

SPHERES OF THE EARTH

Earth's inner core is a solid sphere of mostly iron about 1,200 km (745 miles) thick. It is about 70% of the size of the moon. It is the hottest part of our planet between 9,000 and 13,000 degrees Fahrenheit, but stays as a solid rather than melting into a liquid because of the tremendous pressures of about 45 million pounds per square inch.

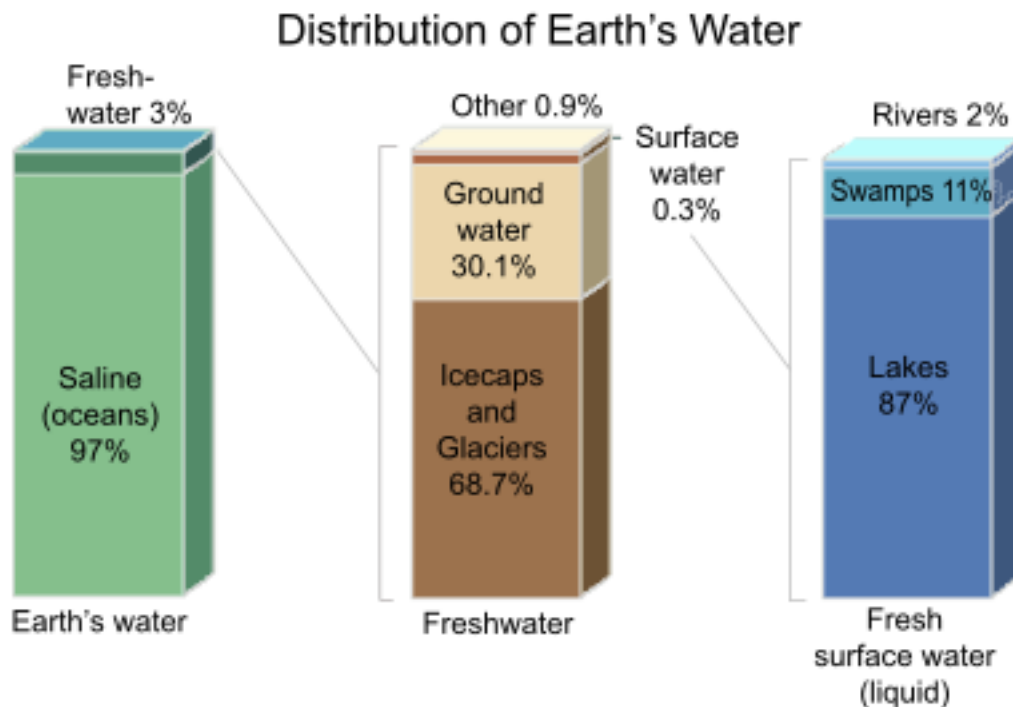
The outer core is mostly iron and nickel and is a liquid. The temperatures are cooler than the inner core but the pressure is less so it forms into a liquid. 7,200-9,000 degrees F.

The Earth's Mantle makes up 84% of the volume of the planet. The mantle is about 2,900 km (1,800 miles) thick and comprised of mostly magnesium and silicate rock or made of rock high in the elements magnesium (Mg12) and silicon (Si14). Magnesium is a strong, lightweight metal, and silicon is quartz or glass. The mantle has two layers, the upper and lower mantle. The upper mantle is called the **ASTHENOSPHERE**. It is a thick, slow flowing solid/liquid and just under the lithosphere. The continents float on top of this thick, plastic like material.

Earth's crust is called the **GEOSPHERE** or **LITHOSPHERE**. It is composed of a great variety of igneous, metamorphic, and sedimentary rocks. The crust is less than 1% of the earth's volume and is between 20 and 30 miles thick. The oceanic crust lies beneath the oceans and is made of basalt, diabase and gabbro. The continental crust is lighter with less dense rocks like granite and lighter oxides. The crust is calculated to contain about 47% oxygen so the rocks and minerals are generally oxides. The lithosphere is broken into plates that float on the asthenosphere. The movement of these plates are associated with earthquakes and volcanoes.

Hydrosphere and Cryosphere

The **hydrosphere** includes all the water on earth in solid, liquid and vapor form, however the cryosphere (from the Greek kryos meaning cold) includes only the solid forms like sea ice, snow, icecaps and glaciers. The hydrosphere covers 70% of the Earth's surface and of that 97% of the water is salt water and 3% fresh water. Of that 3% freshwater, more than half is locked up frozen in glaciers and icecaps. The water cycle moves that fresh water around the planet and is responsible for the erosion of the geosphere (the crust), and is essential for life on our planet. Although Earth's hydrosphere has been around for longer than 4 billion years, it continues to change in size both seasonally and as the climate changes.



The Biosphere is the sphere of life. It comes from the Greek root bio meaning life. The biosphere includes all living things from the simplest bacteria to the most advanced life forms, humans. It also includes their interaction with the elements of the lithosphere, geosphere, hydrosphere, and atmosphere.

Bacteria have been found over 4,500 feet below the bottom of the ocean inside rocks, and over 25 miles above the surface in the atmosphere. However, most life in the biosphere lives on the surface of the land and in shallow waters. The Biosphere is also referred to as the Ecosphere.

The **Atmosphere** contains 5 layers. They are the TROPOSPHERE, STRATOSPHERE, MESOSPHERE, THERMOSPHERE, and EXOSPHERE

The name **Troposphere** comes from the Greek root “tropos” meaning change. This is the layer we live and breathe in. It is the layer that contains all of the clouds and weather. The Troposphere moves along due to the friction caused by the rotating Earth. The air is densest in this lowest layer. In fact, the troposphere contains three-quarters of the mass of the entire atmosphere. The air here is 78% nitrogen and 21% oxygen. The last 1% is made of argon, water vapor, and carbon dioxide.

The **Stratosphere** comes from the root “strat” meaning layer. The Stratosphere has its own layers. There are no storms or turbulence in the stratosphere. No wind means the air does not get mixed up so the warm air rises and the cool air sinks. That’s the opposite of how the layers work in the troposphere, where we live.

This layer is 22 miles (35 kilometers) thick. The stratosphere is where you’ll find the very important **ozone layer**. The ozone layer helps protect us from ultraviolet radiation (UV) from the sun. In fact, the ozone layer absorbs most of the UV radiation the sun sends to us. Life as we know it wouldn’t be possible without this layer of protection.

The **Mesosphere** “*Meso*” means *middle*, and this is the highest layer of the atmosphere in which the gases are all mixed up rather than being layered by their mass. The mesosphere is 22 miles thick. The air is too thin to breathe, but there is more gas in this layer than there is out in the thermosphere above. Meteors burn up in the Mesosphere as this layer is the first with enough density to create friction as the meteors fall through it.

The Thermosphere

The **thermosphere** lies between the mesosphere and the exosphere. Thermo means heat and the thermosphere can reach temperatures of 4,500 degrees Fahrenheit. The higher you go the hotter it gets. However, if you were to find yourself there you would be very cold because there are not enough gas molecules to transfer the heat to you. This also means that there are not enough gas molecules to transfer sound. The layer is about 320 miles thick and is also home to the orbiting International Space Station. The aurora borealis occur in the thermosphere. Charged particles from the sun collide with atoms in this layer causing a jump in energy states.

The Exosphere

This is the uppermost region of Earth’s atmosphere as it gradually fades to the vacuum of space. One definition places the outer limit of the exosphere at 120,000 miles. That is halfway to the moon! At this distance, radiation pressure from the sun is greater than the gravitational pull of the earth and hydrogen atoms will not return to earth. Objects in orbit within the exosphere hit enough atoms and molecules to slow them down eventually causing them fall back to earth and burn up! The ISS loses about 1.2 miles in altitude each month to such "orbital decay", and must periodically be given an upward boost by rocket engines to keep it in orbit.

The Magnetosphere

The Earth's **Magnetosphere** is a region of space surrounding the earth in which CHARGED particles are affected and deflected by the Earth's Magnetic Field. Our magnetosphere shields our planet from harmful particles from the sun.