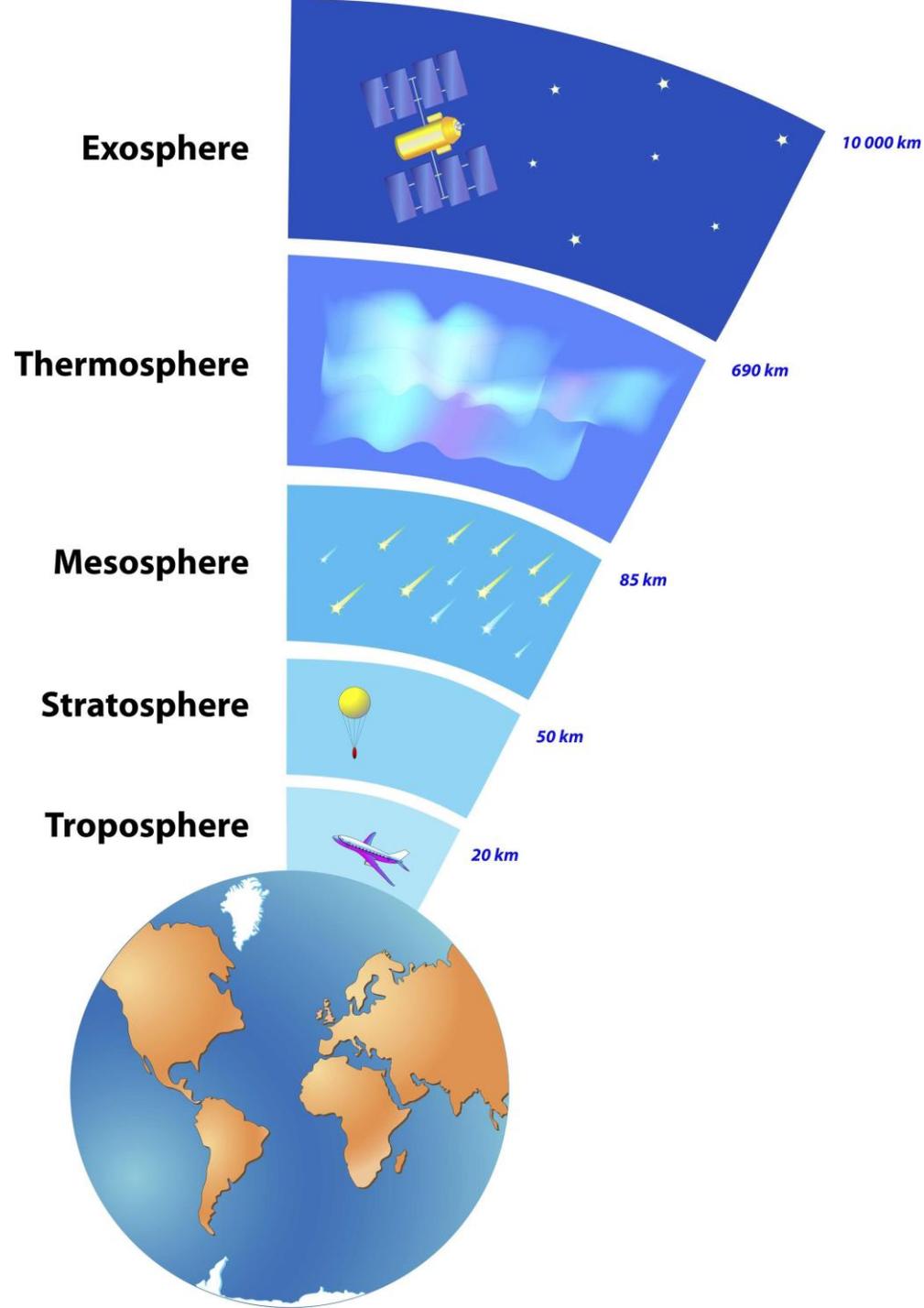


# Earth and Atmosphere





The Earth's atmosphere consists of different layers.

The troposphere is the lowest layer of the atmosphere of Earth. It contains 75% of the total mass of the atmosphere and 99% of the total mass of water vapor and aerosols. It is where most weather phenomena occur.





Around 4.5 Billion years ago the earth was formed out of the debris orbiting the Sun. This coming together generated large amounts of heat energy and the early Earth was a ball of molten rock.

As the surface cooled a crust formed. The crust was covered in volcanoes that produced large volumes of gases such as Carbon Dioxide, Steam and Ammonia.

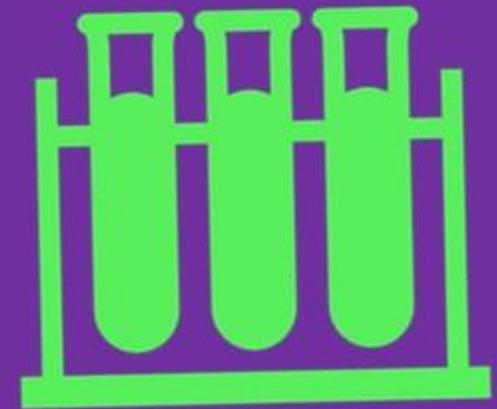




As the earth cooled the Steam in the atmosphere condensed into water vapour and then into liquid water. This fell as rain and the Oceans were formed.



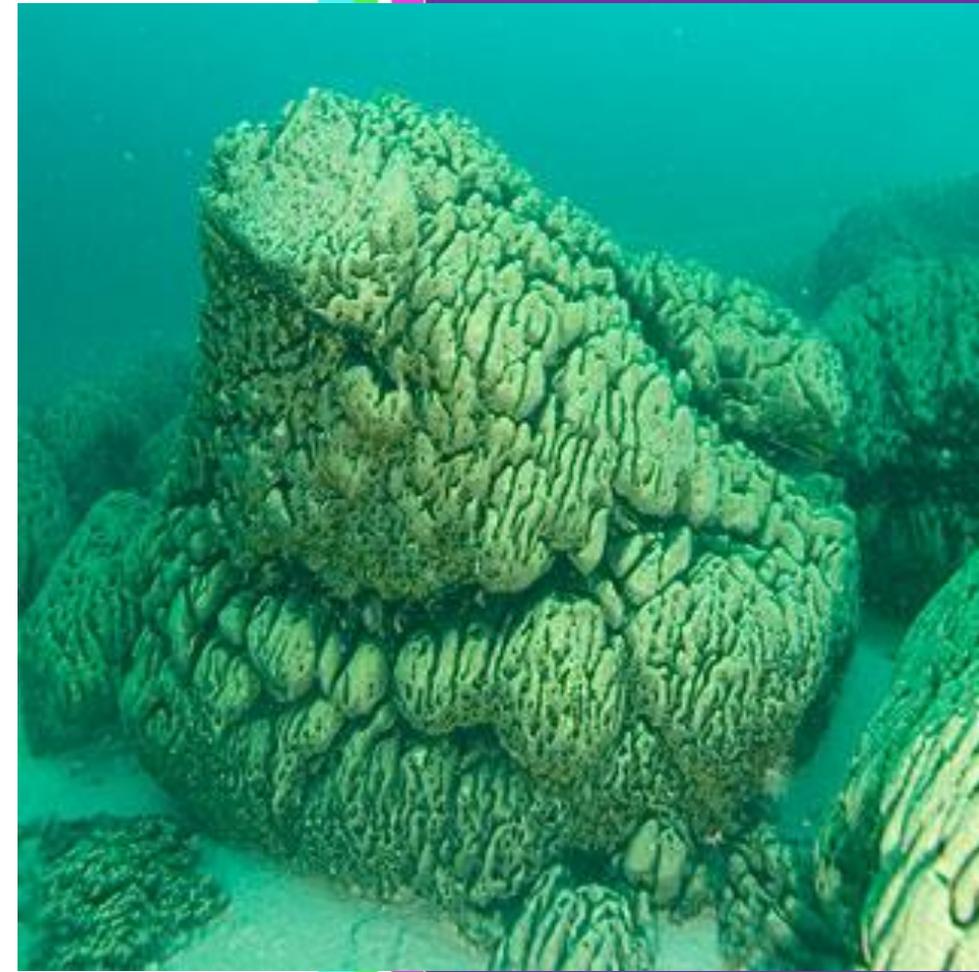
Some of the carbon dioxide in the atmosphere dissolved in the oceans. This led to the formation of carbonates that were deposited on the ocean floor as Limestone. This started the process of trapping the atmospheric carbon in rocks.



Around 3.4 Billion years ago the first life forms developed in the oceans. The water protected them from the lethal Ultra Violet radiation coming from the Sun.

These simple organisms used photosynthesis to produce oxygen as a waste product.

Photosynthesis removed yet more carbon dioxide from the atmosphere. The hard shells of these creatures also became sediments trapping more carbon into rocks.





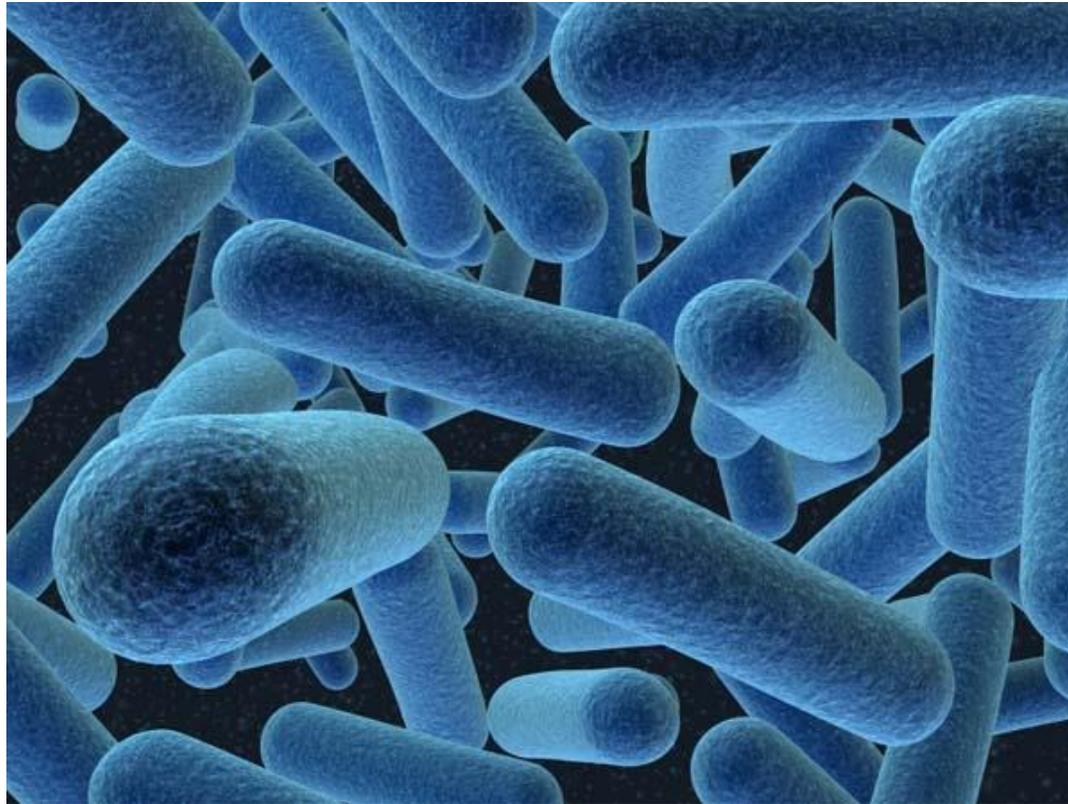
The oxygen ( $O_2$ ) found its way into the atmosphere. Some of it was converted into Ozone ( $O_3$ ). This formed an Ozone layer in the upper atmosphere. The Ozone blocked the lethal UV which in turn allowed life forms to evolve and colonise the dry land.

The increased the number of plants and thus increased to the amount of Oxygen and decreased the amount of Carbon Dioxide in the atmosphere.



The Ammonia ( $\text{NH}_3$ ) produced by the volcanoes reacted with some of the oxygen to produce water and Nitrogen gas ( $\text{N}_2$ ).

Life forms such as bacteria were also able to break down ammonia and produce Nitrogen.



# Development of the atmosphere

Volcanoes on the newly formed Earth released carbon dioxide, methane, ammonia, nitrogen and water vapour.

The water vapour condensed as the Earth cooled and fell as rain (for a long time) to become our oceans.

The early atmosphere had high levels of carbon dioxide.

The carbon dioxide dissolved in the oceans and formed carbonates, these eventually sediment out forming sedimentary rocks.

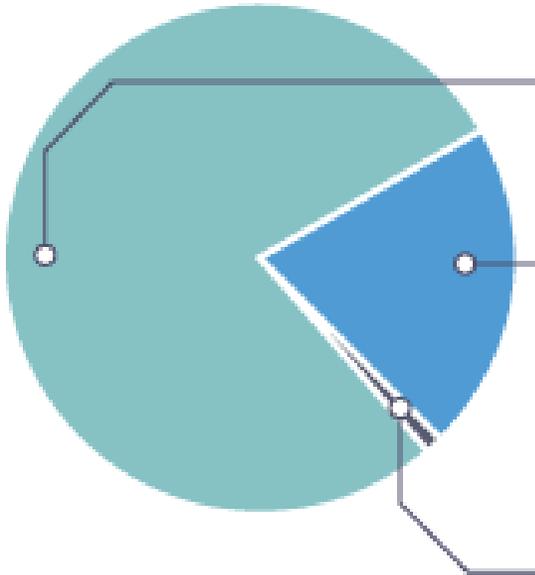
Living organisms took in carbon dioxide for photosynthesis or to produce their carbonate shells.

When these early living organisms died they often became fossil fuels like crude oil.



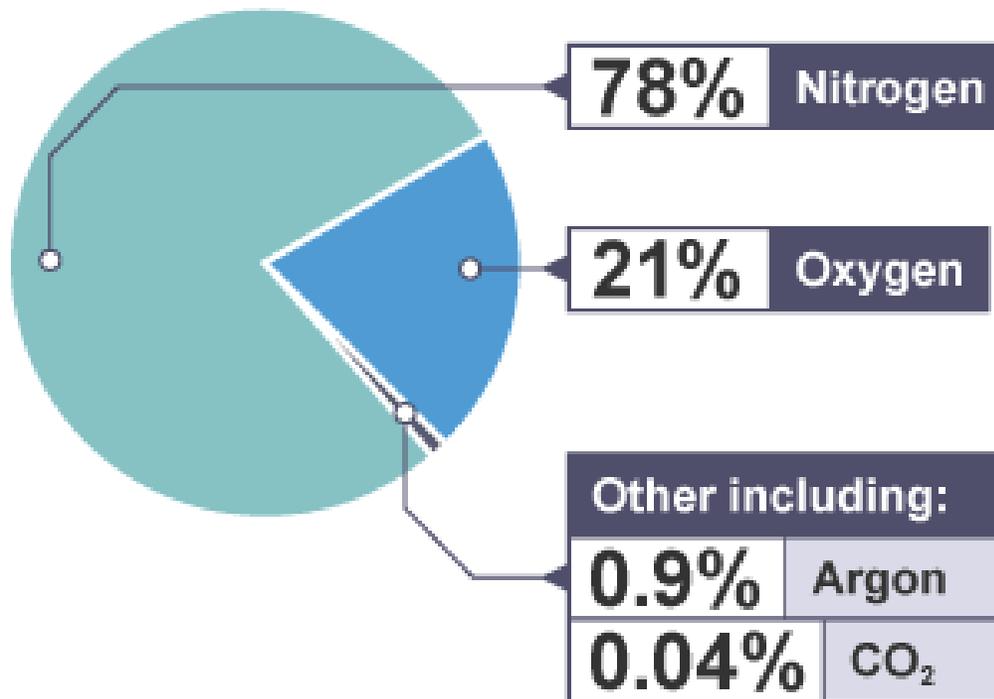
# The modern atmosphere

For approximately 200 million years, the proportions of different gases in the atmosphere have been relatively stable.

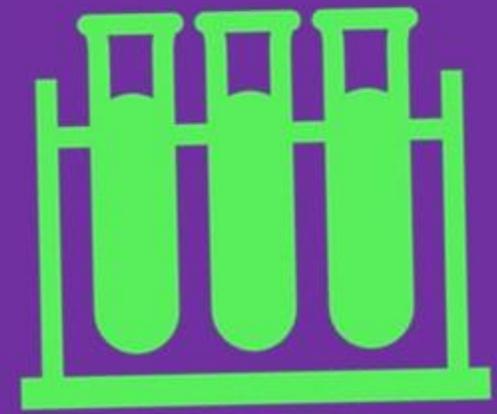
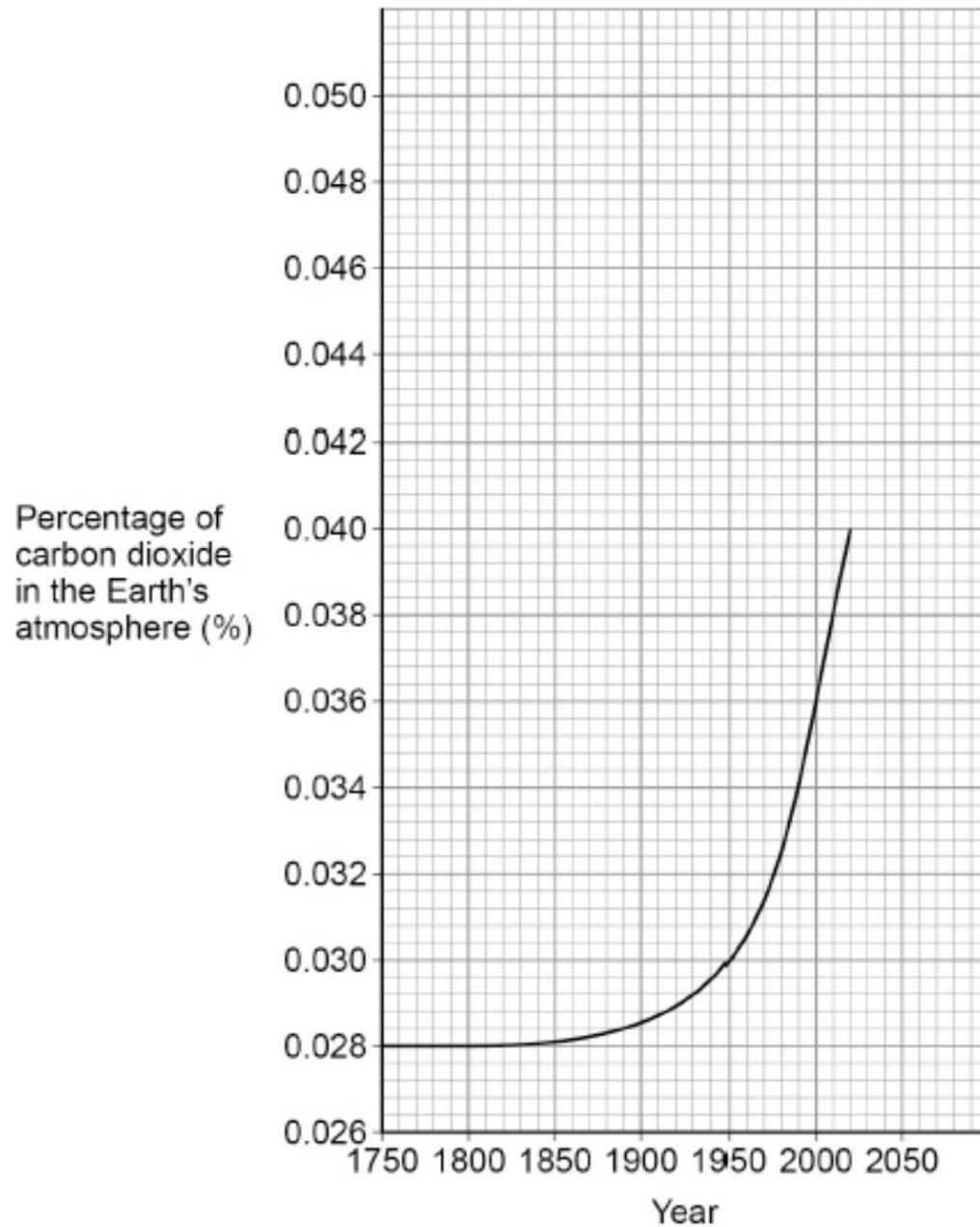


# The modern atmosphere

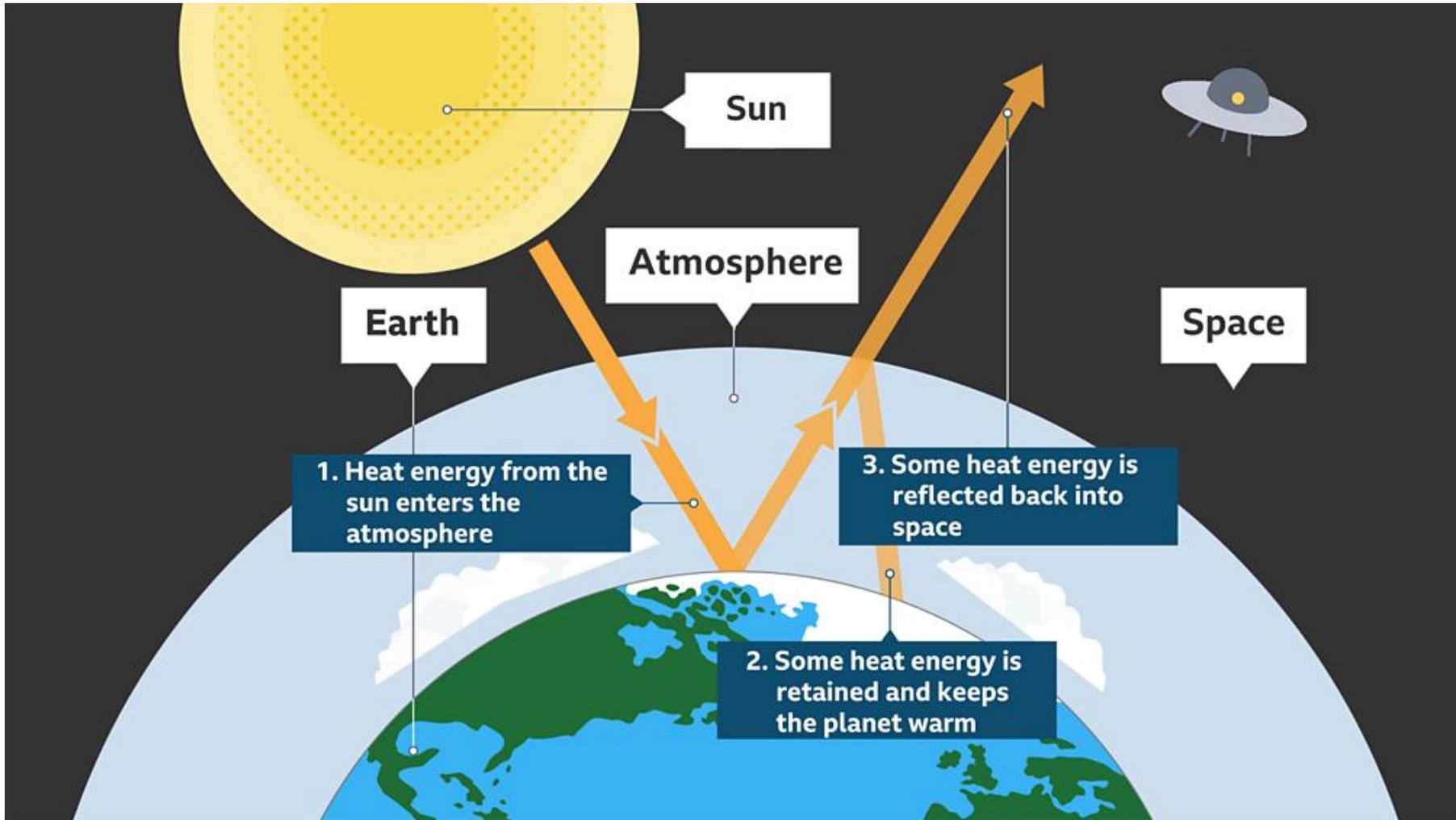
For approximately 200 million years, the proportions of different gases in the atmosphere have been relatively stable.



The graph below shows the percentage of carbon dioxide in the Earth's atmosphere from 1750.



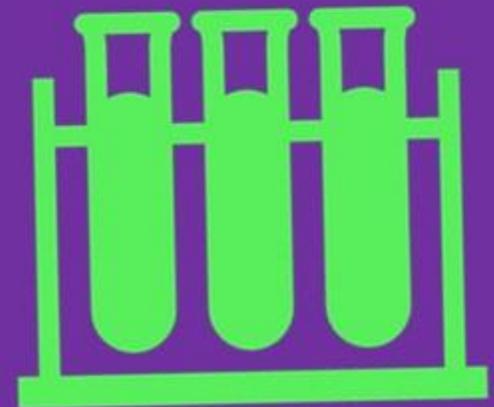
# The Greenhouse Effect



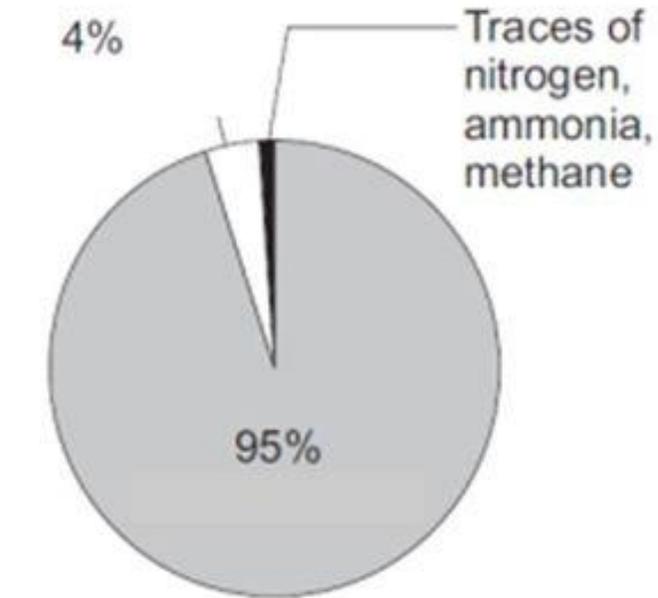
What are greenhouse gases?

What human activities contribute to the greenhouse effect?

What are the consequences of global warming?

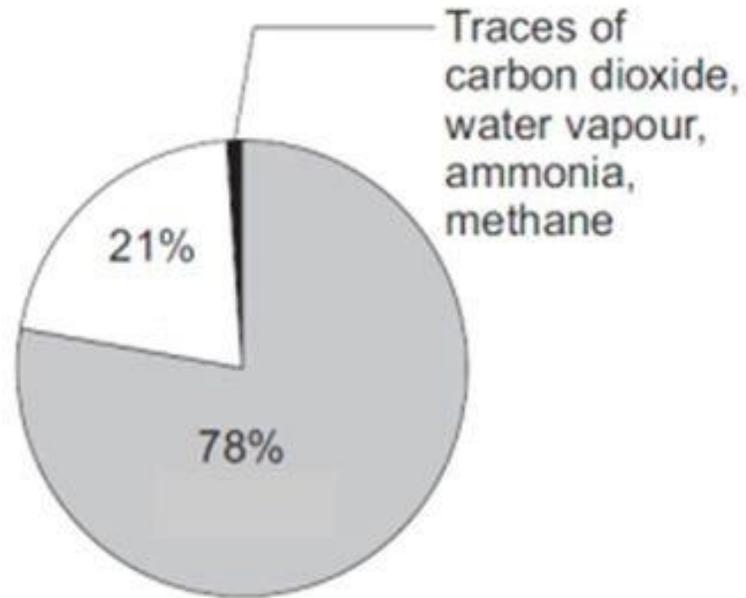


### Earth's early atmosphere

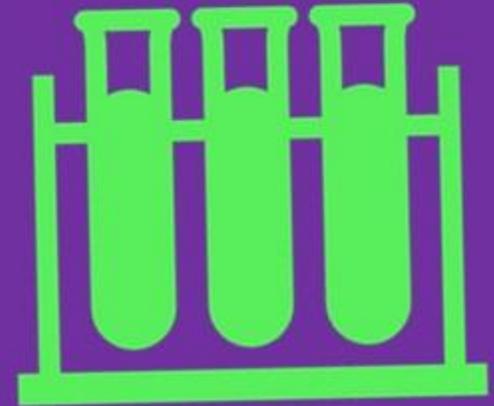


Average surface temperature above 400 °C

### Earth's atmosphere today



Average surface temperature 20 °C



How did the oxygen levels increase?

Algae evolved about 2.7 billion years ago, then plants evolved.

Photosynthesis

Oxygen levels increase



# Chemical tests

Oxygen gas-

Carbon Dioxide

Metal Carbonates-

Hydrogen gas-



# Chemical tests

Oxygen gas-  
relights a glowing  
splint.

Carbon Dioxide  
gas- turns  
limewater milky and  
extinguishes a  
flame.



Metal Carbonates-  
react with acid to  
produce carbon  
dioxide bubbles  
(fizzing observed)  
water and a salt.

Hydrogen gas-  
extinguishes a lit  
splint with a  
squeaky pop



