9 The atmosphere

The atmosphere

For **200 million years**, the proportions of different gases in the atmosphere have been much the same as they are today:

- About **80% nitrogen**
- About **20% oxygen**
- small proportions of various other gases, including **carbon dioxide, water vapour and noble gases.**

Changing ideas

- Theories about what was in the Earth's early atmosphere and how the atmosphere was formed have changed and developed over time.
- **Evidence for the early atmosphere is limited because of the time scale of 4.6 billion years.**
- One theory suggests that during the first billion years of the Earth's existence there was intense **volcanic activity** that released gases that formed the early atmosphere and **water vapour that condensed to form the oceans**.
- At the start of this period the Earth's atmosphere may have been like the atmospheres of Mars and Venus today, consisting **of mainly carbon dioxide with little or no oxygen gas.**
- Volcanoes also produced **nitrogen** which gradually built up in the atmosphere and there may have been small proportions of **methane and ammonia**.
- When the oceans formed, **carbon dioxide dissolved** in the water and **carbonates** were precipitated producing sediments, reducing the amount of carbon dioxide in the atmosphere.
- Carbon dioxide was also decreased by the formation of **sedimentary rocks** and **fossil fuels** that contain carbon.

Definitions

Atmosphere – the gases that surround the Earth or other planet.
Precipitated – a substance is produced as a solid from a liquid.
Algae - simple plant type organism, occurring in water, that have chlorophyll but lack true stems, roots, and leaves.
Bias – supporting one idea in an unfair way based on personal values / ideas.
carbon footprint - the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event.

The role of algae and plants

- Algae and plants produced the **oxygen** that is now in the atmosphere by **photosynthesis**, which can be represented by the equation:
- carbon dioxide + water → glucose + oxygen
- Algae first produced oxygen and soon after this oxygen appeared in the atmosphere
- Over the next billion years plants evolved and the percentage of **oxygen gradually increased to a level that enabled animals to evolve**
- Algae and plants **decreased** the percentage of **carbon dioxide** in the atmosphere by **photosynthesis**.

The greenhouse effect

Water vapour, carbon dioxide and methane are greenhouse gases.

Some human activities (like using petrol in cars, and burning fossil fuels to make electricity) increase the amounts of greenhouse gases in the atmosphere. These include:

- **carbon dioxide**
- **methane**

- Many scientists think that human activities will cause the temperature of the Earths surface to rise but **it is difficult to model such complex systems** as global climate change.
- The effects of climate change can include:
- **Floods**
- **Droughts**
- **Melting ice caps**
- **Sea levels rising**
- The carbon footprint can be reduced by reducing emissions of carbon dioxide and methane.

Pollutants and their sources

- Most fuels, including coal, contain **carbon** and/or **hydrogen** and may also contain some **sulfur**.
- The gases released into the atmosphere when a fuel is burned may include :
- **carbon dioxide,**
- **water vapour,**
- **carbon monoxide,**
- **sulfur dioxide**
- **oxides of nitrogen.**
- **Solid particles** and **unburned hydrocarbons** may also be released that form particulates in the atmosphere.

- **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.