

Journey to the Center of the Earth

There will be temperature and pressure changes as you go through the layers of the Earth to the center core. There are three main layers and each layer has its own conditions and materials. These layers vary greatly in size, composition, temperature, and pressure. The **three main layers** that make up the Earth's interior are:

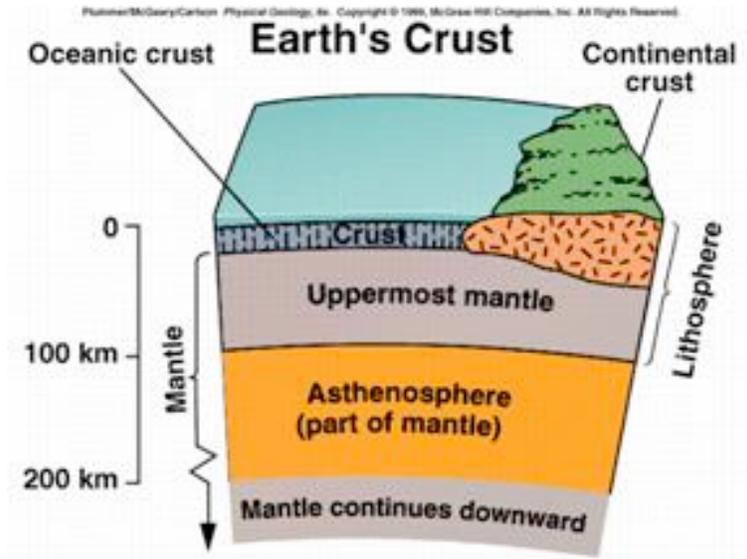
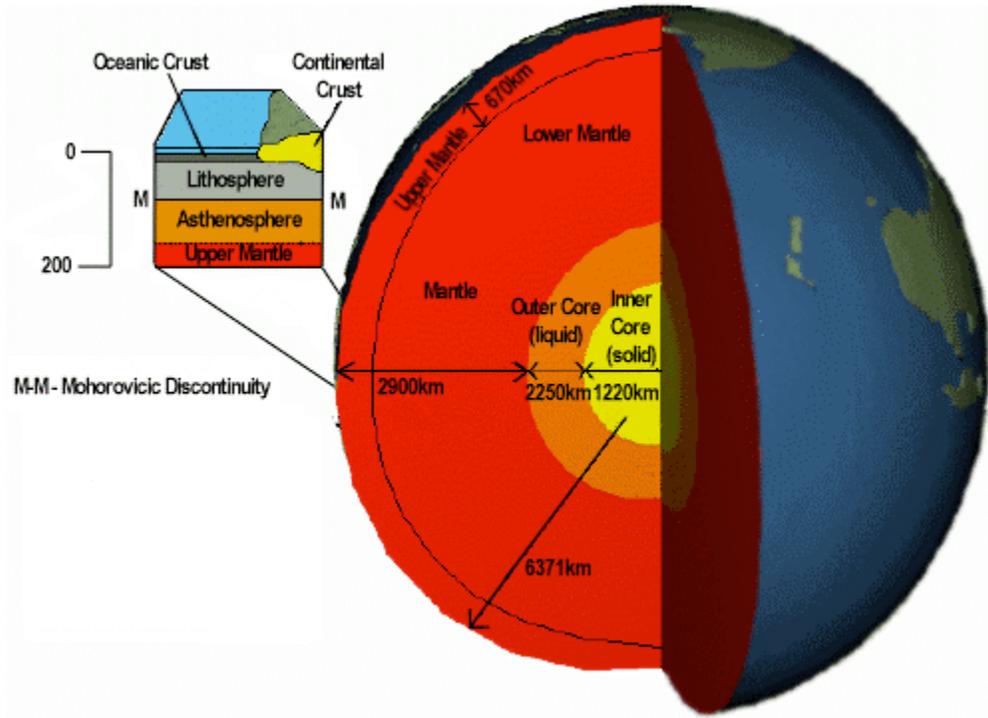
- The Crust
- The Mantle
- The Core

The **Crust** is a layer of rock that forms Earth's outer skin. On the crust are rocks and mountains. The crust also included the soil and water that covers large parts of Earth's surface. The crust includes the dry land and the ocean floor. The crust is thinnest beneath the ocean. The crust is thickest under high mountains. The crust is from 5 to 40 kilometers thick. The crust beneath the ocean is called **oceanic crust** and is mostly of **basalt** rock. Basalt is a dense, dark rock with a fine texture. The land crust, which forms the continents, is **continental crust** and is made of mostly **granite**. Granite is a rock with larger crystals than basalt. Granite is less dense and usually a light color.

The **Mantle** is below the basalt and granite. The mantle has a layer of solid hot rock. The crust and the uppermost part of the mantle are very similar. Together they form a rigid layer called the **lithosphere**. The lithosphere is broken into a number of plates that move over the asthenosphere beneath it. Below the lithosphere the heat and pressure make the mantle less rigid. This part is like road tar softened by the heat of the sun. This soft layer of the mantle is the **asthenosphere**. The material in this layer can flow slowly. The lithosphere floats on top of the asthenosphere. Beneath the asthenosphere, solid mantle material extends all the way to Earth's core. The mantle is about 3000 kilometers thick. Compared with the crust, the mantle is very thick and contains most of the Earth's mass. In some places mantle rock has been pushed up to the surface by tectonic forces. This allows scientists to observe the rock directly.

The **Core** is a layer of molten metal that surrounds the inner core. The **outer core** behaves like a thick liquid. The **inner core** is a dense ball of solid metal. The pressure at this depth squeezes the atoms of iron so tightly that they cannot become liquid. The core is made mostly of the metals iron and nickel and possibly some sulfur and oxygen.

Currents in the liquid outer core force the solid inner core to spin inside Earth slightly faster than the rest of the planet. This movement creates **Earth's magnetic field**. This makes the planet act like a giant bar magnet.



Convection Currents and the Mantle

Heat transfers from a warmer substance to a cooler substance. There are three types of heat transfer:

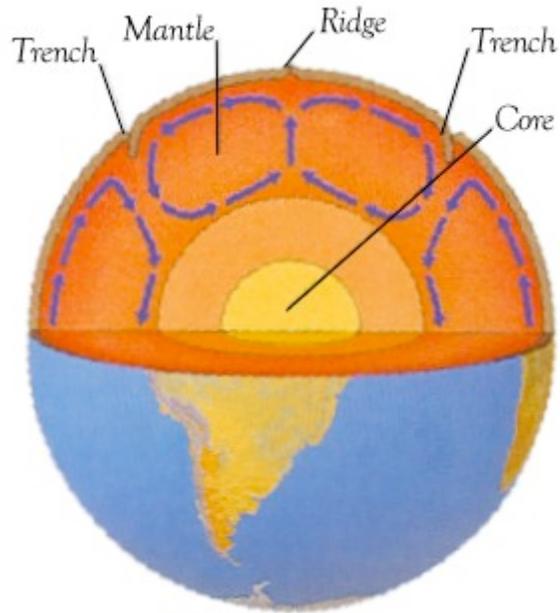
- Radiation
- Conduction
- Convection

The transfer of heat through empty space is called **radiation**. Sunlight is radiation that warms the surface of the Earth. When heat is transferred by radiation, there is no direct contact between the heat source and an object. Heat from an open flame is radiant heat.

The direct transfer of heat in solid material is called **conduction**. The heat is still transferred from the higher heat to the lower heat. An example is placing a spoon in hot tea. The heat from the tea transfers to the spoon. If you touch the spoon, the heat from the spoon will transfer to you. You will feel the heat. This transfer within a material or between materials that are touching is called conduction.

Heat that is transferred by the movement of a heated liquid is **convection**. Heated particles of fluid begin to flow during convection. This transfers heat energy from one part of the fluid to another part of the fluid. Differences in temperature and density in the fluid causes the heat to transfer by convection. A **convection current** is the flow that transfers heat within a fluid. The heating and cooling of the fluid, changes the fluid's density, and the force of gravity combine to set convection currents in motion. Heat from the core and the mantle causes convection currents in the mantle.

In the mantle hot columns of mantle material rise slowly through the asthenosphere where the material spreads out and pushes the cooler material out of the way. The cooler material sinks back into the asthenosphere. The cycle happens over and over again as these **convection currents have been moving inside Earth for more than four billion years.**



Review: The Earth is divided into five main physical layers:

- The lithosphere
- The asthenosphere
- The mesosphere
- Outer Core
- Inner Core

The **Lithosphere** is the outermost rigid layer of the Earth . The lithosphere is made of two parts. The crust and the rigid upper part of the mantle make up the two parts of the lithosphere. The lithosphere is divided into pieces called tectonic plates.

The **asthenosphere** is a soft layer of the mantle on which pieces of the lithosphere move. It is made up of solid rock that flows like tar or putty. It flows very slowly similar to the rate your fingernails grow.

The **mesosphere** is beneath the asthenosphere and is the strong lower part of the mantle. The mesosphere extends from the bottom of the asthenosphere down to the Earth's core.

The **core** is divided into two parts called the inner core and the **outer core**. The outer core is the liquid layer of Earth's core. It lies beneath the mantle and surrounds the inner core.

The **inner core** is the solid, dense center of Earth that extends from the bottom of the outer core to the center of the Earth. You are now 6,378 kilometers beneath the surface of the Earth.