Exercise walk-through

9.1
Evolution of the Earth's atmosphere (4.9.1.1–4.9.1.2)

AQA · GCSE · Chemistry

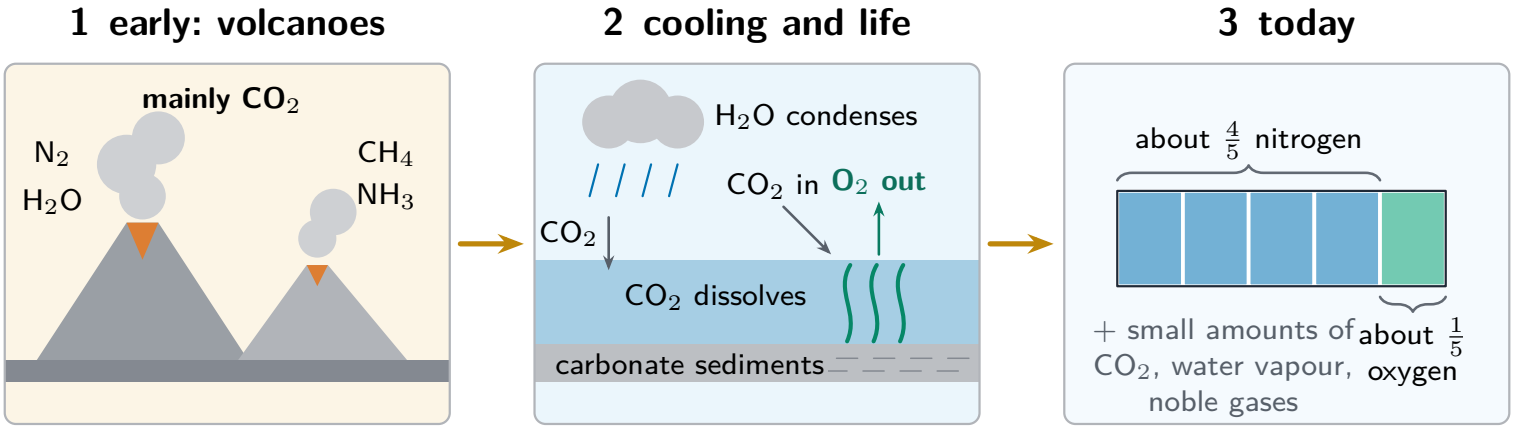
The atmosphere today

- For about the last 200 million years, the atmosphere has been roughly four-fifths (about 80%) nitrogen and one-fifth (about 20%) oxygen.
- The rest is small amounts of other gases: argon and the other **noble gases**, carbon dioxide (about 0.04%), and a varying amount of **water vapour**.
- **Worked example 1.** Estimate the volumes of nitrogen and oxygen in 250 cm^3 of air.
- Nitrogen $= \frac{4}{5} \times 250 = 200$ cm^3; oxygen $= \frac{1}{5} \times 250 = 50$ cm^3.

The early atmosphere

- Earth formed about 4.6 billion years ago.
- Nobody was there to measure the air, and rocks from that time have been changed or destroyed, so the evidence is limited.
- Scientists have theories, which change as new evidence is found.
- One theory is that during the first billion years, intense **volcanic activity** released the gases that formed the early atmosphere.

Figure: The early atmosphere



gases from volcanoes; little or no oxygen

oceans form; carbonates settle as sediments; algae and plants photosynthesise

fractions are the syllabus approximation

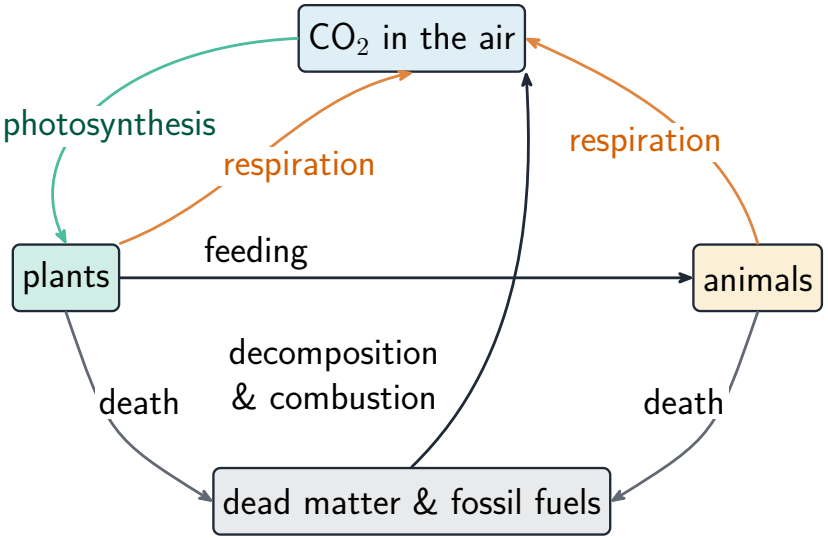
- Volcanoes: mainly CO_2, little or no oxygen.
- Oceans and **algae** later removed CO_2.

How oxygen increased and carbon dioxide decreased

- **Limestone** formed from the calcium carbonate shells and skeletons of sea creatures, which settled on the sea floor and became rock. The White Cliffs of Dover are made of chalk, a kind of **limestone**, formed from tiny shells in this way.
- **Coal** formed from plants that were buried in swamps before they could decay, then squeezed and heated over millions of years.
- **Crude oil** and **natural gas** formed from the remains of tiny sea creatures, buried in mud and changed by heat and pressure.

$$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$$

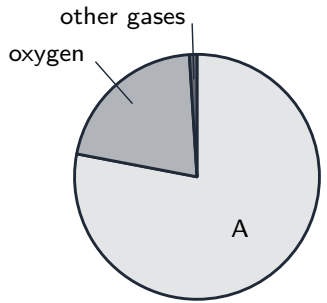
Figure: How oxygen increased and carbon dioxide decreased



- The carbon cycle: **photosynthesis** removes CO_2; **respiration**, combustion and decay return it
- Match each part of the diagram to the text.

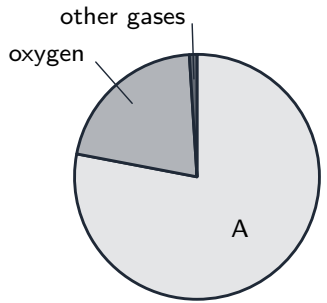
Exercise 2.1

2.1 The pie chart shows the gases in dry air today. Name gas A, and give its percentage. [2]



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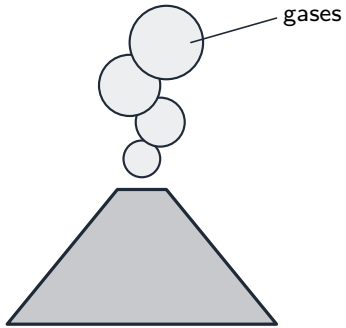


2.1

- nitrogen; about 80%, accept 78%

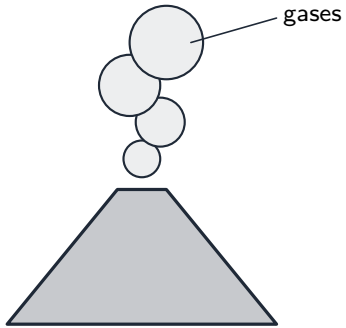
Exercise 2.2

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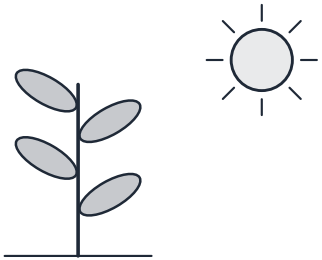


2.2

- volcanoes gave out water vapour; it condensed as the Earth cooled

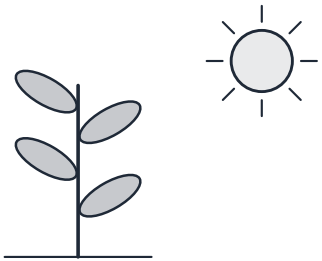
Exercise 3.1

3.1 Explain how the percentage of oxygen in the atmosphere increased. [3]



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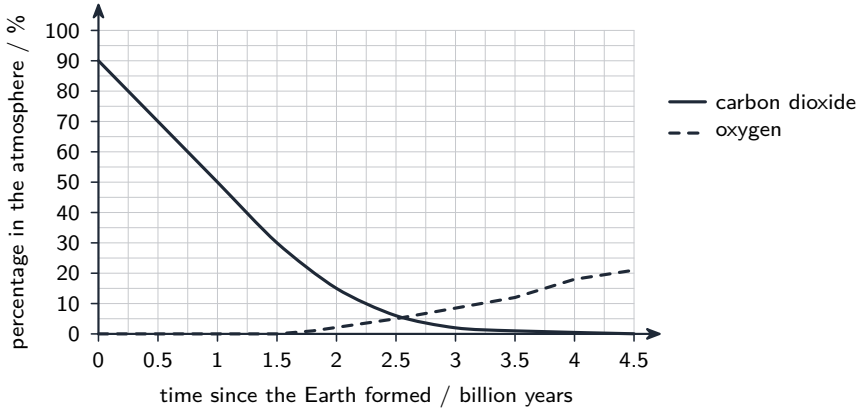
3.1

- algae, and later plants, evolved
- they carry out photosynthesis
- photosynthesis uses carbon dioxide and gives out oxygen

Exercise 3.2 (a)

3.2 The graph shows one theory of how the percentages of carbon dioxide and oxygen in the atmosphere changed after the Earth formed.

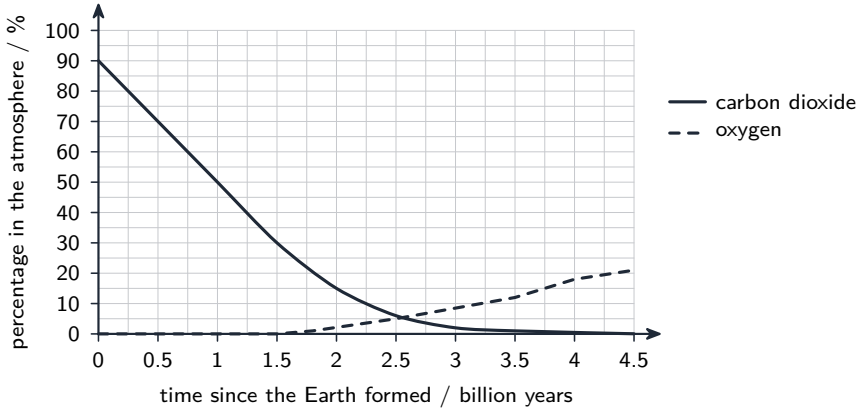
(a) Use the graph to give the percentage of carbon dioxide 1.0 billion years after the Earth formed, and when oxygen first appeared. [2]



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(a) 50%; about 1.8 billion years, accept 1.5–2.0

Exercise 3.2 (b)

3.2 The graph shows one theory of how the percentages of carbon dioxide and oxygen in the atmosphere changed after the Earth formed.

(b) Explain why the percentage of carbon dioxide fell during the first 2 billion years. [3]

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(b) Explain why the percentage of carbon dioxide fell during the first 2 billion years. [3]

(b) the oceans formed and carbon dioxide dissolved in them; algae, and later plants, carried out photosynthesis; which used carbon dioxide

Exercise 3.2 (c)

3.2 The graph shows one theory of how the percentages of carbon dioxide and oxygen in the atmosphere changed after the Earth formed.

(c) Explain why scientists are not sure about the early atmosphere. [2]

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(c) Explain why scientists are not sure about the early atmosphere. [2]

(c) it was billions of years ago; there is little evidence, and no one could measure it

Exercise 3.2 (d)

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(d) Describe how limestone and fossil fuels formed, and explain how this changed the atmosphere. [6]

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(d) points to include:

- sea creatures used dissolved carbon dioxide to make carbonate shells and skeletons
- when they died, the shells built up and were compressed into limestone
- coal formed from the remains of plants that were buried and compressed
- crude oil and natural gas formed from plankton buried in mud
- so carbon was locked away in rocks and fossil fuels
- this lowered the percentage of carbon dioxide; burning fossil fuels now puts it back

Levels: **5–6** a full, logical answer with correct chemistry and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.