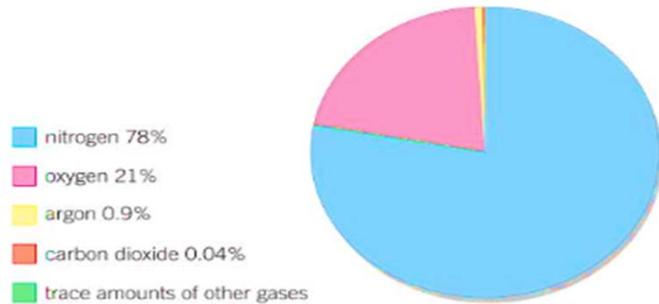


# Topic 9: Chemistry of the Atmosphere

## The atmosphere today

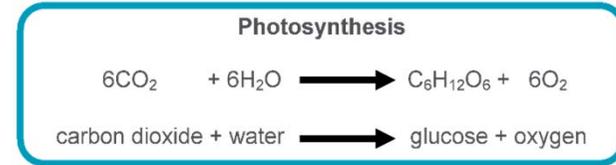
By 200 million years ago, the proportions of gases in the Earth's atmosphere had stabilised. These were much the same as they are today.

Look at the percentage of gases in the atmosphere today in the pie chart in Figure 2.



## The changes in oxygen

Algae and plants produced the oxygen that is now in the atmosphere by photosynthesis:



Plants evolved and the percentage of oxygen gradually increased to a level that enabled animals to evolve.

## Changes in Carbon dioxide

Algae and plants decreased the percentage of carbon dioxide in the atmosphere by photosynthesis.

Carbon dioxide was also decreased by the formation of sedimentary rocks and fossil fuels that contain carbon.

## Evolution of the Earth's Atmosphere- One Theory

Earth's early atmosphere may have been like the atmospheres of Mars and Venus today, mainly carbon dioxide, with little or no oxygen gas.

4.6 billion years ago

Intense **volcanic activity** that released gases such as water vapour and nitrogen. Water vapour condensed to form the oceans.

1<sup>st</sup> algae 2.7 billion years ago

When the oceans formed, carbon dioxide dissolved in the water and carbonates were precipitated producing sediments, reducing the amount of carbon dioxide.

Evolution of algae and plants further reduced carbon dioxide levels and increased oxygen levels due to photosynthesis.

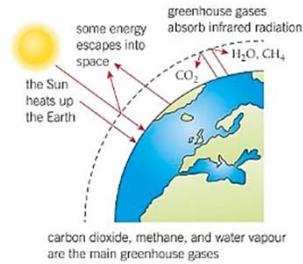
## Formation of carbon compounds

- Over millions of years, the skeletons and shells built up at the bottom of the ocean. They were covered with layers of sediment, the pressure of these layers formed sedimentary rocks e.g **limestone**
- **Coal** is a sedimentary rock, formed from deposits of plant material in swamps with a lack of oxygen and compression for millions of years.
- **Crude oil** and **natural gas** are from remains of plankton deposited in muds on the seabed.

### Greenhouse gases (natural)

Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life. Water vapour, carbon dioxide and methane are greenhouse gases.

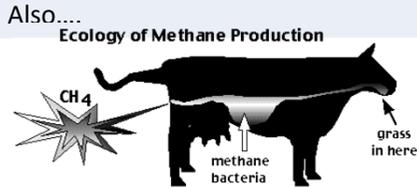
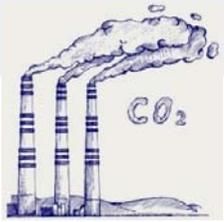
The greenhouse gases let short-wavelength EM radiation pass through but not longer wavelength (infrared radiation – thermal)



### Human activities causing global climate change (unnatural)

Some human activities increase the amounts of greenhouse gases:

Carbon dioxide	Methane
Burning fossil fuels	From swamps and rice fields
Deforestation	Waste in landfill sites



**Carbon footprint** - is the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event.

#### Solutions

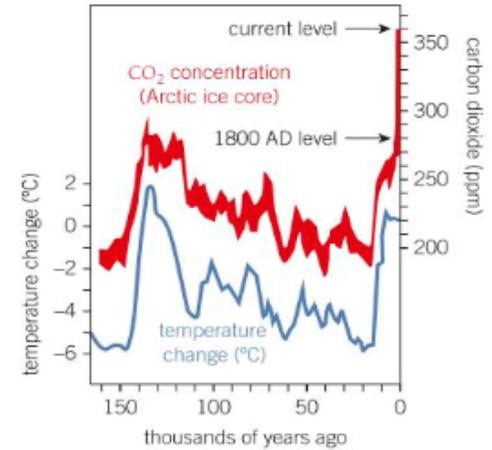
- Carbon capture and storage – pump carbon dioxide produced by fossil fuel power stations deep underground into porous rock. But would be expensive.
- Less demand for beef – to help reduce methane production by cattle.
- Carbon taxes put in place by governments
- Support the use of biofuels

### Effects of global climate change

Based on peer-reviewed evidence, many scientists believe that human activities will cause the temperature of the Earth's atmosphere to increase at the surface and that this will result in global climate change.

#### Effects

- Rising sea levels
- Extreme weather
- Changes in temperature and rainfall
- Distribution of species



### Atmospheric pollutants from fuels

- Carbon monoxide is a toxic gas. It is colourless and odourless and so is not easily detected.
- Sulfur dioxide and oxides of nitrogen cause respiratory problems in humans and cause acid rain.
- Particulates cause global dimming and health problems for humans.

