

Plate Tectonics

The earth consists of four concentric layers: inner core, outer core, mantle and crust. The crust is made up of tectonic plates, which are in constant motion. Earthquakes and volcanoes are most likely to occur at plate boundaries.

Rocks found in the earth's crust are of three main types –

igneous, sedimentary and metamorphic.

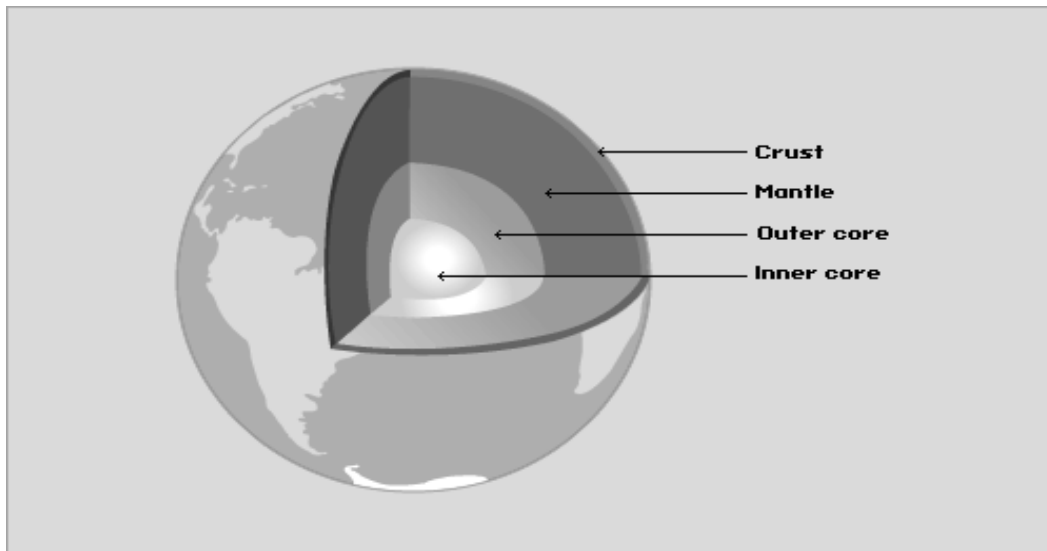
1. **The structure of the earth**
2. **Rock types**
3. **Plates and plate boundaries**

The Structure of the Earth

The earth is made up of 4 distinct layers:

1. **The inner core** is in the centre of the earth and is the hottest part of the earth. The inner core is solid. It is made up of iron and nickel with temperatures of up to 5500°C. With its immense heat energy, the inner core is like the engine room of the Earth.
2. **The outer core** is the layer surrounding the inner core. It is a liquid layer, also made up of iron and nickel. It is still extremely hot here, with temperatures similar to the inner core.
3. **The mantle** is the widest section of the earth. It has a diameter of approximately 2900km. The mantle is made up of semi-molten rock called magma. In the upper parts of the mantle the rock is hard, but lower down, nearer the inner core, the rock is soft and beginning to melt.
4. **The crust** is the outer layer of the earth. It is a thin layer between 0-60km thick. The crust is the solid rock layer upon which we live. There are two different types of crust: **continental crust**, which carries land, and **oceanic crust**, which carries water.

The diagram below shows the structure of the earth. In geography, taking a slice through a structure to see inside is called a **cross section**.



Rock Types

We can learn about the inside of the earth by looking at rocks found on the earth's surface. This is because a lot of rock material comes from inside the earth.

Rocks are classified (organised) into three main groups: igneous rocks, sedimentary rocks and metamorphic rocks.

Three Main Rock Groups

Igneous rocks include basalt and granite. These are formed when magma from inside the Earth erupts to the surface, cools down and solidifies to form rock.

Sedimentary rocks include sandstone, chalk and limestone. These rocks are formed by the remains of living things or from the fragments of other rocks.

Metamorphic rocks include marble, slate and quartzite. These rocks are formed when intense heat and pressure change rocks that already exist. New rocks are formed. These are harder and smaller than the original rocks.

Plates and Plate Boundaries

The earth's crust is broken up into pieces. These pieces are called plates. Heat rising and falling inside the mantle creates **convection currents**. The convection currents move the plates. The movement of the plates, and the activity inside the earth, is called **plate tectonics**.

Plate tectonics cause earthquakes and volcanoes. The point where two plates meet is called a **plate boundary**. Earthquakes and volcanoes are most likely to occur either on or near plate boundaries.

The earth's plates move in different directions. Plates behave differently at different plate boundaries:

- At a **constructive** or **divergent** boundary the plates move apart.
- At a **destructive** or **convergent** boundary the plates move towards each other.
- At a **conservative** or **transform** boundary the plates slide past each other.

Different exam boards and textbooks may use different names for each of the boundary types. For example, a **destructive boundary** may also be called a **collision boundary**. You can use any term so long as you use it correctly, but it is best to stick to the terms you have been taught.

Tectonic Plate Boundaries

Boundaries between tectonic plates can be of three types:

1. **Constructive plate boundaries** create new crust, and often give rise to volcanoes and earthquakes.
2. **Destructive plate boundaries** create mountains and may give rise to volcanoes and earthquakes.
3. **Conservative plate boundaries** do not create or destroy land, but often give rise to earthquakes (not volcanoes).

1. **What happens at a constructive boundary?**
2. **What happens at a destructive boundary?**
3. **What happens at a conservative boundary?**

What happens at a constructive boundary?

At a **constructive boundary** the **plates** are moving apart. The plates move apart due to **convection currents** inside the earth.



Volcano Helgafjell on the Westman Islands near Iceland. The islands are on the boundary of the Eurasian and North American plates moving away from each other.

As the plates move apart (very slowly), **magma** rises from the mantle. The magma erupts to the surface of the earth.

When the magma reaches the surface, it cools and solidifies to form a new crust made up of **igneous rock**. This process is repeated many times, over a long period of time.

Eventually the new rock builds up to form a volcano. **Constructive boundaries** tend to be found under the sea, e.g. the Mid-Atlantic Ridge. Here, chains of underwater volcanoes have formed along the **plate boundary**. One of these volcanoes may become so large that it erupts out of the sea to form a volcanic island, eg Surtsey and the Westman Islands near Iceland.

What happens at a destructive boundary?

At a **destructive boundary** the plates are moving towards each other. This tends to involve a **continental plate** (a plate carrying land) and an **oceanic plate** (a plate carrying ocean).

The oceanic plate is **denser** than the continental plate so, as they move together, the oceanic plate is forced underneath the continental plate. The point at which this happens is called the **subduction zone**. As the oceanic plate is forced below the continental plate it melts to form magma. The magma collects to form a **magma chamber**. This magma then rises up through cracks in the continental crust. As pressure builds up, a volcanic eruption may occur.

As the plates push together, the continental crust is squashed together and forced upwards. This is called folding. The process of folding creates **fold mountains**. Fold mountains can also be formed where two continental plates push towards each other. This is how the **Himalayas** were formed.



Mount Everest and the Himalayas were created by two plates pushing towards each other

What happens at a conservative boundary?

At a **conservative boundary** the plates are sliding horizontally past each other. No land is created at a conservative boundary and none is destroyed.

Volcanoes do not occur along these boundaries but earthquakes are very common. A very well-known example of a conservative boundary is the **San Andreas Fault**, which runs through the state of **California** in the USA.

