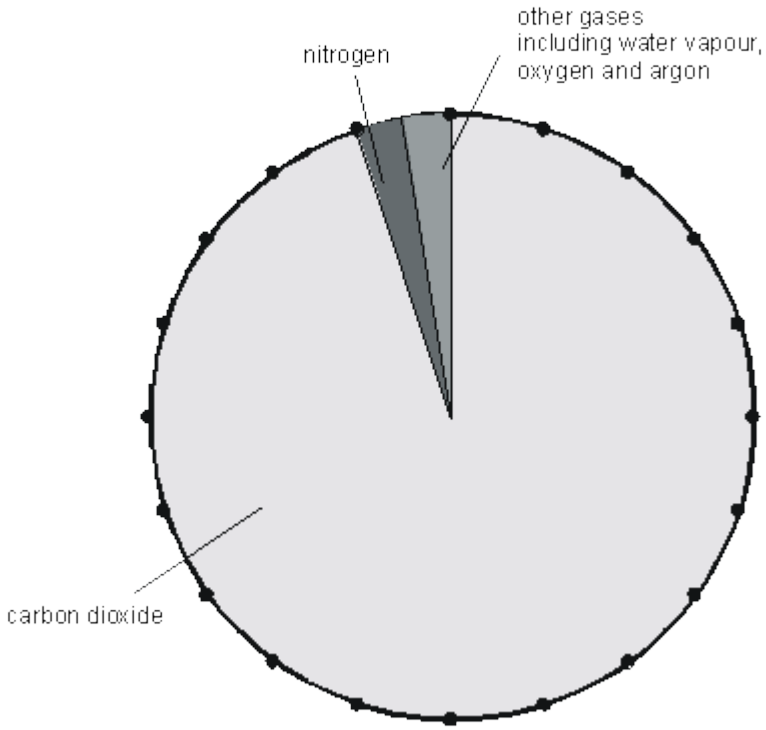
_____

_____

(2)

(Total 10 marks)

10. The pie chart below shows the composition of the atmosphere on the planet Mars.



(a) Use the pie chart above to calculate the percentage of carbon dioxide in the atmosphere on Mars.

_____

_____

_____%

(2)

(b) The atmosphere on Earth is very different from that on Mars. One important difference is that the Earth's atmosphere contains a large amount of oxygen.

Give **two** other ways in which the Earth's atmosphere is different from the atmosphere on Mars.

1. _____

_____

2. _____

_____

(2)

(c) When the Earth was formed its atmosphere is thought to have been similar to the atmosphere on Mars. Explain how green plants and other organisms have changed the composition of the Earth's atmosphere.

(4)

(Total 8 marks)

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*

  *allow oceans store **or** take in **or** dissolve carbon dioxide*
- locked up in (sedimentary) rocks
- locked 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 <u>fuels</u>
- 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 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]

4. (a) (i) bar drawn between 84 and 86

1

(ii) sulfur dioxide linked to acid rain

1

carbon particles linked to global dimming

1

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

- plants / trees <u>absorb</u> (carbon dioxide)
- coal ' <u>locks up</u>' (carbon dioxide)

1

(ii) it <u>increases</u> the amount (of CO_2)

1

because carbon in coal (forms carbon dioxide)

accept because carbon / coal burns / reacts <u>with oxygen</u> (to produce CO_2)

1

[6]

5. (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]

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) curve of best fit drawn through

or close to all of the points

1

(b) (i) 313

1

(ii) 1989 +/– 1

1

(c) concentration / amount of carbon dioxide has <u>increased</u>

1

recently the rate of increase is <u>increasing</u>

1

[5]

8. (a) (i) nitrogen / N_2

1

(ii) carbon dioxide / CO_2

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]

9. (a) oxygen **and** nitrogen

1

20 – 21 % and 78 – 80 %

*accept any two correct responses in the correct space for **one** mark*

1

(b) (i) acid rain

accept toxic gas or consequence of acid rain

1

(ii) idea of the removal or use of sulfur dioxide gas (from the waste gases)

*do **not** accept remove sulfur from coal*

1

(iii) oxygen

accept O_2

1

water

accept H_2O

accept hydrogen oxide / steam

1

(c) any **two** from:

- it's a 'greenhouse gas' or increase greenhouse effect
  accept action of a 'greenhouse gas'
- causes global warming or increase in the Earth's temperature
- sea-levels rise or flooding
- climate change
- (polar) ice-caps melt
- extension of deserts
  *mention of ozone / acid rain / global dimming = max **1** mark*

2

(d) idea trap / store / lock the carbon dioxide

1

in the oil reservoir or under the sea bed
*do **not** accept 'into the oil' / 'under the sea'*

1

[10]

10. (a) 95% (1 mark for working)

2

(b) Much less carbon dioxide
Much more nitrogen

2

(c) Plants take up CO_2
plants give out oxygen
when they die trap CO_2 in rocks and fossil fuels
methane and ammonia reacted with oxygen
nitrogen gas produced
by reaction of oxygen and ammonia
and by denitryfying bacteria
formation of ozone layer
any 4 for 1 mark each

4

[8]