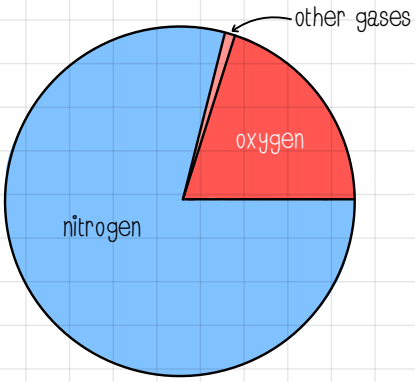
The atmosphere

Proportions of gases in the atmosphere



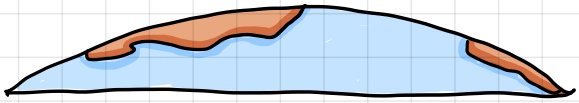
The proportions of the gases in the atmosphere have remained constant for about 200 million years.
About four fifths is nitrogen (approx. 80%)
About one fifth is oxygen (approx 20%)
Small proportions of other gases including carbon dioxide, water vapour and noble gases (e.g. helium).

The early atmosphere

The Earth is estimated to be 4.6 billion years old. Because of the large time scale scientists cannot be certain about the early atmosphere.

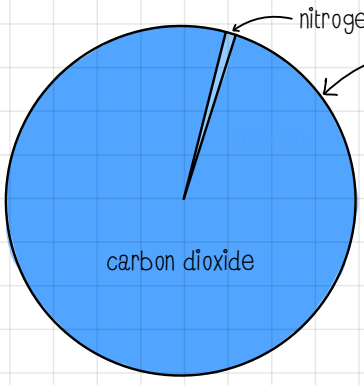
One theory suggests that during the first billion years there was intense volcanic activity which released carbon dioxide and water vapour. The early atmosphere was like Mars.

Over time the Earth cooled. As the Earth cooled the water vapour condensed to form the oceans.



During the intense volcanic activity other gases were also released. Nitrogen was released and gradually built up in the atmosphere. Small amounts of methane and ammonia were also released.

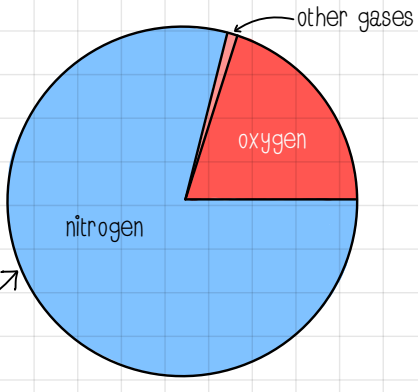
Comparison of early atmosphere and todays atmosphere



early atmosphere

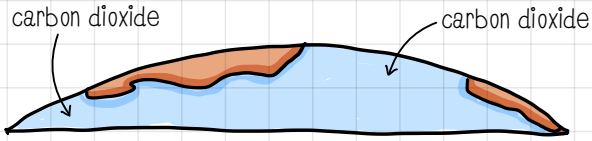
The early atmosphere consists of mainly carbon dioxide with no oxygen.

modern atmosphere



The atmosphere...

Changes to carbon dioxide levels

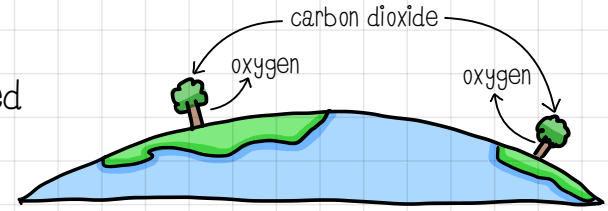


Water vapour from the volcanoes condensed to form the oceans. Some of the carbon dioxide dissolved in the newly formed oceans to make a weak acid.

The acid reacted with minerals in the sea to form precipitates. Over time these formed **sediments** of **carbonate** rock on the sea bed. Some of the carbon dioxide dissolved in the sea was used to make corals and the shells of sea creatures. The **shells** from **dead organisms** formed **limestone.** As a result of these processes the levels of carbon dioxide in the atmosphere decreased.

Changes to oxygen levels

Around 2.7 billion years algae started to photosynthesise and produce oxygen.



Over the next billion years plants evolved and the oxygen in the atmosphere increased. The increase in the levels of oxygen reached a point that enables animals to evolve. In addition to releasing oxygen, **photosynthesis** also takes in carbon dioxide. This contributed to the fall in carbon dioxide levels in the atmosphere. The carbon was trapped in fossil fuels and until the Industrial Age was kept out of the atmosphere.

Photosynthesis equation

carbon dioxide + water ⟶ glucose + oxygen

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

Summary of changes of gases

gas	early atmosphere	modern atmosphere	cause
Nitrogen	1 %	80 %	volcanic eruption
Oxygen	0 %	20 %	photosynthesis
Carbon dioxide	99 %	< 1 %	limestone, carbonate and photosynthesis

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