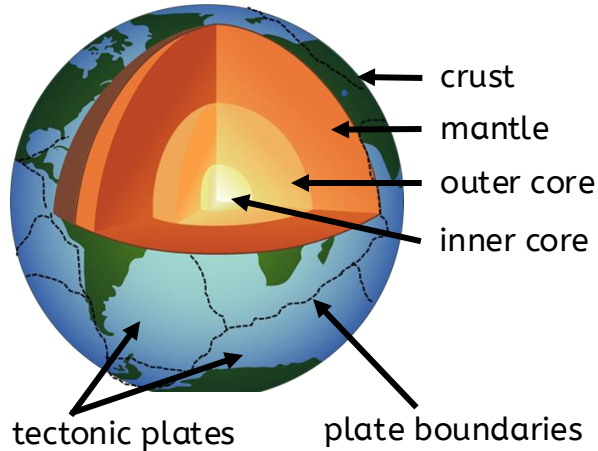


8.02: Earth and the Atmosphere

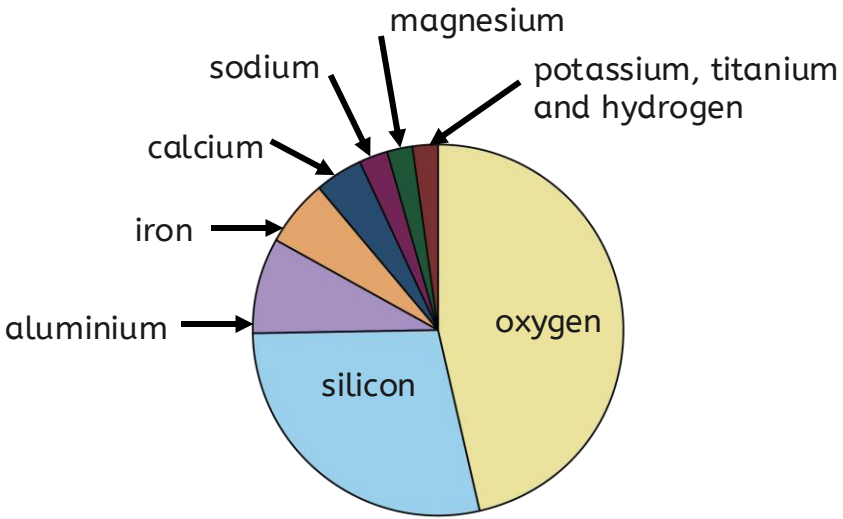


Composition and structure of the Earth



Layer	State	Composition	Thickness (km)	Temperature (°C)
crust	solid	rocks and minerals	5 to 70	0 to 30
mantle	solid	rocks and minerals	2900	1400 to 3000
	liquid	molten iron and nickel	2200	4400
inner core	solid	solid iron and nickel	1200	5430

The two types of crust are continental crust, which is found beneath landmasses, and oceanic crust, which is found below the oceans. Continental crust is the thickest. Earth's crust is broken up into tectonic plates that meet at plate boundaries.



The most common elements that make up the minerals of Earth's crust.

Scientists can't explore deep inside Earth, so they use models to show what it's like. These models have limitations and can change when new evidence is found.

<p>An apple</p>	<p>A layer cake</p>
<p>+</p> <ul style="list-style-type: none"> ● has a thin outer layer ● has a thick middle layer ● has a core 	<p>+</p> <ul style="list-style-type: none"> ● has a thin outer layer ● has thicker middle layers ● has four layers
<p>-</p> <ul style="list-style-type: none"> ● not spherical ● the outer layer is the same thickness all around ● the inner and outer cores are not clear 	<p>-</p> <ul style="list-style-type: none"> ● not spherical ● doesn't show the difference in layer thickness ● the core is not hot



8.02: Earth and the Atmosphere



Scientific theory: continental drift

Peer review

After data collection, scientific thinkers propose a scientific theory; it is based on a body of facts and is repeatedly confirmed by observation (and experiment).

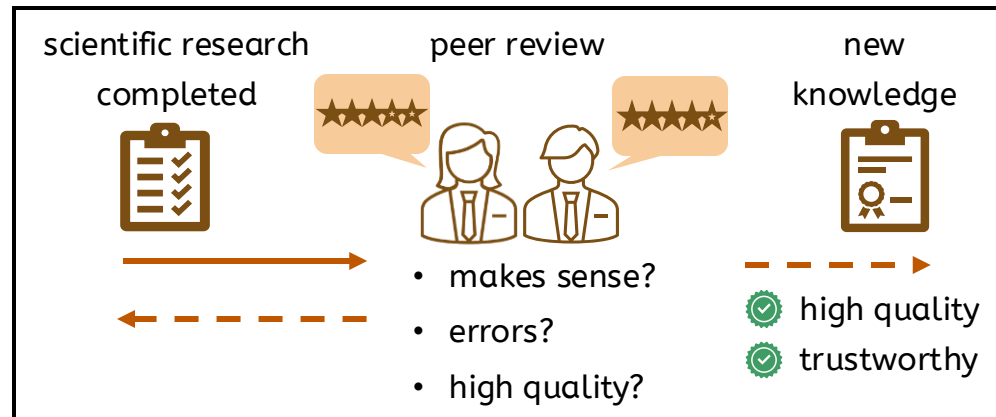
Scientific thinkers present evidence to their peers in order to support an opinion and explain their reasoning.

The theory of continental drift is the theory that the continents were once connected in a land mass (Pangaea) but have broken apart and drifted away over time.

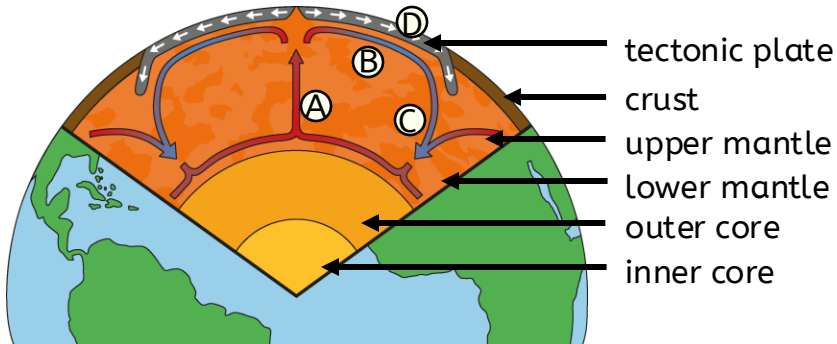
Peer review is when researchers submit work for peer feedback. Peer review is important because it helps to make sure that the research is trustworthy and of high quality.

Three pieces of evidence that support the theory are:

- The coastlines of many continents appear to fit together like a jigsaw puzzle.
- There were similar types of rocks across continents that are now far apart.
- There were identical plant and animal fossils found on different continents that are now far apart.



Convection currents cause continent movement



- Hot, less dense rock rises towards the upper mantle.
- In the upper mantle, the hot rock spreads and moves sideways.
- As it cools, it becomes more dense and sinks back down, creating convection currents.
- These convection currents cause the tectonic plates above to shift. As a result, the continents slowly change position over millions of years.

8.02: Earth and the Atmosphere



Rocks and the rock cycle

Igneous rock

- Igneous rocks are formed when molten rock crystallises.
- Molten rock above the Earth's surface is called **lava** and forms **extrusive** igneous rock when it cools and crystallises.
- Molten rock below the Earth's surface is called **magma** and forms **intrusive** igneous rock when it cools and crystallises.
- If molten rock cools **slowly**, it will form rock with **large** crystals.
- If molten rock cools **quickly**, it will form rock with **small** crystals.

Metamorphic rock

- Metamorphic rocks form from existing rocks, deep within the Earth's crust due to high temperature and pressure, causing chemical changes in minerals.
- Over millions of years, sedimentary and igneous rocks transform into metamorphic rocks, often near tectonic plate boundaries.

Sedimentary rock

Sedimentary rocks are formed through:

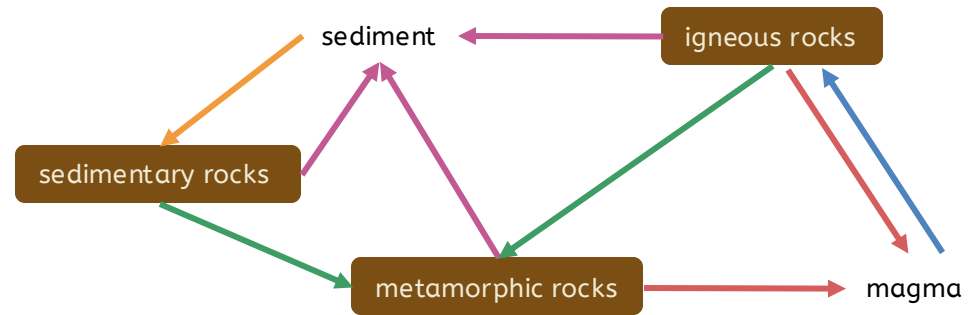
weathering → transportation → deposition → sedimentation → compaction → cementation

Layers, called **strata**, can be seen in sedimentary rock.

Weathering is the slow breakdown of rocks while they are in place. It can be **biological** (by living organisms), **chemical** (by chemical reactions) or **physical** (by forces e.g. freeze-thaw).

Erosion is the movement and carrying away of rock fragments.

The rock cycle involves the recycling of rocks, during which rocks can change into different types.



Key:

weathering and erosion

sedimentation, compaction and cementation

heat and pressure

melting

crystallisation

Fossils

Fossils are the preserved remains or traces of a dead organism that was alive millions of years ago. Fossils can be **trace fossils** (preserved imprints or evidence), **body fossils** (actual remains) or **mineralised fossils** (when hard parts are replaced by minerals).

Fossils are found in sedimentary rocks. High temperatures and pressures destroy fossils, so they are not found in metamorphic or igneous rocks.



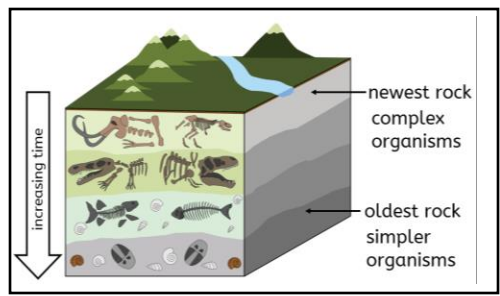
8.02: Earth and the Atmosphere



Fossils continued

Fossilisation process:
 Organism dies → buried in sediment → soft parts rot, hard parts stay → pressure compacts layers → minerals replace hard parts → fossil forms → uplift exposes fossil

The fossil record is a collection of fossils documenting the history of life on Earth. It shows how organisms and environments have changed over time.



More complex fossil organisms are found at the top in newer rocks. Simpler fossils are deeper in older rocks.

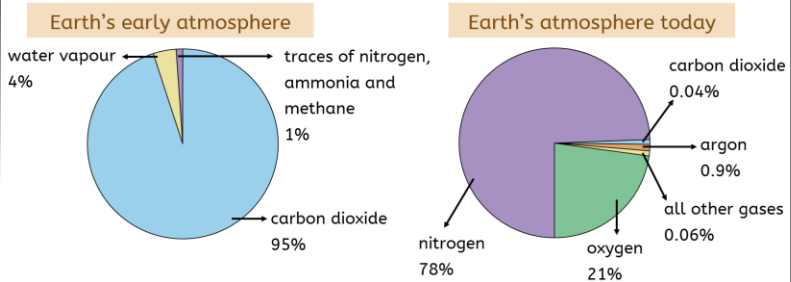
Fossil fuels

Fossil fuels are natural resources formed over millions of years from the remains of dead organisms, such as plants and animals. Fossil fuels are **non-renewable** energy resources because they take a very long time to replenish.

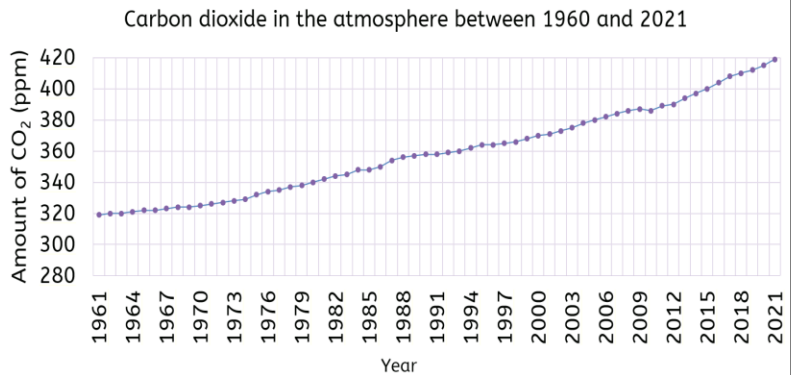
Fossil fuel extraction provides energy, products, and jobs, but causes pollution, habitat loss, resource depletion, and global social inequality.

<p>coal</p>	<p>Swamp plants die → buried in mud and sediment → form peat → more burial → heat & pressure → peat turns to coal</p>
<p>crude oil</p>	<p>Coal is extracted through surface and underground mining. Uses: heating, generating electricity, steel production.</p>
<p>natural gas</p>	<p>Plankton die → sink → buried in sediment → pressure and heat → oil and gas form → trapped under impermeable rock</p> <p>Crude oil and natural gas are extracted by drilling wells through impermeable rock. Uses of crude oil: refined to make petrol, diesel, plastics. Uses of natural gas: cooking, generating electricity, industry.</p>

Earth's atmosphere



Human activities, such as the combustion of fossil fuels, which release large amounts of CO₂ into the atmosphere, result in an increase in atmospheric CO₂ concentration.

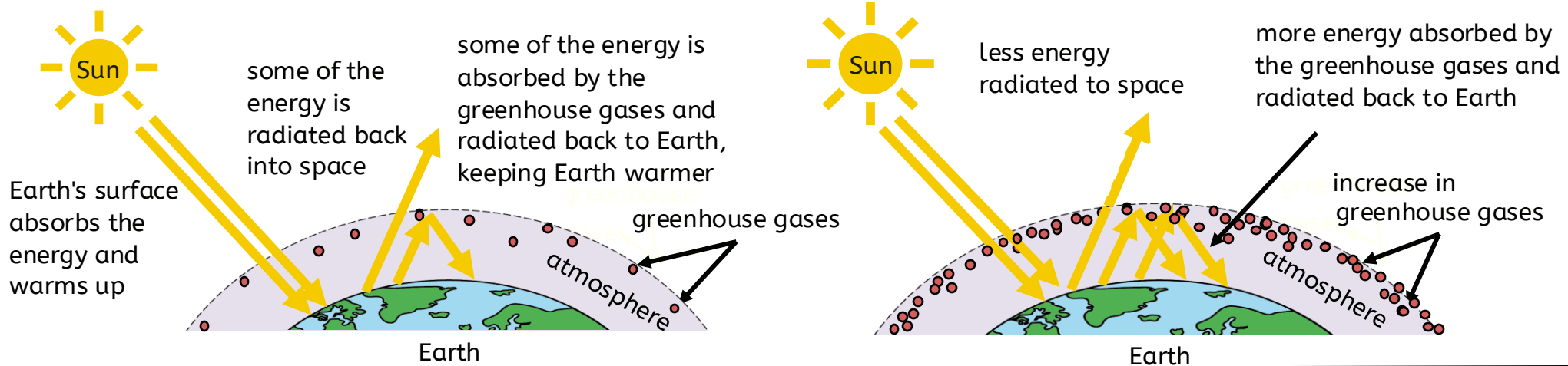


8.02: Earth and the Atmosphere

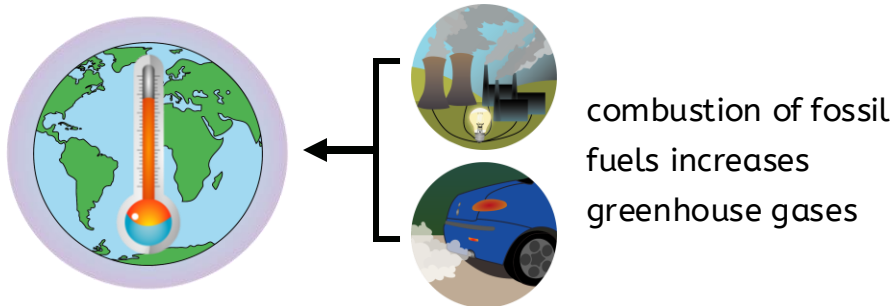


The greenhouse effect, global warming and climate change

Earth's atmosphere contains greenhouse gases (carbon dioxide, methane, water vapour), which keep Earth warmer than it would be without them. The greenhouse effect is the natural warming of the planet to habitable temperatures, caused by greenhouse gases. The enhanced greenhouse effect is the unnatural warming of the Earth due to increased greenhouse gases in the atmosphere.



Global warming is the increase in Earth's average temperature, caused by the enhanced greenhouse effect.



Climate change is the change in the Earth's long-term weather patterns, including precipitation, wind and temperature. It leads to social, economic and environmental impacts.

Environmental impacts cause habitat loss, food shortages, wildlife threats, farming issues, water problems, and human displacement.

