

AQA Chemistry of the atmosphere Journey of Knowledge

Context and introduction to the unit: The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity.

KS3:

Earth's atmosphere, Climate change, Greenhouse gases, fuels, Radiation, Photosynthesis.

CORE KNOWLEDGE

5.9.1.1 The proportions of different gases in the atmosphere - For 200 million years, the proportions of different gases in the atmosphere have been much the same as they are today: • about four-fifths (approximately 80%) nitrogen • about one-fifth (approximately 20%) oxygen • small proportions of various other gases, including carbon dioxide, water vapour and noble gases.

5.9.1.2 The Earth's early atmosphere - 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.

5.9.1.3 How oxygen increased - Algae and plants produced the oxygen that is now in the atmosphere by photosynthesis, which can be represented by the equation:



Algae first produced oxygen about 2.7 billion years ago 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.

5.9.1.4 How carbon dioxide decreased - 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.

Disciplinary knowledge

Ratio, fractions, percentages. WS 1.1, 1.2, 1.3, 1.4, 1.5, 3.5, 3.6, 4.1

Vocabulary

Atmosphere, carbon dioxide, oxygen, algae, photosynthesis, evolved, greenhouse gas, methane, climate change, emissions, carbon footprint, pollutants, combustion, sulfur dioxide, global dimming, carbon monoxide

Reading is Power

Greenhouse gases
'Warmest September' – news article

Where next?

Biology – Global warming

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CORE KNOWLEDGE

5.9.2.1 Greenhouse gases - Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life. Water vapour, carbon dioxide and methane are greenhouse gases. Students should be able to describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.

5.9.2.2 Human activities which contribute to an increase in greenhouse gases in the atmosphere - Some human activities increase the amounts of greenhouse gases in the atmosphere. These include: • carbon dioxide • methane. Students should be able to recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. 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. However, it is difficult to model such complex systems as global climate change. This leads to simplified models, speculation and opinions presented in the media that may be based on only parts of the evidence and which may be biased.

5.9.2.3 Global climate change - An increase in average global temperature is a major cause of climate change. There are several potential effects of global climate change.

5.9.2.4 The carbon footprint and its reduction - The 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. The carbon footprint can be reduced by reducing emissions of carbon dioxide and methane.

5.9.3.1 Atmospheric pollutants from fuels - The combustion of fuels is a major source of atmospheric pollutants. 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 and oxides of nitrogen. Solid particles and unburned hydrocarbons may also be released that form particulates in the atmosphere.

5.9.3.2 Properties and effects of atmospheric pollutants - 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.

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