Structure of the Earth

The internal structure of Earth is divided broadly into three layers based on chemical arrangement and composition. Only two significant variations in composition led to the formation of three chemical layers, as described below.

First Layer of Interior of Earth - Crust

The crust accounts for about 1% of the Earth's volume and 0.5% of its mass. It is the Earth's outermost solid layer, which is typically 8-40 km thick. It has a fragile structure.

- The thickness of the crust differs between oceanic and continental areas.
- The oceanic crust is thinner (approximately 5km) than the continental crust (about 30 km).
- Because the major parts of the crust are silica (Si) and aluminium (Al), it is sometimes referred to as SIAL (Sometimes SIAL is used to refer to the Lithosphere, which is the region comprising the crust and uppermost solid mantle, also).
- The materials in the crust have a mean density of 3g/cm3.

Second Layer in Internal Structure of Earth - Mantle

The mantle is the region of the interior that extends beyond the crust. The Mohorovich Discontinuity, or Moho discontinuity, is the boundary between the crust and the mantle.

- The thickness of the mantle is approximately 2900 kilometres.
- The mantle accounts for around 84 per cent of the Earth's volume and 67 per cent of its mass.
- Because silicon and magnesium are key component elements of the mantle, it is also known as SIMA.
- The layer has a greater density than the crust, ranging from 3.3 to 5.4g/cm3.

Third Layer in Interior of the Earth - Core

The deepest layer surrounds the Earth's core, and Guttenberg's Discontinuity separates the core from the mantle. Because it is mainly constituted of iron (Fe) and nickel (Ni), it is also known as NIFE.

- The term "barysphere" can apply to the planet's core or interior.
- The core accounts for almost 15% of the Earth's volume and 32.5 per cent of its mass.
- The core is the Earth's densest layer, ranging from 9.5 to 14.5g/cm3.

Composition and Internal Structure of Earth - Physical Layers

The Earth is separated into five physical layers based on how each layer reacts to pressure. There are major differences between the physical and chemical layers, and they overlap, especially in the boundary of the core and mantle.

Lithosphere Layer of Earth

The Lithosphere is regarded as the Earth's outermost physical layer, including the crust, continental and oceanic elements. The Lithosphere is split into numerous segments called plates.

- The term Litho stands for rock.
- A boundary of these plates is where two plates connect and move close to one another.
- Tectonic plates are visible at or around these boundaries comprising earthquakes, volcanic eruptions, and mountain ranges.
- Oceanic Lithosphere is thin and robust, ranging from zero to 140 km in thickness.
- The continental Lithosphere is thicker, having a width between 40 - 280 km.

Asthenosphere - 2nd Layer of Earth

The layer of Earth just beneath the Lithosphere is the Asthenosphere, which has the most remarkable property of movement. Since this layer of Earth is mechanically not so strong, it flows and moves.

- The word Astheno stands for weak.
- The Lithosphere plates can move because the convection of internal heat partially pushes this layer.
- The layer remains solid at the short time scales and experiences few seismic wave types.
- The deepness of the layer depends on heat and can be shallow at middle-ocean peaks and deep in plate interiors and under mountains.

Mesosphere - 3rd Layer of Earth

The mesosphere is also known as the lower mantle sometimes, and it is stiff, hot, and stationary than the Asthenosphere. Between the depth of 410 - 660 km, the mantle is in the transition state, as minerals get altered into multiple forms due to increased pressure.

- The outer core is the only liquid layer seen within Earth.
- The solid inner core can be witnessed with the immense pressure inhibiting melting, though as the Earth cools down by warmness flowing to the exterior, the inner core expands over time.
- The Mesosphere zone is considered a physical obstacle to movement as many discrepancies are observed in the velocity of seismic waves.

Structure of Earth - Summary and Outline

The Earth's structure is divided into crust, mantle, and core based on relative position, composition, density, representative chemical composition, temperature, and pressure.

Internal Structure of Earth			
Parameters	**Crust**	**Mantle**	**Core**

Relative Position	Outermost layer Thinnest Layer under the ocean, thickest under continents Crust and top of mantle is called lithosphere	Middle layer Thickest layer Top portion is called asthenosphere	Inner layer Consists of the Inner core and outer core
Composition	Solid rock, Mostly Silicon and Oxygen Oceanic Crust – Basalt Continental Crust - Granite	Hot softened Rock Contains Iron and Magnesium	Mostly Iron and Nickel Outer Core- Soft flowing liquid Inner Core - solid

Density (grams/cubic centimetre)	Least dense layer overall Oceanic crust is more dense than continental crust (2.7)	Density increases with depth as pressure increases with depth (3.5 – 5.5)	Heaviest material therefore most dense layer (10 – 12)
Representative Chemical Composition	SiO2	(Fe, Mg) SiO4	Fe, Ni
Temperature (Kelvin)	300-500	500-3,000	3,000 – 5,300
Pressure (Atmosphere)	1 – 1,000	10^3 - 10^6	10^6– 10^7

Factors Affecting Internal Structure of Earth

Listed are the factors affecting the interior layers of the Earth. The factors include Temperature, Density, and Pressure.

- The temperature rises with increasing depth, as observed in mines.
- The temperature rises as one moves from the Earth's surface to the centre. But, the temperature rise under the surface decreases towards the centre.
- Pressure rises from the Earth's surface to its core, just as it rises in temperature. It is owing to the enormous weight of the overlaying elements, such as rocks.
- Because of the pressure of the surrounding layers, the materials in the planet's centre are solid even at such high temperatures.
- The density of the Earth's layers increases towards the centre due to increased pressure and the presence of heavier minerals such as nickel and iron.

Discontinuities in the Interior of the Earth

The discontinuities in the internal structure of Earth are Repiti Discontinuity, Mohorovicic Discontinuity, Gutenberg Discontinuity, Conrad Discontinuity, and Lehman Discontinuity. The change in the zone between the Earth's internal structure is as follows.

- **Mohorovicic Discontinuity**: Shift zone between the Crust and Mantle.
- **Conrad Discontinuity**: Separation between the hydrosphere and the crust.
- **Lehmann Discontinuity** - Separation between the upper and lower cores.
- **Repetti Discontinuity -** Transition between the upper and lower mantles.
- **Gutenberg Discontinuity**: Shift zone between Mantle and Core.