

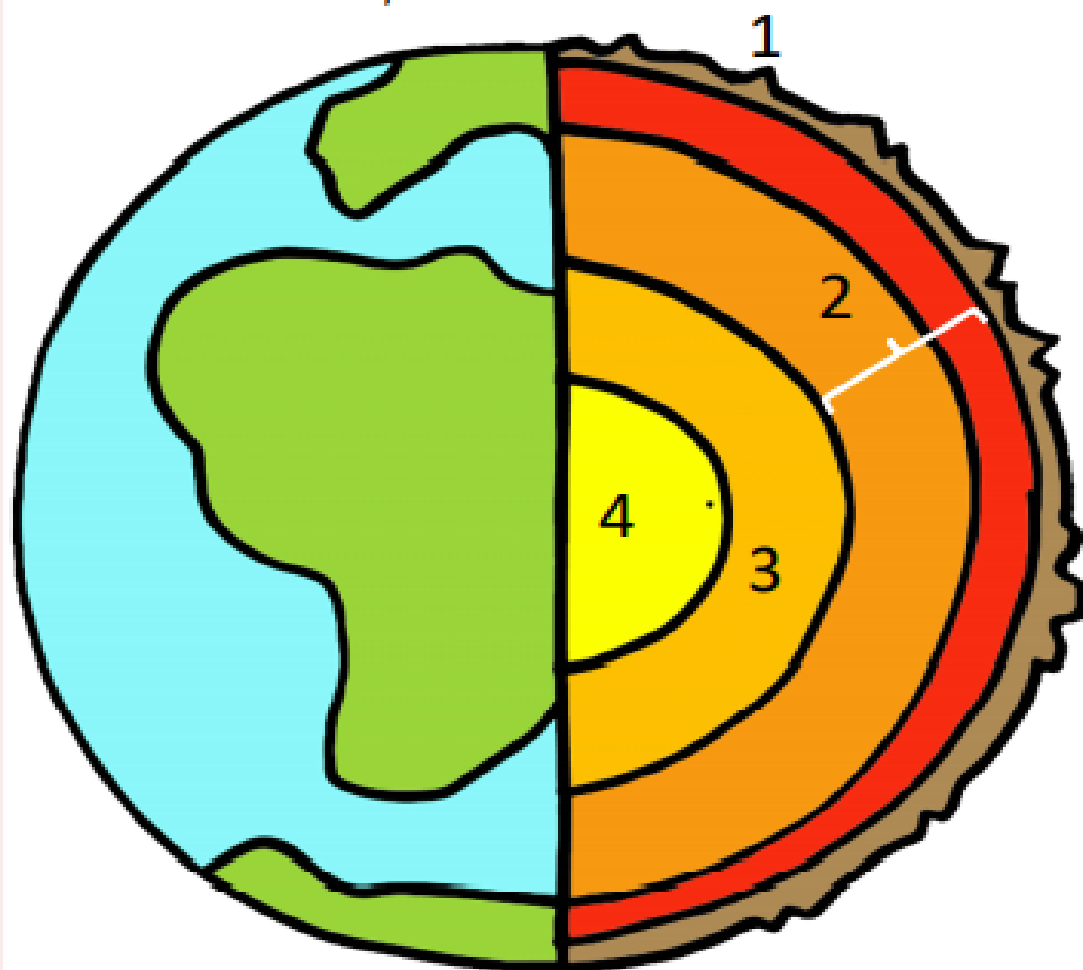
Chemistry Knowledge Organiser

Geology

KPI 7.1 Describe the structure and composition of the Earth and link this to the rock cycle

Composition and Structure of the Earth

The earth has four layers:



1 – Crust
2 – Mantle

3 – Outer core
4 – Inner core

Key Terms	Definitions
Crust	The outermost layer of the Earth's structure. The crust is thin, rocky and it is where we get materials from, such as glass, plastic, paper and aluminium.
Mantle	The layer beneath the crust. Much thicker than the crust. Solid (made up of rock) but flows slowly like a liquid.
Outer core	The layer beneath the mantle. Made from molten nickel and iron. Liquid because of the immense temperature.
Inner core	The innermost part of the Earth. Also made from nickel and iron but they are solid because of the immense pressure – even though the inner core is hotter than the outer core.
Igneous	A type of rock that is formed by the cooling of magma.
Extrusive	When magma cools rapidly above the surface.
Intrusive	When magma cools slowly below the surface.

Rocks

There are **three** main types of rock

- Igneous rock
 - Formed by cooling of magma
 - Rapid** cooling (e.g. volcanic eruption) gives extrusive igneous rock.
 - Slow** cooling (under the earth's surface) gives intrusive igneous rock

	Extrusive	Intrusive
Magma cools	On surface	Underground
Speed of cooling	Rapid	Slow
Crystal size	Small	Large
Example	Basalt (used in construction)	Granite (also used in construction but can be polished e.g. kitchen counters)

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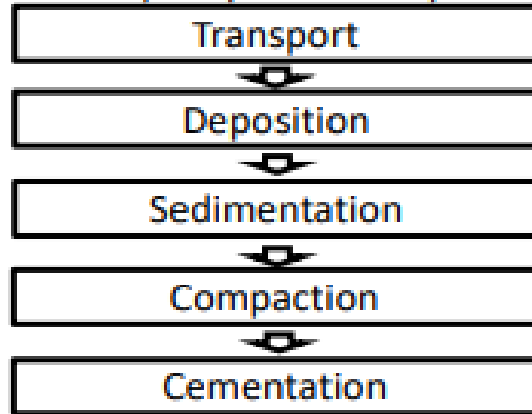
Geology

Rocks

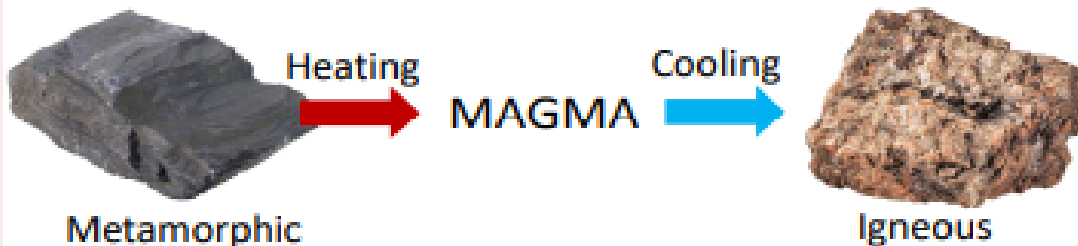
There are **three** main types of rock

2. Sedimentary rock

- Formed by compression of layers of sediment in the ocean



- Once formed, sedimentary rock may be slowly moved to the Earth's surface by **uplift**, or remain underground where immense pressure and heat will turn it into metamorphic rock
- Limestone** is an example of a sedimentary rock, which is used to manufacture glass and cement
- Sedimentary rocks have:
 - 1. **Layers**, because of the layers of sediment
 - 2. **Fossils**, because the sediment includes animal remains
 - 3. **Rounded grains**, because of weathering by the water



Key Terms	Definitions
Sedimentary	A type of rock that is formed by the compression of many layers of sediment over time.
Metamorphic	A type of rock that is formed when immense heat and pressure change the chemical properties of the minerals in sedimentary rocks.
Transport	Rocks are transported by rivers to the sea.
Deposition	Rocks settle at the bottom of the sea.
Sedimentation	Layers of sediment (rocks, dead sea life, etc.) begin to build up.
Compaction	As more layers build up, pressure is put on lower layers.
Cementation	Salt crystals "glue" the layers together.
Uplift	Some rocks are pushed to the surface by the pressure of new rocks forming beneath them.
Magma	Melted rock; cools to form igneous rock

Rocks

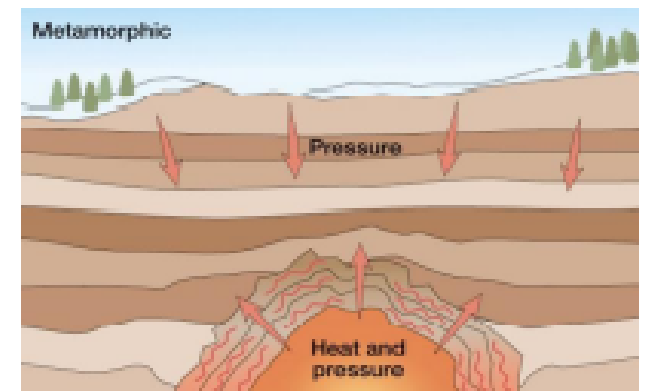
There are **three** main types of rock

3. Metamorphic rock

- Formed when immense **heat and pressure** change the chemical properties of the minerals in sedimentary rock
- Properties depend on which sedimentary rock was involved

e.g.
Limestone becomes marble

Shale becomes slate



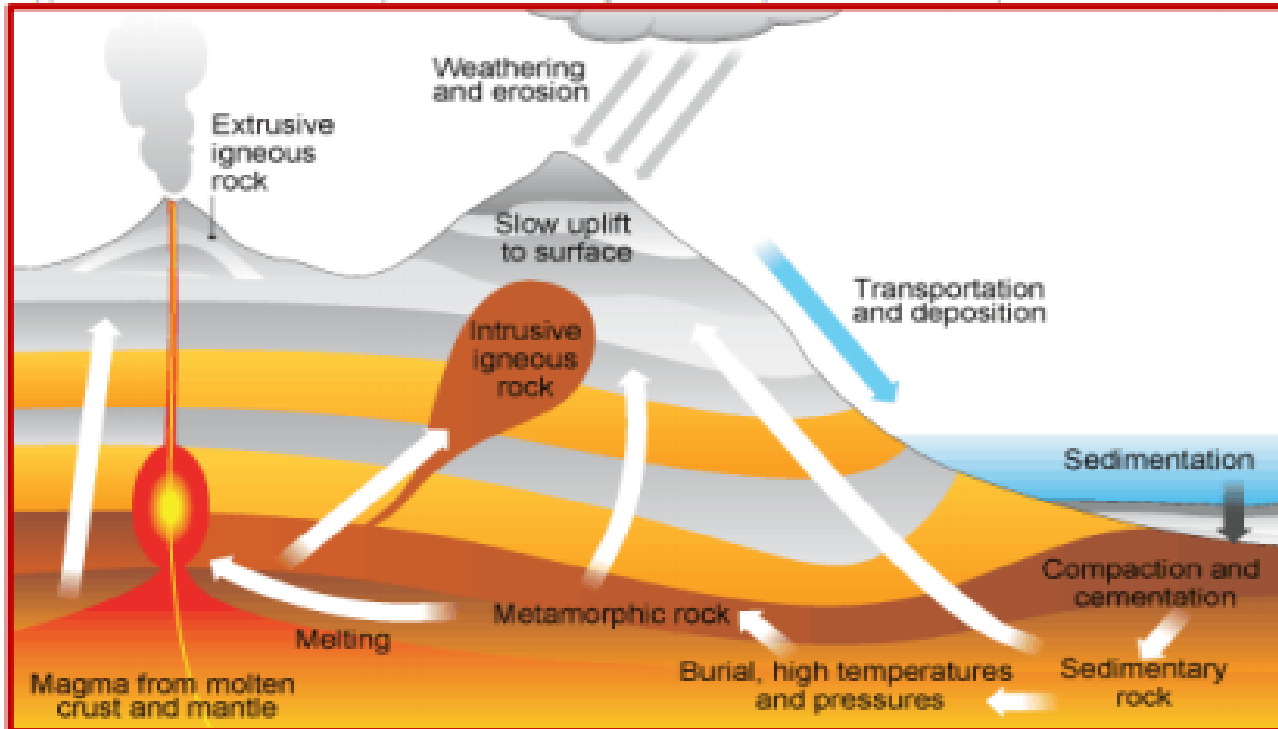
- If melted, metamorphic rock becomes magma

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Geology

The Rock Cycle

This diagram below shows the rock cycle – how physical processes change rocks from being one type, to another. The key terms tables give descriptions of these processes.



Key Terms	Definitions
Rock cycle	Igneous, metamorphic and sedimentary rocks can turn into one another through various processes, which are represented in the rock cycle
Weathering	The breaking down of rock by natural processes: wind, ice, water and gravity
Erosion	The movement of that broken-down rock by natural processes: wind, ice, water and gravity (transportation is an example of erosion)
Recycling	Treatment of resources so they may be used again
Sustainable	An activity which you can carry on doing indefinitely

Resources and recycling

- The Earth's crust provides us with resources such as glass, plastic, paper and aluminium
- However, these resources are finite (they are not unlimited), which is why we recycle them

How rocks change

Igneous rocks become sedimentary rocks by:

- Weathering, erosion, transportation, deposition, sedimentation, compaction, cementation

Sedimentary rocks become metamorphic rocks by:

- Burial (high pressure) and high temperatures

Metamorphic rocks become extrusive igneous rocks by:

- Melting to magma, eruption, rapid cooling above the surface

Metamorphic rocks become intrusive igneous rocks by:

- Melting to magma, slow cooling beneath the surface, uplift

Resource	Made from	Recyclable?
Glass	Sand	Yes, but needs sorting
Plastic	Oil	Yes but needs sorting
Paper	Wood	Yes, but only a few times
Aluminium	Aluminium ore	Yes, but not all metals

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Atmosphere

KPI 10.1: Explain how carbon is recycled in the Earth's atmosphere and link the impact of human activity to climate change

Evolution of the Earth's atmosphere

In the 4.5 billion years since the Earth formed, its atmosphere has changed considerably. This has happened in three main stages:

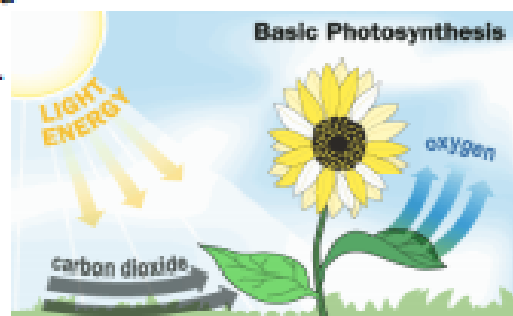
Stage 1 – Volcanoes

The Earth's surface was originally molten before it cooled and a thin crust formed. Volcanoes were continually erupting and the atmosphere was produced from the gases they emitted. The atmosphere was made mostly of carbon dioxide with little oxygen. There was also water vapour, ammonia and methane. As the Earth cooled the water vapour condensed to form the oceans.



Stage 2 – Green plants

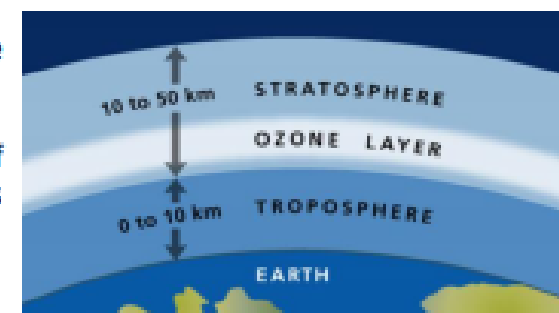
Green plants and algae evolved and were able to survive in the carbon dioxide rich atmosphere. They absorbed some of the carbon dioxide and released oxygen during photosynthesis. A lot of the carbon dioxide dissolved into the newly formed oceans and levels of the gas began to fall.



Key Terms	Definitions
Atmosphere	A layer of gases surrounding a planet
Photosynthesis	A chemical process that uses energy to produce glucose
Ozone layer	A layer of the Earth's atmosphere that absorbs radiation from the sun

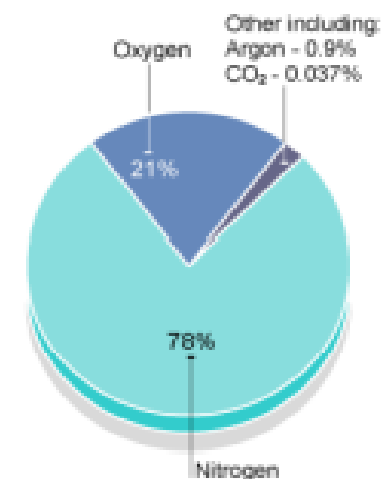
Stage 3 – Complex animals

The oxygen released during photosynthesis started to build up in the atmosphere and allowed more complex organisms to evolve. The build up of oxygen also created the ozone (O₃) layer which blocked the harmful rays from the sun reaching the planet leading to even more complex life forms developing. Carbon dioxide now makes up less than half a percent of the Earth's atmosphere.



Atmospheric composition

The Earth's atmosphere has remained much the same for the past 200 million years. The pie chart shows the proportions of the main gases in the atmosphere today.



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Atmosphere

The Carbon Cycle

All cells - whether animal, plant or bacteria - contain carbon, because they all contain proteins, fats and carbohydrates.

Carbon is passed from the atmosphere, as carbon dioxide, to living things, passed from one organism to the next in complex molecules, and returned to the atmosphere as carbon dioxide again. This is known as the carbon cycle.

- **Step 1: Removing carbon dioxide from the atmosphere**

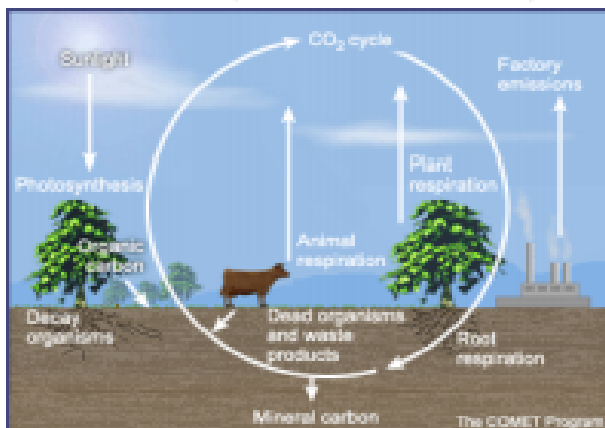
Green plants remove carbon dioxide from the atmosphere by photosynthesis. The carbon becomes part of complex molecules such as proteins, fats and carbohydrates in the plants.

- **Step 2: Returning carbon dioxide to the atmosphere**

Organisms return carbon dioxide to the atmosphere by respiration. It is not just animals that respire. Plants and microorganisms do, too.

- **Step 3: Passing carbon from one organism to the next**

When an animal eats a plant, carbon from the plant becomes part of the fats and proteins in the animal. Microorganisms and some animals feed on waste material from animals, and the remains of dead animals and plants. The carbon then becomes part of these microorganisms and detritus feeders.



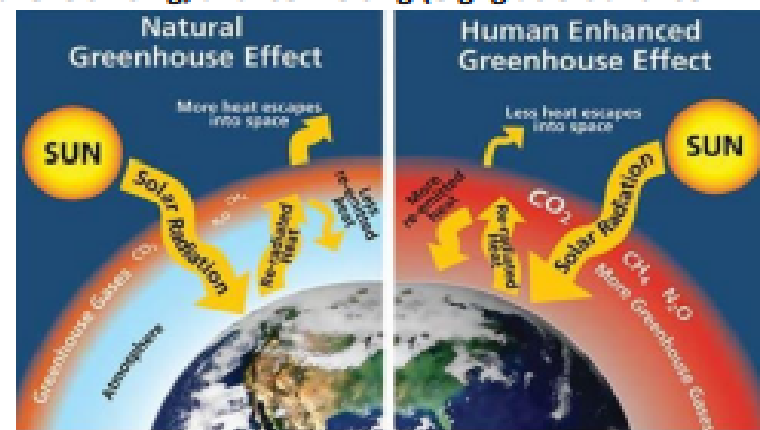
Key Terms	Definitions
Carbon cycle	A series of processes that moves carbon through organisms and the atmosphere
Respiration	A chemical process that releases energy
Global warming	The gradual increase in global temperatures

The greenhouse effect

The natural greenhouse effect is when gases in the Earth's atmosphere trap radiation from the sun and heat up the planet. Without the greenhouse effect the Earth would be too cold for us to survive on it. The gases involved are called greenhouse gases and include carbon dioxide, methane and water vapour.

The enhanced greenhouse effect and global warming

The extra greenhouse gases released by human activity lead to the enhanced greenhouse effect. More heat is trapped by the atmosphere, causing the planet to become warmer than it would be naturally. The increase in global temperature this causes is called global warming, which can cause **changes to animals' habitats, sea levels rising, and ice melting (e.g. glaciers and ice caps).**



The Climate Change Debate

Despite evidence, there are those who believe that climate change and global warming are:

1. Not real
2. Not as important as other problems facing the world's population
3. Not anthropogenic (caused by humans)

A dangerous position

- These views are dangerous because countries might stop helping to combat climate change, e.g. the USA withdrew from the Paris Climate Agreement