

## Air

What is the composition of clean air?

Name and explain the process used to separate air into its components.

Name 2 *Greenhouse Gases*.

How are they produced?

What problems do greenhouse gases cause?

## Composition of Air:

**Oxygen:** 21%

**Nitrogen:** 78%

**The remaining 1%** is mainly Argon

*plus a little Carbon Dioxide (about 0.04%)*

*plus a little Water Vapour*

*plus a small amount of the other noble gases (Helium, Neon, Krypton & Xenon)*

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## Fractional Distillation of Liquid Air:

**Cleaning:** Air is cleaned to remove water vapour, carbon dioxide and pollutants

**Liquefying:** The air is cooled to  $-200^{\circ}\text{C}$

**Fractional Distillation:** The liquid air is warmed in a fractionating column

*The gas with the lowest boiling point will evaporate first and can be collected in its gaseous form. Nitrogen has a lower boiling point than oxygen, so nitrogen evaporates first.*

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## Greenhouse Gases:

**Carbon Dioxide,  $\text{CO}_2$ ,** is produced by:

- Complete combustion of carbon containing fuels
- Respiration (in plants and animals)
- Reaction of acid with carbonates, e.g. acid rain dissolves limestone rocks
- Thermal decomposition of carbonates, e.g. limestone ( $\text{CaCO}_3$ )

**Methane,  $\text{CH}_4$ ,** is produced:

- From the decomposition of vegetation (by bacteria)
- As a waste gas from digestion in animals, e.g. cows, sheep

**Problems:** An increase in greenhouse gas levels could cause global warming. This might lead to climate change.

*e.g. average world temperatures rising, drought, melting ice-caps, rising sea levels, habitat loss*

## Air Pollutants

Name 4 *Air Pollutants*.

Explain where each comes from and the problems they cause.

What problems does acid rain cause?

How do *Catalytic Converters* remove pollutants from car exhaust fumes?

## Carbon Cycle

Describe 3 ways in which carbon is transferred in the *Carbon Cycle*.

## Air Pollutants:

Pollutant	Source	Problems
<b>Carbon Monoxide</b> CO	Incomplete combustion of carbon-containing fuels ( <i>due to insufficient oxygen supply</i> )	Toxic gas – binds to haemoglobin in blood, stopping it carrying oxygen
<b>Sulfur Dioxide</b> SO <sub>2</sub>	Combustion of fossil fuels ( <i>which contain sulfur compounds</i> )	<ul style="list-style-type: none"><li>• Causes respiratory (breathing) problems</li><li>• Dissolves in rain to form <b>acid rain</b></li></ul>
<b>Nitrogen Oxides</b> NO and NO <sub>2</sub>	Vehicle engines ( <i>where nitrogen and oxygen from the air react together</i> )	<ul style="list-style-type: none"><li>• Causes respiratory (breathing) problems</li><li>• Dissolve in rain to form <b>acid rain</b></li></ul>
<b>Lead compounds</b>	Car engines using leaded petrol ( <i>banned in the UK</i> )	<ul style="list-style-type: none"><li>• Damages children's brains</li><li>• Damages the kidneys and nervous systems of adults</li></ul>

## Acid Rain:

- Dissolves limestone & marble buildings
- Lowers pH in lakes & rivers, killing fish
- Kills trees and insects

## Catalytic Converters in cars:

Contain transition metals which convert:

- Carbon monoxide into carbon dioxide
- Nitrogen oxides into nitrogen
- Unburnt hydrocarbons into carbon dioxide and water

## Carbon Cycle:

**Combustion:** Burning carbon-containing compounds (e.g. fossil fuels) releases carbon dioxide into the atmosphere

**Respiration:** Plants and animals respire, converting carbon in glucose into carbon dioxide in the atmosphere

**Photosynthesis:** Plants photosynthesise by taking in carbon dioxide from the air to make glucose (which contains carbon)

## Water

How is water treated in order to make it safe to drink?  
List the 4 stages of the process.

Give uses of water:

*In the Home*

*On Farms*

*In Industry*

*In Power Stations*

## Rust

Explain 3 ways of preventing iron and steel from rusting.

## Water Treatment:

**Screening:** Water is passed through a screen, which traps large particles, e.g. twigs

**Coagulation:** A coagulant is added to the water to make very fine particles stick together. These are skimmed off.

**Filtration:** Water is passed through a filter of fine sand to remove any remaining small particles

**Chlorination:** Chlorine is added to kill bacteria and other microbes

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## Uses of Water:

**In the Home:** Drinking, cooking, washing, flushing toilets

**On Farms:** As a drink for animals, for watering crops

**In Industry:** As a solvent, to wash things, for cooling, manufacture of ethanol

**In Power Stations:** Heated to make steam, which turns the turbines that generate electricity

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## Rust Prevention:

**Coating:** Coat the metal in paint or grease to prevent oxygen and water from reaching the metal surface

**Sacrificial Protection:** A more reactive metal is attached to iron/steel so that the more reactive metal corrodes instead of the iron/steel  
e.g. a bar of magnesium is attached to the side of a steel ship or the leg of an oil rig

**Galvanising:** Iron/steel is coated in zinc to prevent air and water from reaching the iron/steel

*The zinc also provides sacrificial protection to the iron/steel*