

# KNOWLEDGE

# Chemistry Topic C9 Chemistry of the atmosphere

# ORGANISER

## Section 1: Key terms

Acid rain	Rain made so <b>acidic</b> that it <b>causes harm</b> to the <b>environment</b> .
Atmosphere	The <b>thin</b> layer of gases <b>that surround</b> planet <b>Earth</b> .
Biofuels	A source of <b>renewable</b> energy made from <b>plant material</b> that <b>absorbs carbon dioxide during photosynthesis</b> . When it <b>burns</b> it <b>returns the same amount of carbon dioxide</b> into the atmosphere.
Carbon footprint	The carbon footprint of a product, service or event is the total <b>amount of carbon dioxide</b> and other greenhouse gases <b>released</b> over its complete <b>life cycle</b> .
Climate change	The <b>change</b> in <b>global weather</b> patterns that could be <b>caused</b> by excess amounts of <b>greenhouse gases</b> in the atmosphere.
Ecosystems	A large <b>community</b> of <b>living organisms</b> in a particular area.
Fossil fuels	Fuels such as coal, oil or natural gas <b>formed from</b> the <b>remains</b> of <b>decaying plants</b> and <b>animals</b> .
Global dimming	A decrease in the amounts of sunlight reaching the surface of the Earth.
Global warming	Gradual <b>heating</b> of the <b>Earth</b> due to increased levels of <b>greenhouse gases</b> .
Haemoglobin	A red pigment located in red blood cells <b>responsible</b> for <b>transporting oxygen</b> around the body.
Longwave radiation	The <b>radiation emitted from the Earth's surface</b> . Some is <b>absorbed</b> by greenhouse gases and <b>doesn't escape the atmosphere</b> (e.g. IR).
Non-renewable	Something which <b>cannot be replaced</b> once it is <b>used up</b> .
Particulates	Very <b>small particles</b> in the atmosphere given off by incomplete combustion of fuels.
Pollutant	A substance that causes <b>harm to the environment</b> .
Photosynthesis	The process by which plants make food using carbon dioxide, water and sunlight. <b>Releases oxygen</b> as a waste product.
Sedimentary rock	When plants, plankton and marine animals die and fall to the seabed, they get laid down in layers. Over time, these layers are squashed under more layers of sediment (sand, mud and pebbles) forming sedimentary rock. Limestone & coal are example of sedimentary rocks.
Shortwave radiation	The <b>radiation from the Sun</b> . Is able to <b>pass through the Earth's atmosphere</b> and <b>warm the surface</b> of the Earth <b>without being absorbed</b> by greenhouse gases (e.g. Ultraviolet radiation)

## Section 2: History of our atmosphere

Early atmosphere is mainly **carbon dioxide** and little or no oxygen gas.



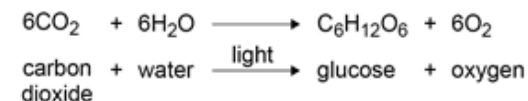
**Volcanoes** release **nitrogen, water vapour** and small amounts of methane and ammonia.



The Earth begins to cool, **water vapour condenses** and forms the **oceans**. Some **carbon dioxide dissolves in the oceans**. **Carbon dioxide** is also **locked in fossil fuels** and **sedimentary rocks**.



Green **plants & algae evolve** and **release oxygen** through **photosynthesis**.



This process takes in more **carbon dioxide**.

Earth's early atmosphere

## Section 3: Formation of coal, oil, gas and limestone

Coal	<b>Plants absorbed CO<sub>2</sub></b> . They <b>died and decayed</b> . This layer of decaying plants was <b>compressed</b> to form <b>coal</b> .
Oil and natural gas	<b>Plankton absorbed CO<sub>2</sub></b> . Plankton died and were <b>deposited in muds on the sea floor</b> . They were covered over by sediments and <b>compressed over millions of years</b> .
Limestone	<b>Skeletons &amp; shells (containing calcium carbonate)</b> of dead <b>marine animals</b> build up on seabed. They were covered over by sediments and <b>compressed over millions of years</b> .

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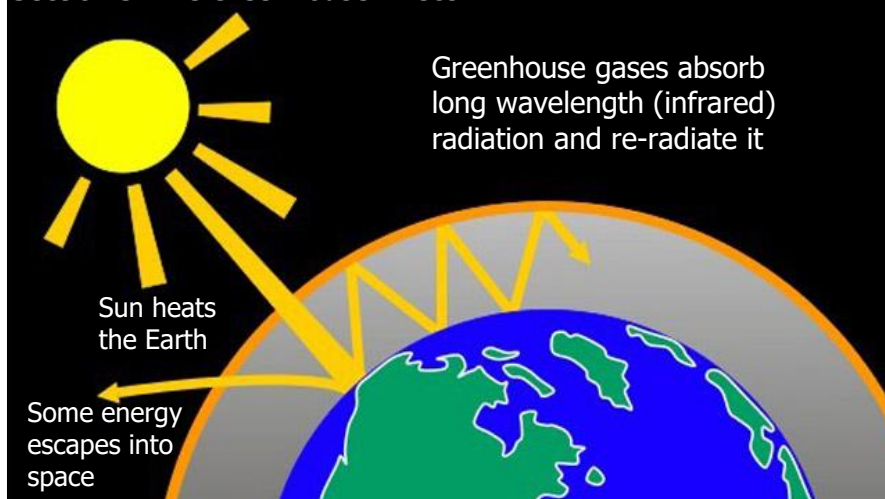
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## Section 4: The atmosphere today

Nitrogen 78%	<p>Traces of carbon dioxide, water vapour and argon</p> <p>21% oxygen</p> <p>78% nitrogen</p>
Oxygen 21%	
Argon 0.9%	
Carbon dioxide 0.04%	
Trace amounts of other gases	

## Section 5: The Greenhouse Effect



- Greenhouse gases (like carbon dioxide, methane and water vapour act like an **insulating layer** in the Earth's atmosphere.
- They keep the Earth **warm enough to support life**.
- Greenhouse gases **don't absorb short wavelength** radiation from the Sun but they **do absorb long wavelength** radiation (infrared or thermal radiation) reflected from the Earth.
- They **re-radiate** it back towards the Earth warming the Earth's surface.

## Section 6: Global climate change

How humans increase carbon dioxide in the atmosphere	How humans increase methane in the atmosphere
<b>Combustion of fossil fuels</b>	Increased <b>animal farming</b>
<b>Deforestation</b>	<b>Rice fields</b>
	Decomposition of <b>rubbish in landfill</b>
How humans can decrease carbon dioxide concentration	How humans can decrease methane concentration
Use <b>alternative forms of energy</b> e.g. wind turbines, solar panels	Alternative foods – <b>non-animal based</b>
<b>Energy efficiency</b> e.g. more efficient cars e.g. electric cars	Increased <b>recycling</b>
<b>Carbon capture</b> – capturing CO <sub>2</sub> from power stations and trapping it underground in porous rocks.	
<b>Carbon off-setting</b> – planting <b>more trees</b>	
Effects of global warming	
Some regions will <b>not</b> be able to produce <b>enough food</b> due to <b>drought</b> .	
<b>Changes to distribution of species</b> and migration patterns put ecosystems under stress.	
<b>Rising sea levels</b> because of melting of polar ice caps.	
Increasing <b>common extreme weather</b> events such as severe storms.	

## Section 7: Common Pollutants

Pollutant	Cause	Effect
Carbon monoxide	CO	<b>Incomplete combustion</b> of a <b>hydrocarbon</b> fuel. <b>Toxic</b> gas. Colourless and odourless so hard to detect.
Sulfur dioxide	SO <sub>2</sub>	<b>Burning coal or petrol.</b> Both contain sulfur which reacts with oxygen in air. Cause <b>respiratory problems</b> (e.g. for those with asthma).
Nitrogen oxides	NO <sub>x</sub>	In <b>car engines</b> . <b>N<sub>2</sub></b> and <b>O<sub>2</sub></b> from air react at <b>high temperatures</b> . Combine with water vapour to cause <b>acid rain</b> .
Particulates	C	<b>Incomplete combustion</b> of a hydrocarbon fuel. <b>Global dimming</b> (reduction in sunlight reaching Earth). Can damage cells in lungs.