

GCSE Chemistry

Worksheet: The Earth's early atmosphere

TIME 30 min	TOTAL 27 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The Earth's early atmosphere

NAME _____

CLASS _____

DATE _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The Earth is about 4.6 billion years old. One theory describes how the Earth's early atmosphere formed.

0 1 . 1

According to this theory, what was the main gas in the Earth's early atmosphere?

Tick (✓) **one** box.

Argon

☐

Carbon dioxide

☐

Nitrogen

☐

Oxygen

☐

[1 mark]

0 1 . 2

Where did the gases in the early atmosphere come from?

.....

.....

[1 mark]

0 1 . 3

How were the oceans formed?

.....

.....

[1 mark]

0 1 . 4

Name **two** other gases that may have been in the early atmosphere in small proportions.

.....

.....

.....

.....

[2 marks]

0 2

0 2 . 1

According to one theory, which gas made up most of the Earth's early atmosphere?

Tick (✓) **one** box.

Nitrogen

☐

Oxygen

☐

Carbon dioxide

☐

Argon

☐

[1 mark]

0 2 . 2

Name the process that released most of the gases that formed the Earth's early atmosphere.

.....

.....

.....

.....
[1 mark]

Table 1 summarises two types of evidence about the Earth's early atmosphere.

Table 1

Type of evidence	What it can show
Compositions of volcanic gases today	What gases the early atmosphere might have contained
The atmospheres of Mars and Venus	What an early, carbon-dioxide-rich atmosphere might look like

Explain why neither type of evidence in Table 1 can prove exactly what the Earth's early atmosphere contained.

.....

.....

.....

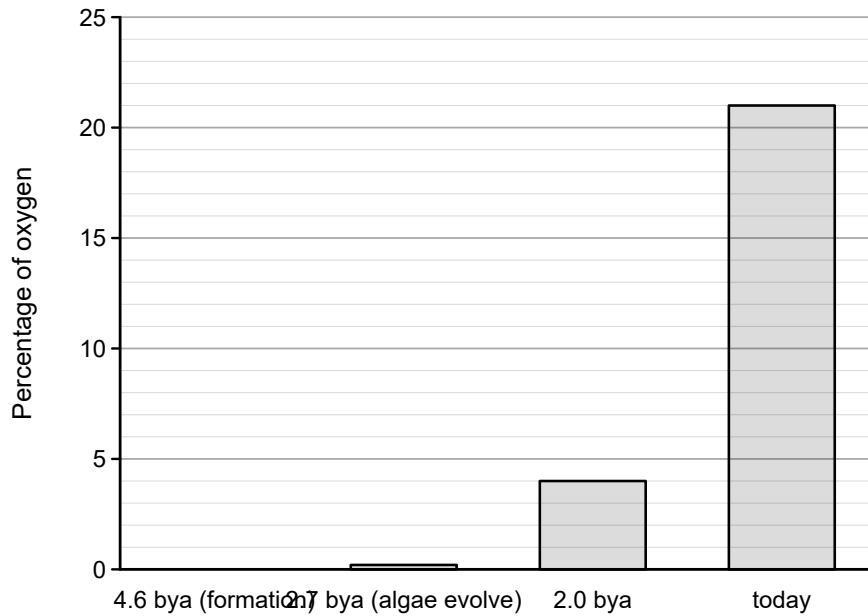
.....

[2 marks]

0 4

Figure 1 shows scientists' estimates of the percentage of oxygen in the atmosphere at four points in Earth's history (bya = billion years ago).

Figure 1



0 4 . 1

Describe the trend shown in Figure 1.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Suggest why there is likely to be more uncertainty in the estimate for 4.6 billion years ago than in the value for the present day.

.....

.....

[1 mark]

0 5

During the first billion years of the Earth's existence there was intense volcanic activity.

0 5 . 1

Describe how the oceans formed.

[2 marks]

0 5 . 2

Explain how the formation of the oceans reduced the amount of carbon dioxide in the atmosphere.

[2 marks]

0 5 . 3

Volcanoes also released nitrogen. The nitrogen gradually built up in the atmosphere.

Suggest why the nitrogen built up rather than being removed from the atmosphere.

[1 mark]

0 6

Table 2 shows the approximate percentages of some gases in the atmospheres of Venus, Mars and the Earth today.

Table 2

Gas	Venus	Mars	Earth
Carbon dioxide	96.5	95.0	0.04
Nitrogen	3.5	2.8	78
Oxygen	less than 0.01	0.2	21
Argon	less than 0.01	2.0	0.9

0 6 . 1

Scientists think the Earth's early atmosphere may have been like the atmospheres of Mars and Venus today.

Use Table 2 to describe what the Earth's early atmosphere was probably like.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Give **two** reasons why evidence about the Earth's early atmosphere is limited.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Suggest why scientists study the atmospheres of Mars and Venus to find out about the Earth's early atmosphere.

.....

.....

[1 mark]

0 7

Some scientists think that the Earth’s early atmosphere may have been like the atmospheres of Mars and Venus today.

Table 3 shows the main gases in the atmospheres of Mars and Venus.

Table 3

Gas	Percentage in the atmosphere of Mars	Percentage in the atmosphere of Venus
Carbon dioxide	95.3	96.5
Nitrogen	2.7	3.5
Argon	1.6	less than 0.1
Oxygen	0.1	less than 0.1
Other gases	0.3	less than 0.1

0 7 . 1

Use Table 3 to explain how the atmospheres of Mars and Venus support the theory that the Earth’s early atmosphere was mainly carbon dioxide, with little or no oxygen.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Give **one** reason why this evidence does not prove what the Earth’s early atmosphere was like.

.....

.....

[1 mark]

.....

0 8

Volcanoes today typically release gases that are about 60% water vapour and 25% carbon dioxide by volume, with the rest other gases including nitrogen and sulfur dioxide.

0 8 . 1

Show that these figures are broadly consistent with the theory that the Earth's early atmosphere formed from volcanic gases and was mostly water vapour and carbon dioxide.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: The Earth's early atmosphere · 27 marks

Question 1 (5 marks)

01.1 [1 mark]

Correct: Carbon dioxide

01.2 [1 mark]

- volcanoes / volcanic activity (1)
-

01.3 [1 mark]

- water vapour (from volcanoes) condensed (1)
-

01.4 [2 marks]

- nitrogen (1)
 - methane (1)
 - ammonia (1)
 - water vapour (1)
-

Any 2 of the points above.

Question 2 (2 marks)

02.1 [1 mark]

Correct: Carbon dioxide

02.2 [1 mark]

Answer: volcanic activity

- volcanic activity / volcanoes (1)
-
-

Question 3 (2 marks)

03.1 [2 marks]

- both rely on assuming that conditions today, or on other planets, are similar to conditions on the early Earth billions of years ago (1)
 - these are reasonable assumptions but cannot be directly tested or confirmed, since no direct samples of the early atmosphere exist (1)
-

Question 4 (3 marks)

04.1 [2 marks]

- the percentage of oxygen was zero, or almost zero, when the Earth formed and for a long time afterwards (1)
- it began to increase only after algae evolved (about 2.7 billion years ago), and has continued increasing, though not at a constant rate, up to today's level (1)

04.2 [1 mark]

- there is very little direct evidence from so long ago, since rocks may have been destroyed or changed and no one could measure it directly, whereas today's atmosphere can be measured directly and accurately (1)

Question 5 (5 marks)

05.1 [2 marks]

- volcanoes released water vapour (1)
- the water vapour condensed (as the Earth cooled) (1)

05.2 [2 marks]

- carbon dioxide dissolved in the (ocean) water (1)
- carbonates were precipitated, producing sediments (1)

05.3 [1 mark]

- nitrogen is unreactive / does not dissolve well in water (so it was not removed) (1)
-

Question 6 (5 marks)

06.1 [2 marks]

- mainly carbon dioxide (1)
- little or no oxygen (and a small percentage of nitrogen) (1)

06.2 [2 marks]

- it existed billions of years ago / the time scale is 4.6 billion years (1)
- no one was there to measure it / no samples of it exist (1)
- rocks from that time have been changed or destroyed (1)

Any 2 of the points above.

06.3 [1 mark]

- there is little direct evidence about the Earth's early atmosphere, and the planets may have formed in similar ways (e.g. from volcanic activity) (1)

Question 7 (3 marks)

07.1 [2 marks]

- both atmospheres are mainly (more than 95%) carbon dioxide (1)
- both contain very little oxygen (0.1% or less) (1)

07.2 [1 mark]

- Mars and Venus are different planets (e.g. different sizes and distances from the Sun), so their atmospheres today may not be the same as the Earth's was billions of years ago (1)

Question 8 (2 marks)

08.1 [2 marks]

- today's volcanic gases are mostly water vapour and carbon dioxide ($60\% + 25\% = 85\%$ of the total) (1)
 - this supports (but does not prove) the theory, assuming volcanic gases had a broadly similar composition billions of years ago (1)
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