

Lesson 01:

Fundamentals of Planet Earth



The **Earth** is the only **habitable** planet in our solar system. It is the only planet that has life and can support life.

The Earth has many systems that work together and interact together.

- Shape and change the Earth's surface.
- Destroy the old and create the new.
- Protect the Earth.
- Support life



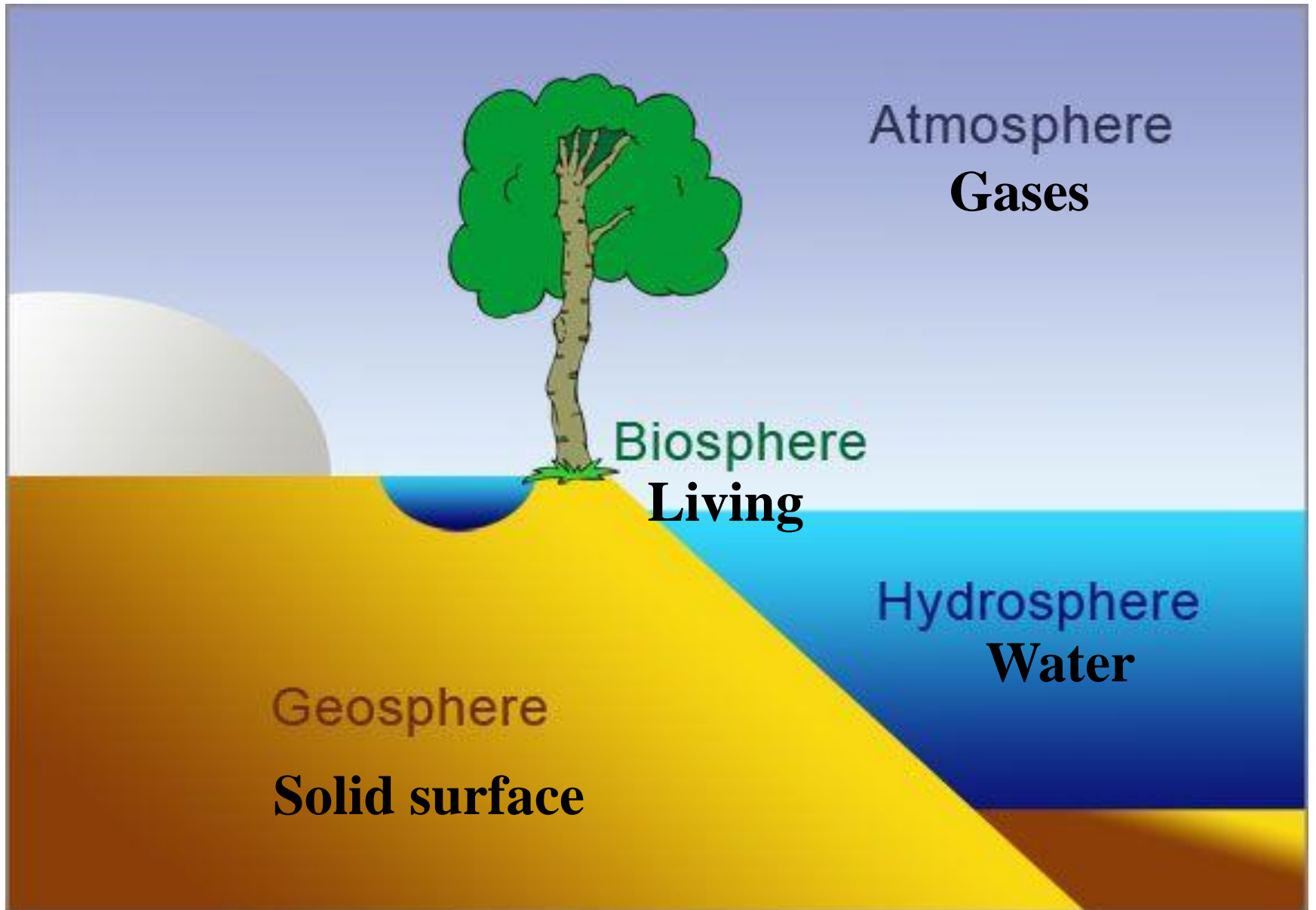
The Earth has four (4) “spheres” or zones

- Geosphere: Solid parts of the Earth
- Hydrosphere: Water parts of the Earth
- Atmosphere: Air, gas parts of the Earth
- Biosphere: Living parts of the Earth

The Earth has many important **cycles**. Cycles are the continuously changing and moving components of systems on Earth.

- Rock cycle
- Water cycle





Geosphere: Zones of the Earth's surface that are inorganic and solid.

- Earth's surface is made of silicate rocks.
- Continental crust and oceanic crust.
- The Earth's interior (core) is made of iron & nickel.



- Atmosphere:** Zones of the Earth's surface that include all of the gases that surround the Earth.
- From the Earth's surface to the edge of space.
 - The air and the sky.
 - Weather
 - Air is made of nitrogen & oxygen



Hydrosphere: Zones of the Earth's surface that include water and the transport of water.

- Solid water on the Earth's surface as ice.
- Water vapor in the Earth's atmosphere
- Liquid water in the oceans and glaciers



Biosphere: Zones of the Earth's surface that have life and support life. The living parts of the Earth.

- Plant, animal, and microscopic life.
- On land, in the water, in the air.



The Earth's Surface

71% Earth's surface covered by oceans

Pacific Ocean, Atlantic Ocean, Indian Ocean, Arctic Ocean, and other connected bodies of water.

29% Earth's surface covered by continents and land

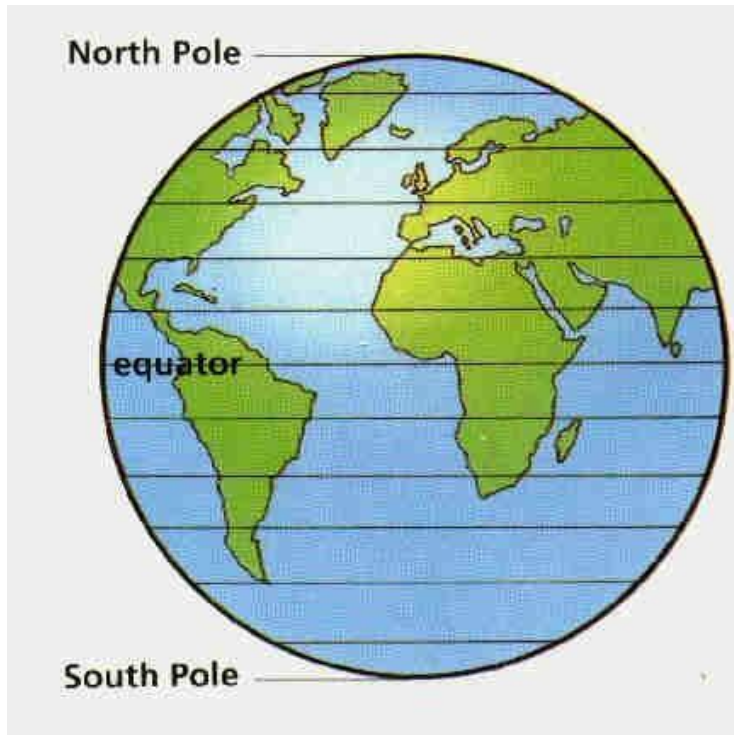
Africa, Antarctica, Asia, Australia, Europe, North America, South America, and large island systems.



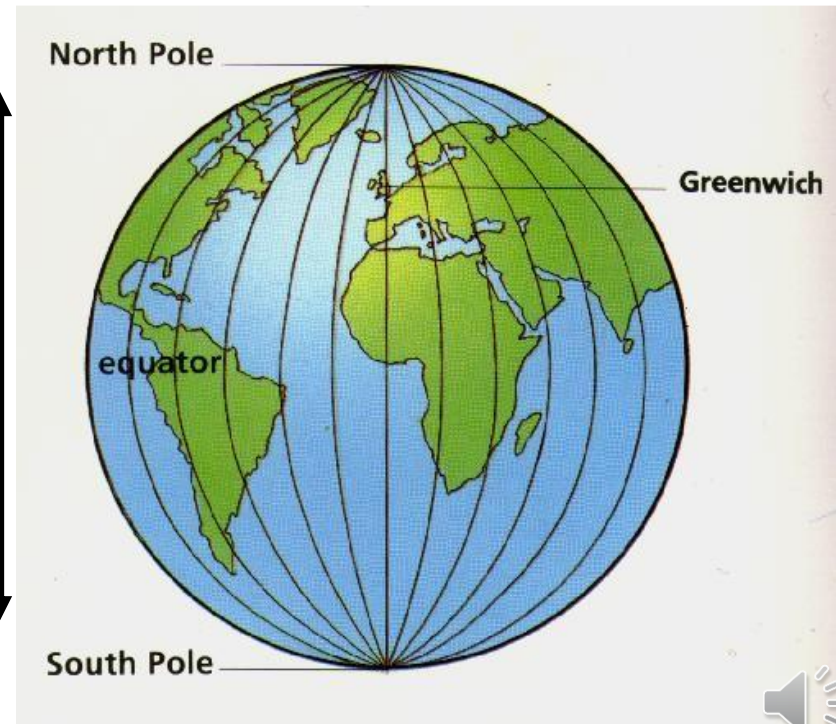
The Earth is an **oblate spheroid** shape: Earth is not a perfect sphere. The Earth is slightly wider at the equator and slightly compressed from pole-to-pole.

- The diameter of the Earth at the Equator is 12,756 km.
- The diameter of the Earth pole-to-pole is 12,714 km.

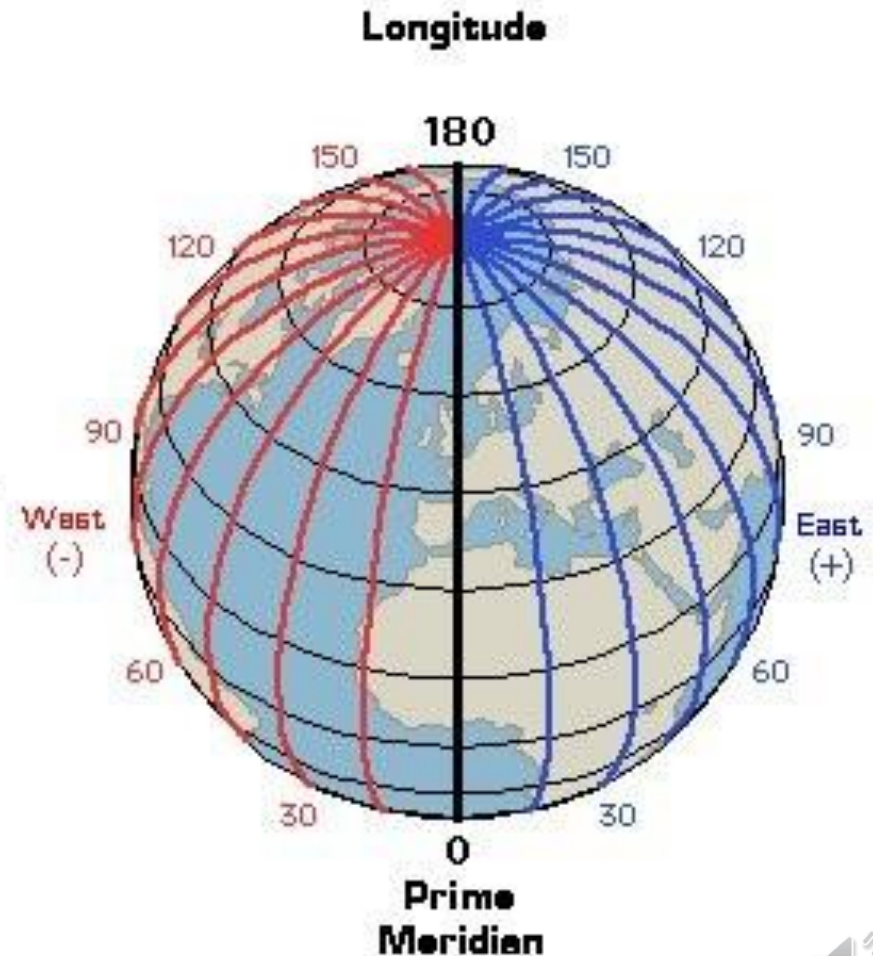
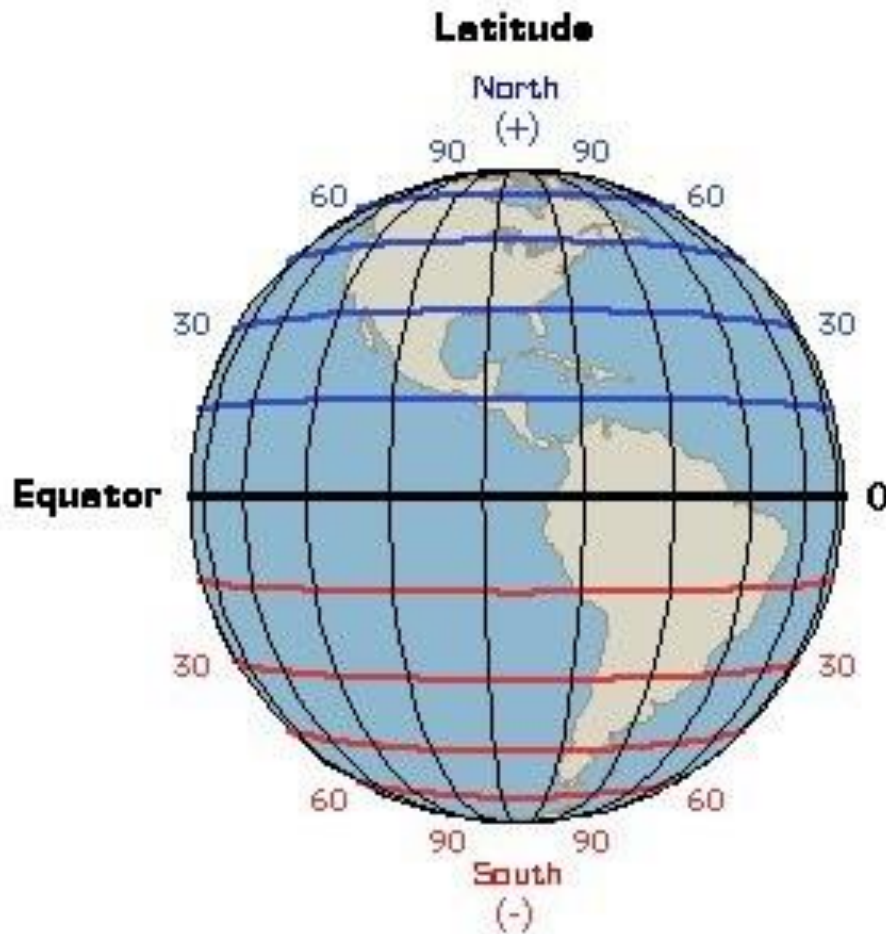
12,757 km



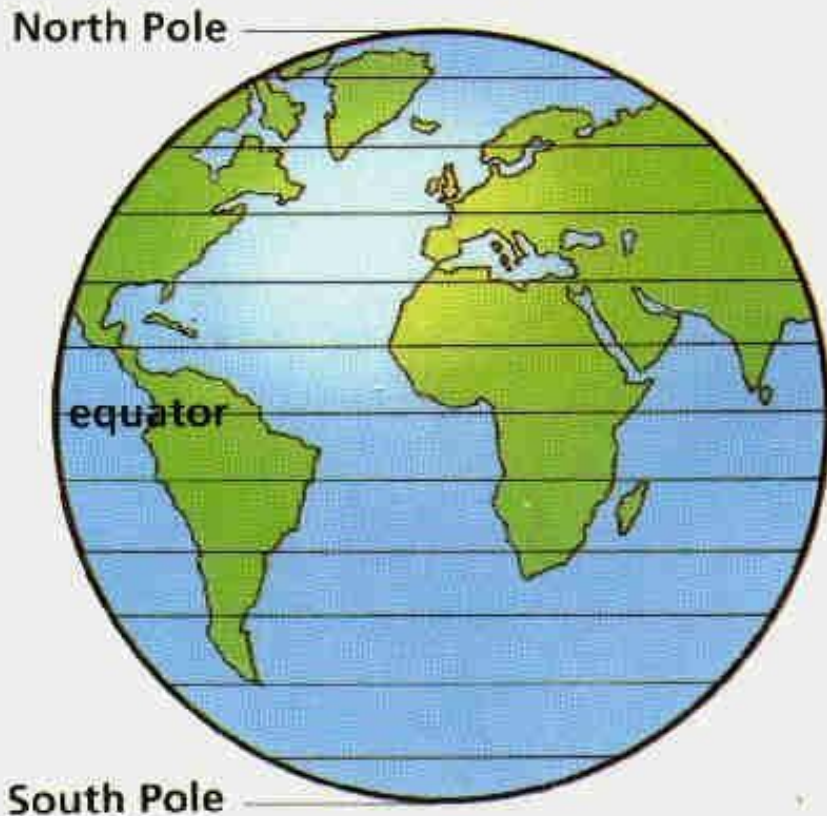
12,714 km



Geographic grid with the imaginary reference lines for latitude and longitude (Global projection view)



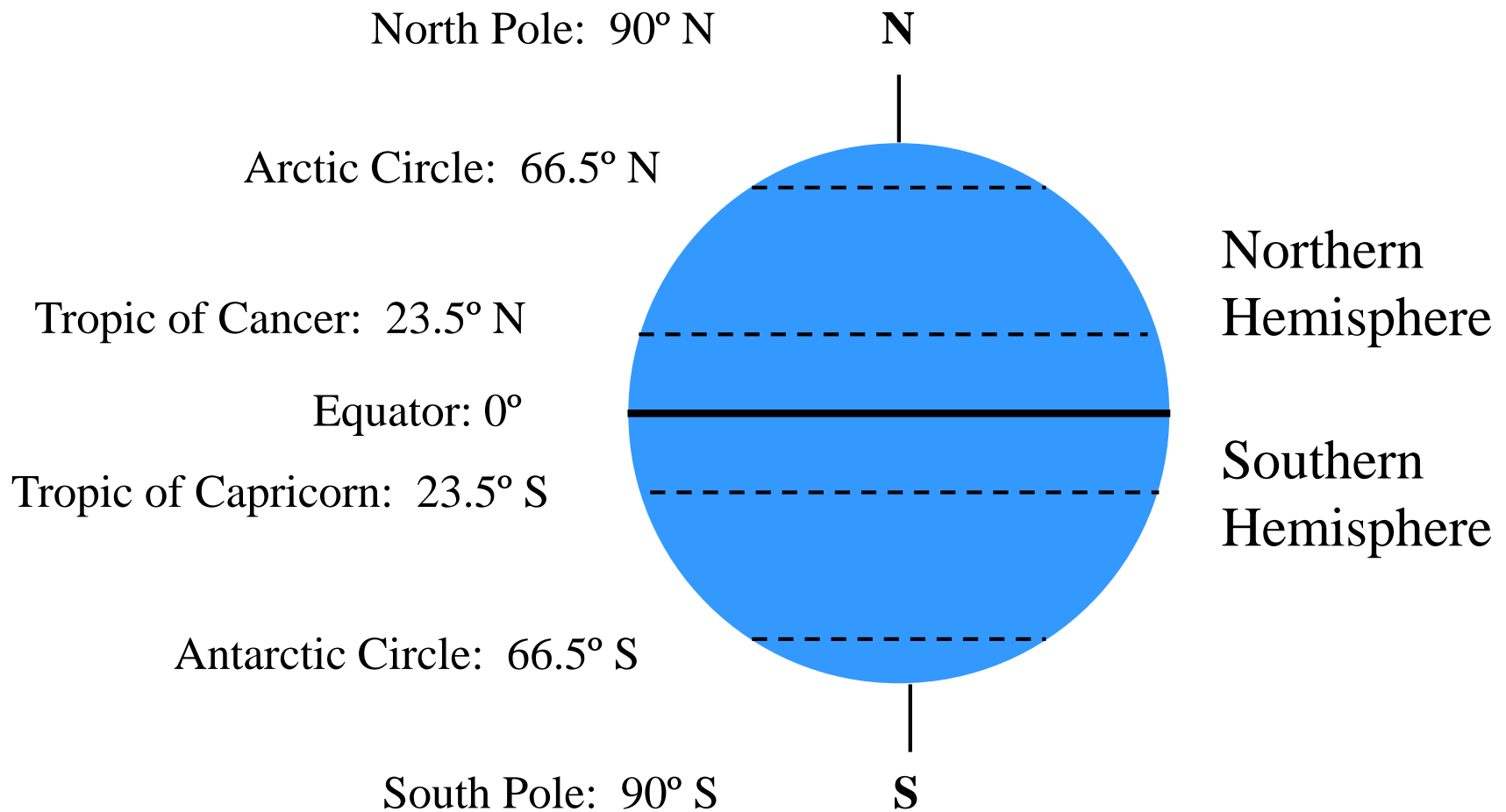
Latitude: the angular distance of the Earth's curved surface **north or south** of the equator. The **equator** is the reference for latitude, and is given the value of 0° .



Lines of latitude are called **parallels**. Parallels circle the Earth as east-west curved transects.

Parallels connect all geographic points along the same latitude.

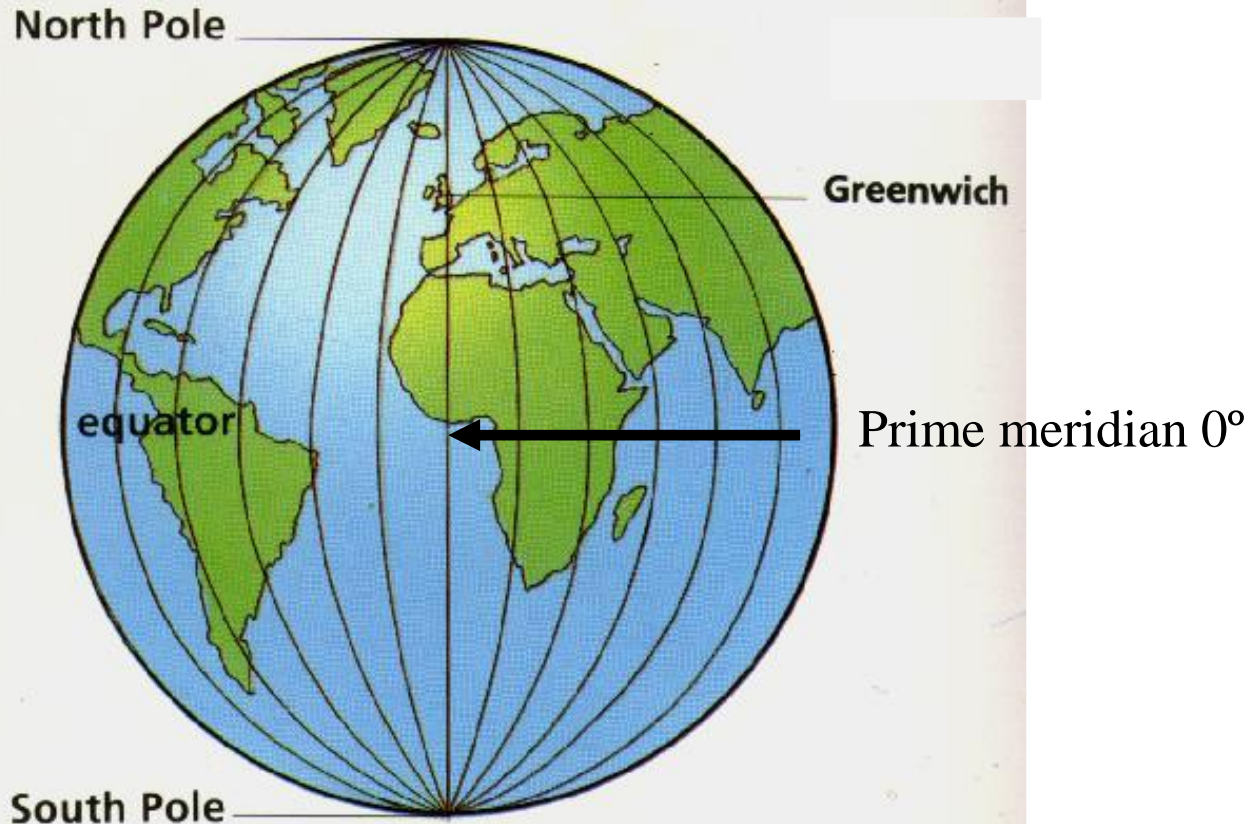




The **equator** (parallel 0°) bisects the Earth into the northern hemisphere and the southern hemisphere.

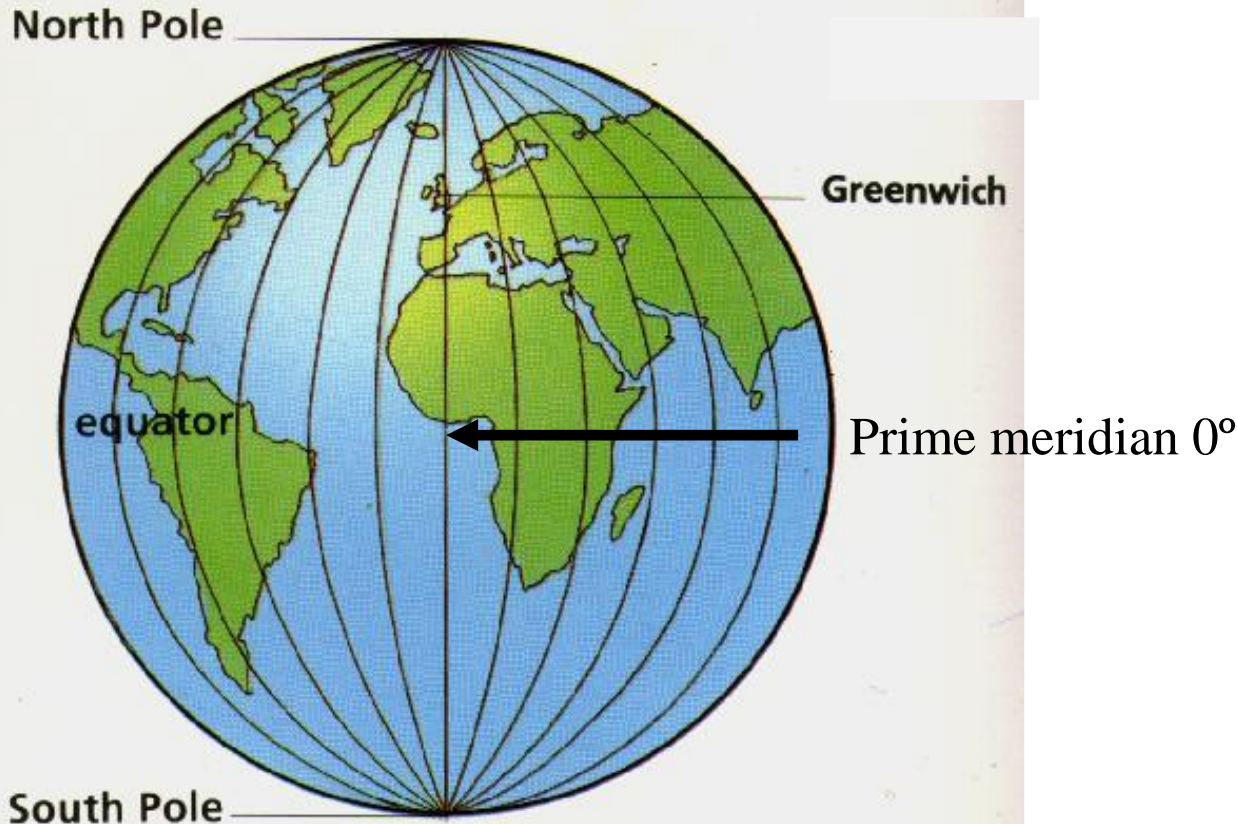


Longitude: the angular distance of the Earth's curved surface **east or west** of the **prime meridian (Greenwich meridian)**. The **prime meridian** is the reference for longitude, and is given the value of 0° .



Lines of longitude are called **meridians**. Meridians start at the north pole, cross the Earth's curved surface, and end at the south pole.

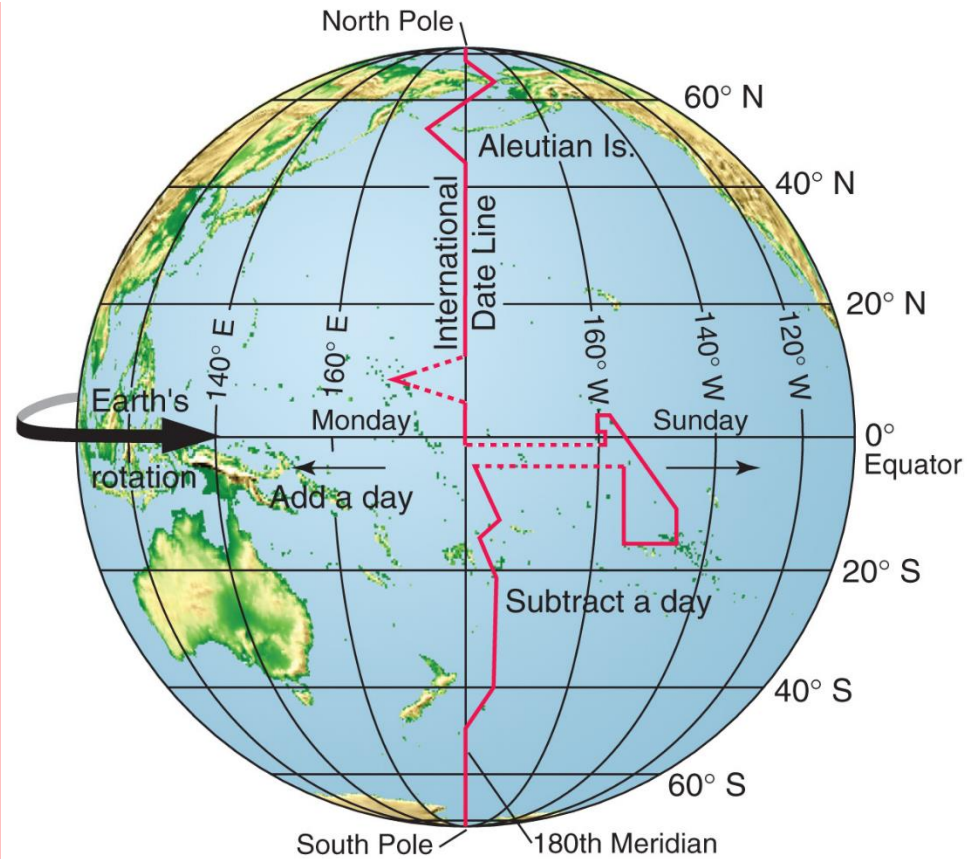
Meridians connect all geographic points along the same longitude.



The **international date line**, longitude 180° , is exactly opposite of the prime meridian. The international date line runs through the center of the Pacific Ocean from pole-to-pole with adjustments for islands.

As the Earth **rotates from west to east**, the international date line marks the beginning of the next calendar day and the end of the previous calendar day.

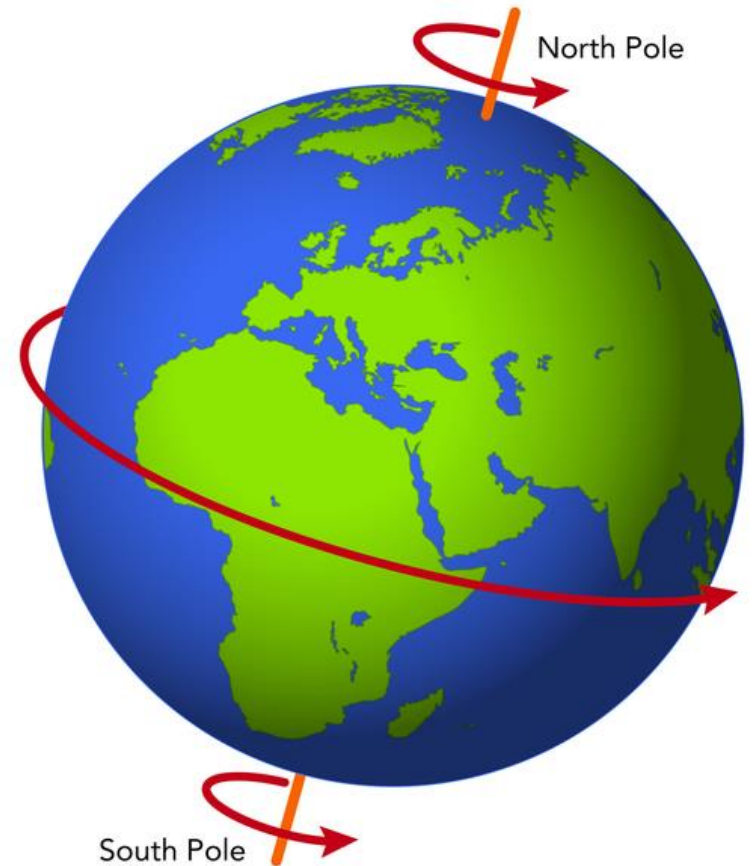
The prime meridian and the international date line divide the Earth into the **eastern hemisphere** and **western hemisphere**.



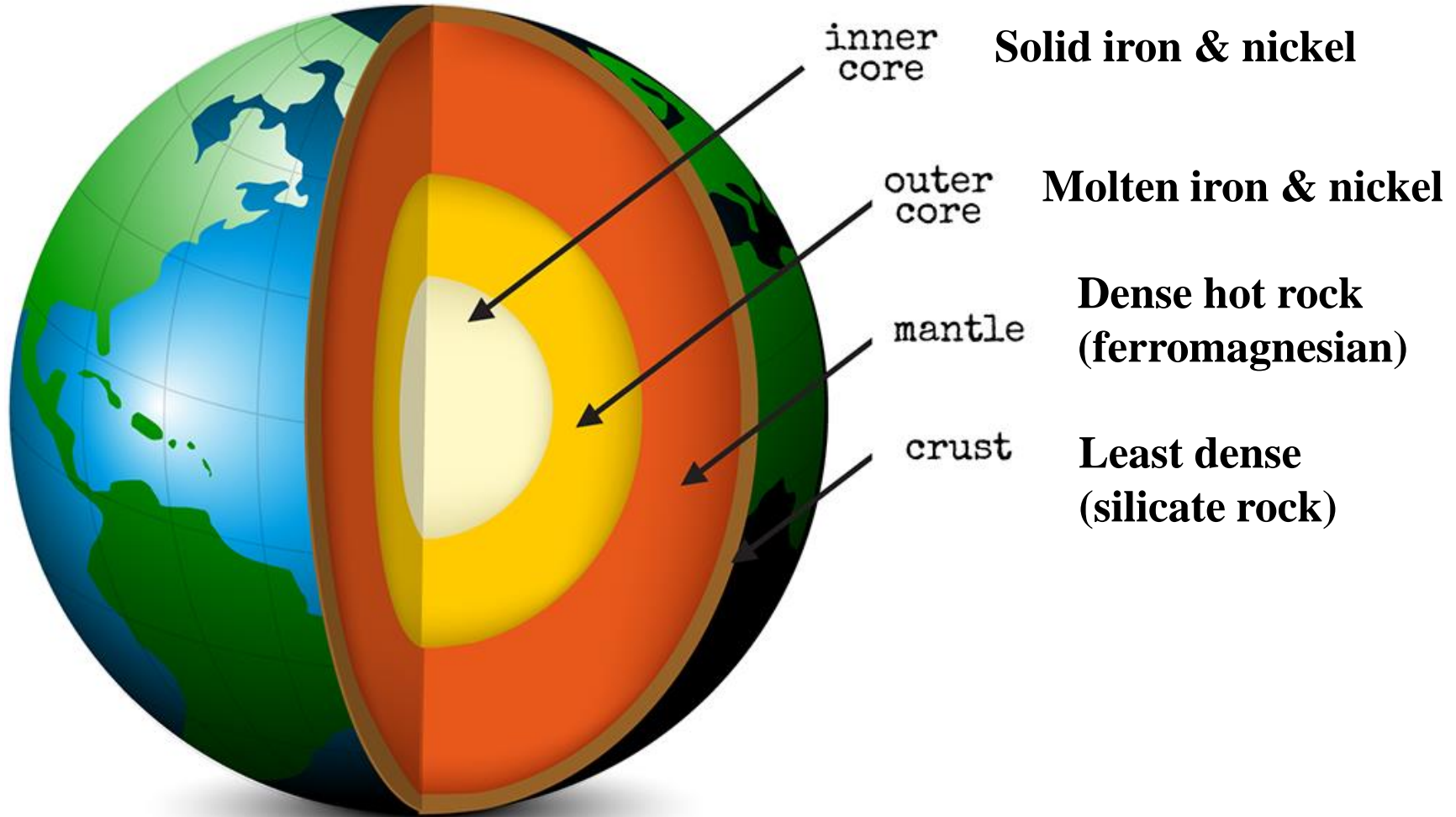
Geographic Poles: The points on the Earth at which the Earth's imaginary **axis of rotation** emerges.

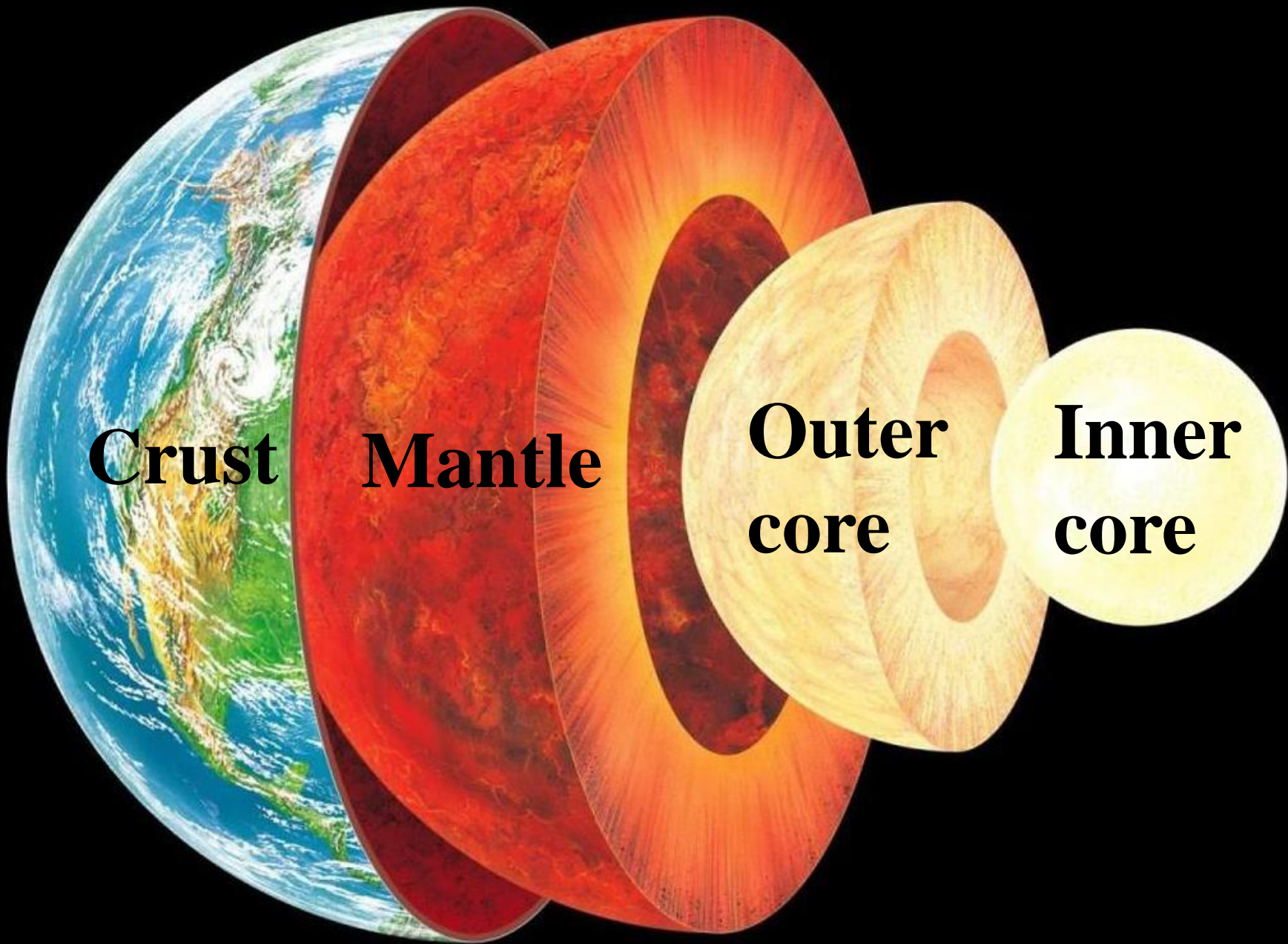
Earth's rotation (spin) is from west to east; counterclockwise looking down at the north pole. from NP perspective.

The Earth rotates 1 time every 24 hours. This is the Earth's day-night cycle.



Layers of the Earth: Densest heaviest materials (iron and nickel) are in the center of the Earth (deepest). Lightest least dense materials (silicate rock) rise to the top.





Crust

Mantle

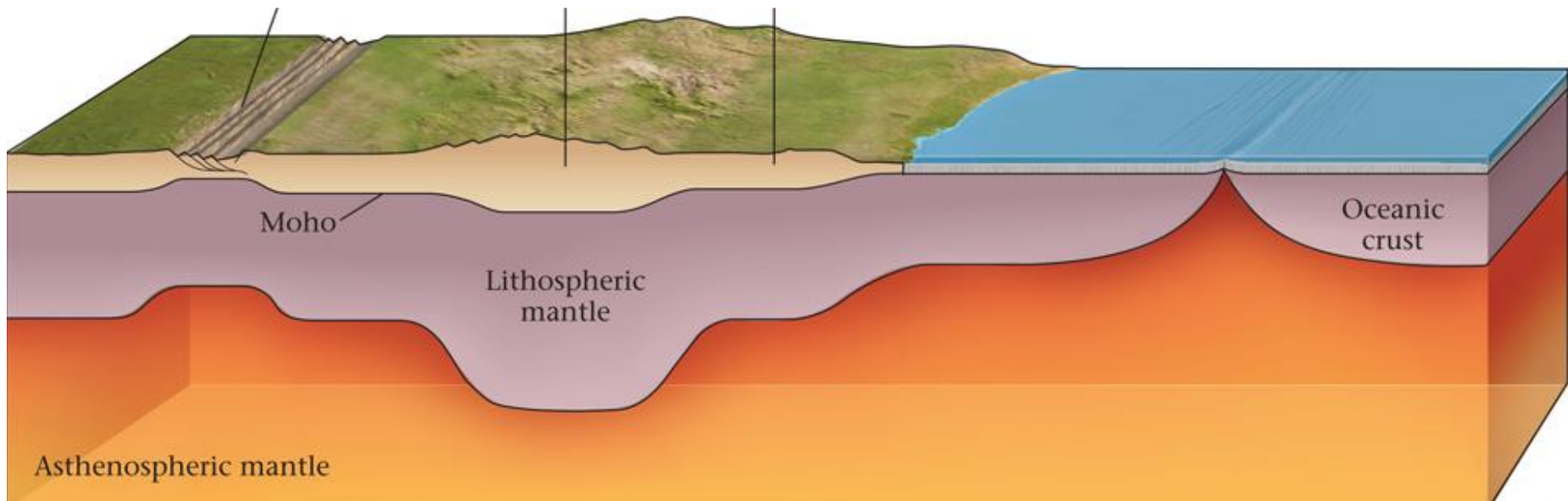
**Outer
core**

**Inner
core**

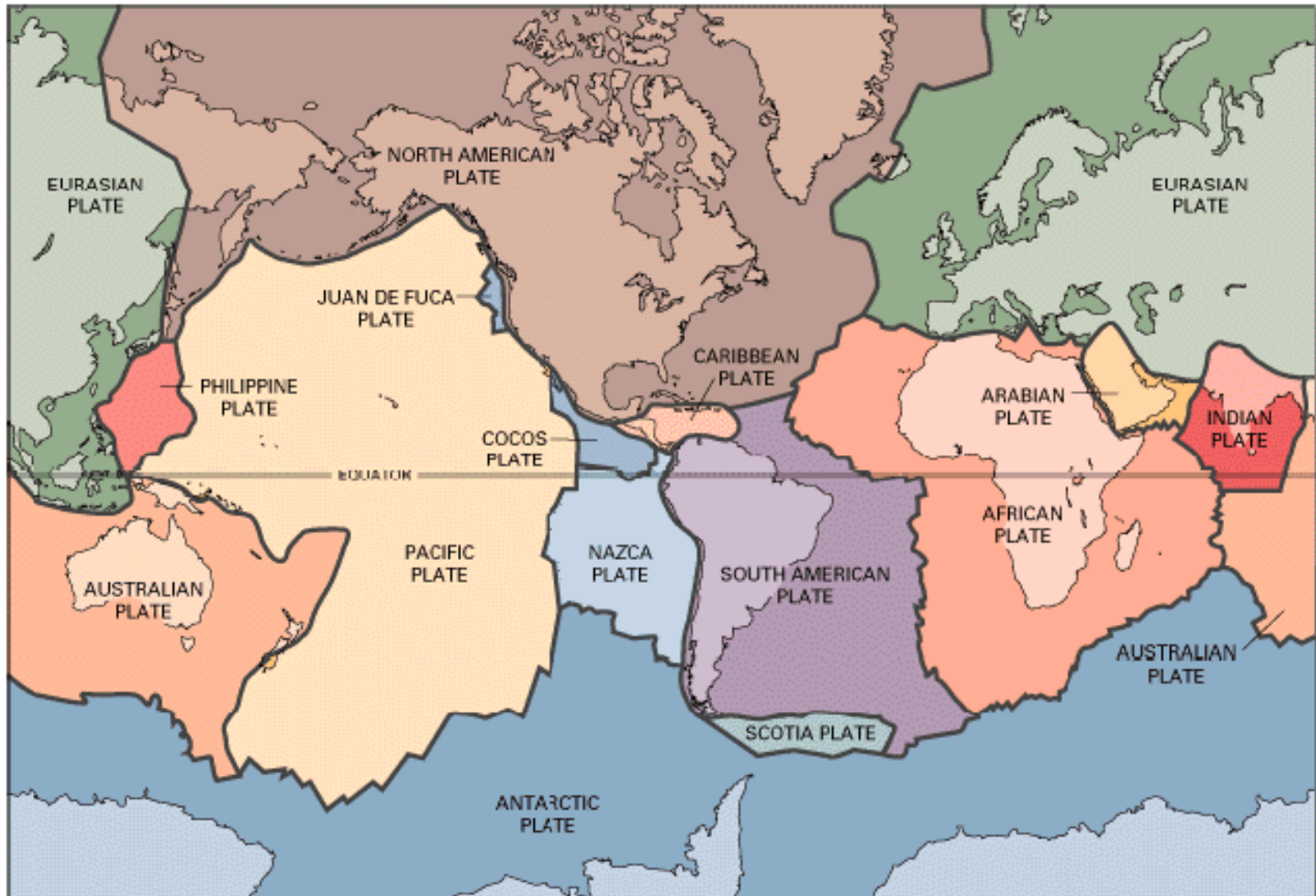


Crust

- Very thin, outermost layer (“skin of the Earth”).
- Least dense and coolest layer
- Forms the Earth’s solid surface
- Supported by the lithospheric mantle (uppermost layer of the mantle).
- Two types of crust: Oceanic crust and continental crust.



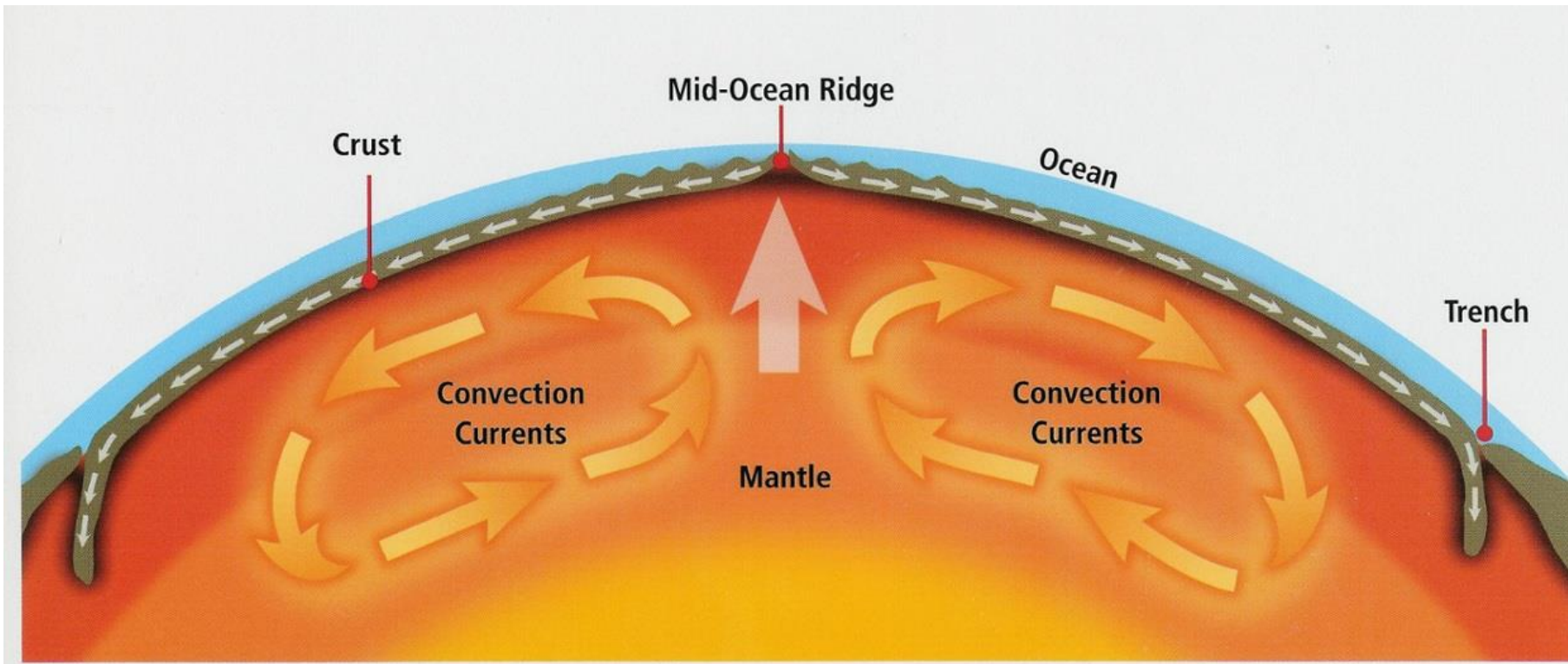
The Earth's solid surface is broken into large slabs called **tectonic plates**. Some plates have only oceanic crust. Some plates have both oceanic crust and continental crust.



Mantle

- Largest zone of the Earth's interior
- Dense, very hot iron-rich silicate rocks like olivine, pyroxene and perovskite
- Three zones
 - Lithospheric mantle (upper)
 - Asthenosphere (middle)
 - Lower mantle (lower)
- Mantle convection transports heat from the Earth's interior upward to the Earth's crust. Mechanism for plate tectonics.



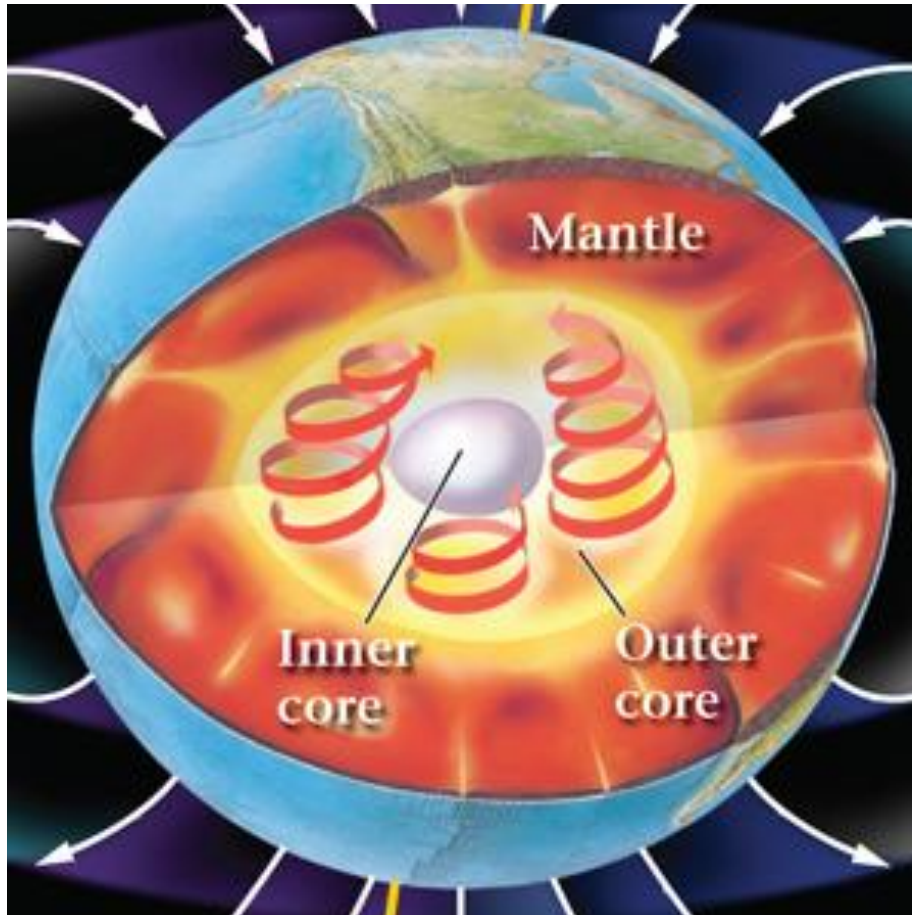


Circulation of soft, very hot rock in the Earth's mantle. Very hot rock flows upward from the **lower mantle** into **asthenosphere**. The hot rock moves laterally through the asthenosphere and cools, it drags **tectonic plates** over the Earth's surface. As the rock cools, it flows downward from the asthenosphere back to the lower mantle.



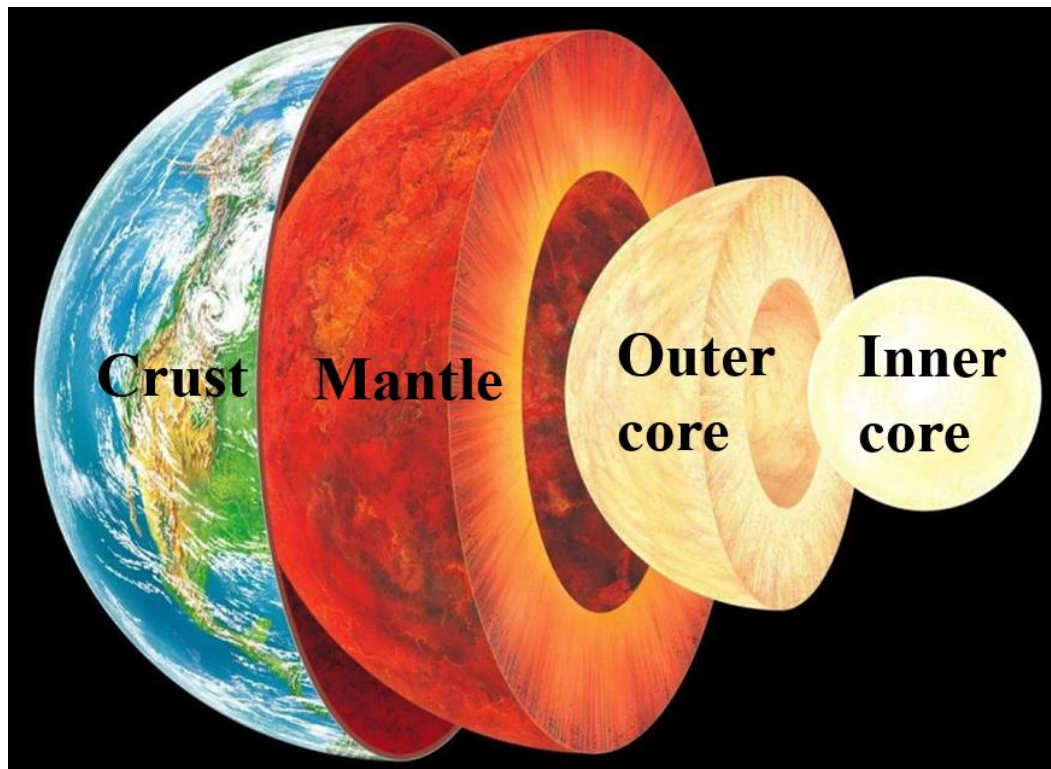
Outer Core

- Molten layer of iron and nickel metal
- Very dense, but melted
- Very hot temperature: ~ 4000 Celsius



Some of the places in the outer core move as **whirlpools or eddies**. These swirling places create the Earth's strong **magnetic field**.





Inner Core

- Solid sphere of iron and nickel metal
- Very dense
- Hottest temperature: ~ 6000 Celsius
- The inner core's mass is slowly increasing as the outer core cools and solidifies.



Follow-up Questions

- What is unique about our Earth that it supports life?
- What is unique about our Earth that is different from other planets in our solar system?
- What are the most notable latitudes and longitudes on the surface of the Earth?
- What is important about water on the surface of the Earth?
- What are the layers of the Earth, and what are they made of?

