

GCSE Combined Science: Trilogy

Worksheet: How oxygen increased

TIME 25 min	TOTAL 22 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: How oxygen increased

NAME	CLASS	DATE
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- 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

0 1 . 1 Which process produced the oxygen that is now in the atmosphere?

Tick (✓) **one** box.

Combustion

☐

Photosynthesis

☐

Respiration

☐

Volcanic activity

☐

[1 mark]

0 1 . 2 Complete the word equation for this process.

carbon dioxide + → glucose + oxygen

.....

.....

.....

[1 mark]

0 1 . 3

Which organisms first produced oxygen, about 2.7 billion years ago?

.....

.....

.....

.....

[1 mark]

0 2

0 2 . 1

Which gas's percentage in the atmosphere increased as a direct result of photosynthesis by algae and plants?

Tick (✓) **one** box.

Nitrogen

☐

Oxygen

☐

Argon

☐

Water vapour

☐

[1 mark]

0 2 . 2

About how many billion years ago did algae first produce oxygen?

.....

.....

.....

Time = billion years ago

[1 mark]

0 3

0 3 . 1

Which type of organism first produced oxygen by photosynthesis, according to the accepted theory?

Tick (✓) **one** box.

Fish

☐

Algae

☐

Insects

☐

Fungi

☐

[1 mark]

0 3 . 2

Name the gas that plants and algae take in during photosynthesis.

.....

.....

.....

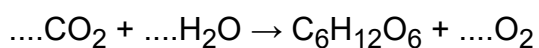
[1 mark]

0 4

Algae and plants produced the oxygen that is now in the atmosphere.

0 4 . 1

Balance the symbol equation for photosynthesis.



.....

.....

[1 mark]

0 4 . 2

Where does the energy needed for photosynthesis come from?

.....

.....

[1 mark]

0 4 . 3

Explain how the evolution of plants led to an increase in the percentage of oxygen in the atmosphere.

.....

.....

.....

.....

[2 marks]

0 4 . 4

Suggest why animals could only evolve after the percentage of oxygen in the atmosphere had increased.

.....

.....

[1 mark]

0 5

Table 1 lists four events in the history of the Earth, lettered A to D but not in the correct order.

Table 1

Letter	Event
A	Water vapour condenses to form the oceans
B	First algae evolve and begin photosynthesising
C	Enough oxygen has built up for animals to evolve
D	The Earth forms

0 5 . 1

Write the letters A, B, C and D in the correct order, earliest event first.

.....

.....

.....

.....
[1 mark]

0 5 . 2

Suggest why scientists are more confident about the order of these events than about the exact number of years between them.

[1 mark]

0 6

Oxygen did not suddenly appear in the atmosphere as soon as algae evolved; it built up gradually over roughly a billion years.

0 6 . 1

Suggest **two** reasons for this gradual increase, rather than a sudden rise.

[2 marks]

0 7

Earth's early atmosphere contained little or no oxygen. Today, about 20% of the atmosphere is oxygen.

0 7 . 1

Explain how the percentage of oxygen in the atmosphere increased from almost none to about 20%, and how this affected the evolution of life.

Suggest why scientists are less certain about these changes than about the composition of the atmosphere today.

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[6 marks]

END OF QUESTIONS

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

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: How oxygen increased · 22 marks

Question 1 (3 marks)

01.1 [1 mark]

Correct: Photosynthesis

01.2 [1 mark]

Answer: water

- water (1)
-

01.3 [1 mark]

Answer: algae

- algae (1)
-
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: Oxygen

02.2 [1 mark]

Answer: 2.7 billion years ago

- 2.7 (billion years ago) (1)
-
-

Question 3 (2 marks)

03.1 [1 mark]

Correct: Algae

03.2 [1 mark]

Answer: carbon dioxide

- carbon dioxide (1)
-

Question 4 (5 marks)

04.1 [1 mark]

Answer: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

- $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (1)
-

04.2 [1 mark]

- light / sunlight (1)
-

04.3 [2 marks]

- plants photosynthesise, taking in carbon dioxide and giving out oxygen (1)
 - as plants evolved and spread over the next billion years, oxygen gradually built up (1)
-

04.4 [1 mark]

- animals need oxygen for (aerobic) respiration (1)
-

Question 5 (2 marks)

05.1 [1 mark]

Answer: D, A, B, C

- D, A, B, C (1)
-

05.2 [1 mark]

- evidence such as fossils and rock layers can show which event came first, but precisely dating very ancient events is much harder and less certain (1)
-

Question 6 (2 marks)

06.1 [2 marks]

- at first there were relatively few algae, so oxygen was produced only slowly (1)
 - much of the oxygen produced was used up reacting with other substances (e.g. dissolved iron in the oceans, or other reactive minerals and gases), rather than building up in the atmosphere immediately (1)
-

Question 7 (6 marks)

07.1 [6 marks]

Answer: Algae first produced oxygen by photosynthesis about 2.7 billion years ago (carbon dioxide + water → glucose + oxygen), which also removed carbon dioxide. Over the next billion years plants evolved and the percentage of oxygen gradually increased, to a level that enabled animals to evolve. These changes happened billions of years ago, so the evidence is limited and has to be interpreted, whereas today's atmosphere can be measured directly.

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- algae first produced oxygen by photosynthesis, about 2.7 billion years ago
- photosynthesis: carbon dioxide + water → glucose + oxygen ($6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$), using energy from light
- oxygen soon appeared in the atmosphere; over the next billion years plants evolved and the percentage of oxygen gradually increased
- photosynthesis also removed carbon dioxide from the atmosphere
- the percentage of oxygen reached a level that enabled animals (which need oxygen for respiration) to evolve
- these changes happened billions of years ago, so no one could measure the atmosphere at the time
- the evidence (e.g. from rocks and fossils) is limited and incomplete and has to be interpreted, whereas today's atmosphere can be measured directly

Notes: Accept about 2.7 billion years for algae; ignore other dates.

Level 3 (5–6 marks): explains the increase in oxygen by photosynthesis by algae and then plants over a long time, links the increase to the evolution of animals, and gives a valid reason for the uncertainty linked to the time scale and the limited evidence.

Level 2 (3–4 marks): explains that photosynthesis by algae or plants increased the oxygen, with either the link to animals or a reason for the uncertainty.

Level 1 (1–2 marks): simple statements, e.g. 'plants made the oxygen' or 'it was a long time ago'.
