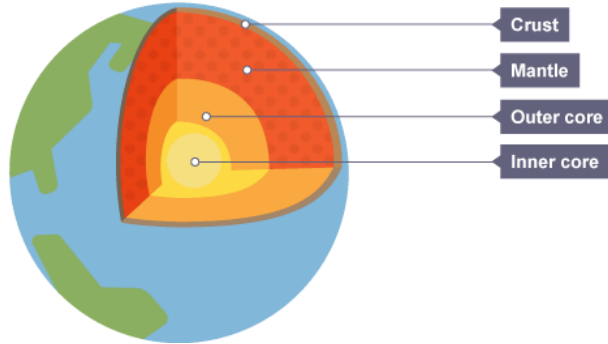


Earth & Atmosphere

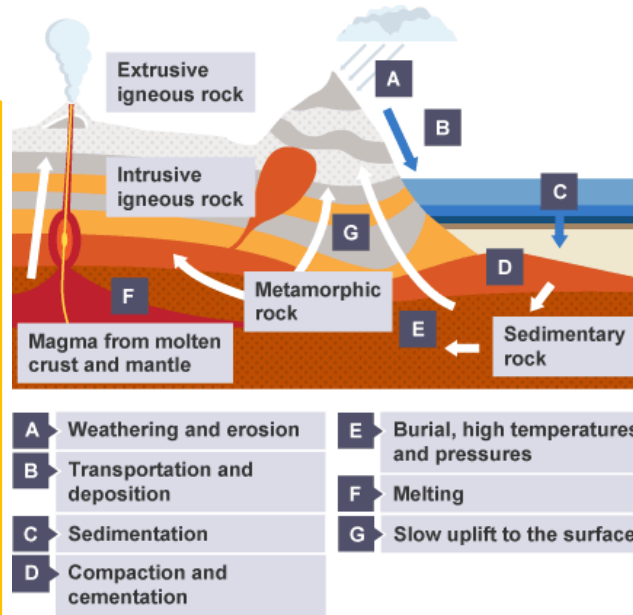
Earth's Structure

The Earth is a planet and is roughly the shape of a sphere. There are three layers that make up the Earth's structure.



The three layers, starting from the outside, are:

- the **crust** – the rocky outer layer. The crust is made of huge pieces of land called tectonic plates which fit together like a huge jigsaw. These plates move around because they are floating on the mantle below them, and this moves very slowly. The tectonic plates only move a few centimetres each year.
- the **mantle** – the mantle is a semi-solid layer below the crust. The mantle is the thickest layer of the Earth and is made of semi-solid rock that moves very slowly, like a liquid. The tectonic plates float on top of the mantle, meaning the tectonic plates and the mantle move at the same time.
- the **core** - the innermost layer which is divided into an inner core and outer core. The core is made of iron, with a smaller amount of nickel. The inner core is solid and the outer core is liquid. The two metals in the core, iron and nickel, are both magnetic. This is what gives the Earth its **magnetic field**, including the north and south poles.



Weathering & Erosion

Weathering breaks down rocks on the surface of the Earth. There are **three** types of weathering.

- 1. Biological weathering:** this describes rocks being broken up by the roots of plants, or animals burrowing into them.
- 2. Chemical weathering:** this describes rocks being broken up because substances in rainwater, rivers and seawater or the air, react with minerals in the rocks.
- 3. Physical weathering:** this describes rocks being broken up by changes in temperature, freezing and thawing of trapped water or the action of waves and rivers.

Erosion is the process of moving the small pieces of rock formed by weathering. Erosion occurs from the action of water or wind.

Sedimentary rocks are formed by small rock pieces which are transported by rivers and deposited at the bottom of oceans. The grains are arranged in layers. The oldest layers are at the bottom and the youngest layers are at the top.

There are **five** processes that make a sedimentary rock:
 transport → deposition → sedimentation → compaction → cementation

Stage	Process	Definition
1	Sediment transport	Sediment transport is the first all of the processes by which the sediment is formed. For example, small pebbles of rock are rolled along a river-bed.
2	Deposition	In deposition, sediment carried in transport is laid down.
3	Sedimentation	Layers of sediment form on top of each other in sedimentation.
4	Compaction	As more and more layers build up, the weight of the layers on top compacts the layers below.
5	Cementation	In the final process of sedimentary rock formation, some of the minerals in the sediment harden and form a kind of cement which sticks the grains of the rock together.

The Rock Cycle

Rocks are continually changing due to processes such as weathering, erosion and large earth movements. The rocks are gradually recycled over millions of years, changing between the different rock types. The three rock types are:

- **igneous** - formed from the cooling of molten rock
 - **sedimentary** - formed by small rock pieces being transported in rivers and laid down in layers
 - **metamorphic** - formed from another rock under heat and pressure
- This recycling of rocks is a process called **the rock cycle**.

Igneous rocks are formed from molten (liquid) rock that has cooled and solidified. The inside of the Earth is so hot that rocks deep underground are often liquid. **Molten** (liquid) rock underground is called **magma**. Volcanoes can bring molten rock to the surface, which we call **lava**. When the molten rock cools, it turns into a solid and igneous rock forms.

Igneous rocks contain randomly arranged interlocking **crystals**. The size of the crystals depends on how quickly the molten magma solidifies. If the lava cools on the outside of the volcano, it will cool quickly and there won't be time for large crystals to form. This is called **extrusive** igneous rock and it has small crystals. If the lava cools inside the volcano where it is hotter, it will cool slowly and there will be time for larger crystals to form. This is called **intrusive** igneous rock.

Metamorphic rocks are formed from other rocks which change due to **heat** or **pressure**. The original rocks are usually sedimentary rocks or igneous rocks. Sometimes one metamorphic rock can be turned into a different metamorphic rock.

There are three stages involved in the formation of metamorphic rocks:

1. Earth movements cause rocks to be deeply buried or compressed.
2. This causes the rocks to be heated and puts them under great pressure.
3. They do not melt, but the minerals they contain are changed chemically, and form metamorphic rocks.

Recycling

Humans extract many resources from the Earth that can then be turned into useful substances or products. Resources are extracted from the air (atmosphere), water and land. Some resources are **finite** (this means their supply is limited and they will eventually run out). However, others are **renewable** (which means they can be replaced).

Recycling is one way that we can reduce the amount of finite resources being extracted from the Earth.

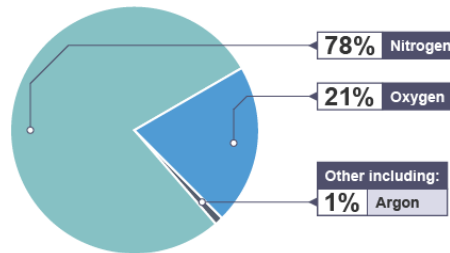
The atmosphere

The Earth's atmosphere is the relatively thin layer of gases surrounding the planet. The atmosphere is held close to Earth by gravity, but the higher you go away from the Earth's surface, the thinner the air. Because of this, it's impossible to say how high the atmosphere extends above Earth accurately. However, most scientists use around 100 km when describing where the atmosphere ends and space begins. The three gases with the highest percentages in the atmosphere are all elements:

- 78% nitrogen, N₂
- 21% oxygen, O₂
- 0.9% argon, Ar.

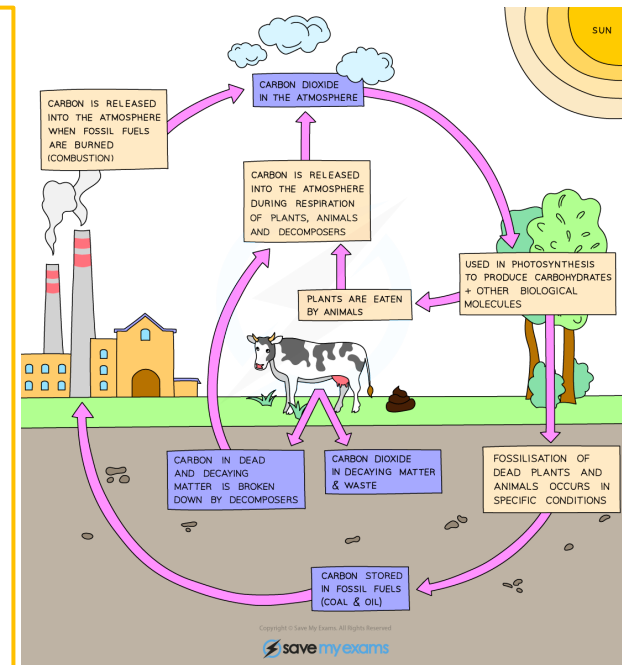
These three gases make up 99.9% of the atmosphere.

The remaining gases are found in much smaller proportions. These include carbon dioxide and water vapour.



Climate Change

Carbon dioxide makes up less than 1% of the atmosphere; however, it is an important **greenhouse gas**. This means that its molecules in the atmosphere absorb heat radiation, keeping the Earth warmer than it would otherwise be. For the past 100 or so years, carbon dioxide has been added to the atmosphere by human activity more quickly than it is removed. The extra carbon dioxide contributes towards **climate change**, including more frequent droughts and stronger storms.



Carbon Cycle: Carbon is one of the most important elements for life. It is cycled around the environment in a variety of processes as shown in the diagram above and the table below.

Process	What happens to carbon
Combustion	CO ₂ is released to the atmosphere when fuel is burned.
Respiration	All organisms release CO ₂ as a waste product when energy is released.
Photosynthesis	Plants absorb CO ₂ to convert it into glucose in photosynthesis.
Feeding	Carbon in the prey biomass is digested by the predator.
Excretion	Carbon is lost in urine and faeces.
Decomposition	Microbes release CO ₂ during respiration when they feed on dead organic matter. They also return mineral ions to the soil.