Density

	Composition	Average Density (g/cm ^{3})	State	% of Earth's mass
Crust	Oxygen (O), Silicon (Si), Aluminum (Al), Calcium (Ca), Sodium (Na), Potassium (K)	2.7–3.0	Solid	1%
Mantle	Oxygen (O), Silicon (Si), Magnesium (Mg), Iron (Fe)	3.3–5.7	Solid (Taffy-like)	67%
Outer Core	Iron (Fe), Nickel (Ni), small amounts of Sulfur (S), Oxygen (O)	9.9-12.2	Liquid	30%
Inner Core	Iron (Fe), Nickel (Ni)	12.8-13.1	Solid	2%

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💧 Where Does Earth's Heat Come From—and How Does It Drive Convection?

Have you ever wondered what causes earthquakes, volcanoes, or why the continents slowly drift apart? These powerful movements all start deep inside the Earth—where heat plays a big role.

But where does that heat come from? And how can it move solid rock?

🌍 Earth’s Internal Heat Sources

Even though Earth formed over 4.5 billion years ago, it’s still incredibly hot inside. In fact, the temperature at the center of Earth is hotter than the surface of the Sun—around 5,000–6,000°C (9,000–11,000°F)!

Scientists have discovered two main sources for this internal heat:

1. Heat Left Over from Earth’s Formation

When Earth formed, gravity pulled billions of pieces of rock and metal together. As those materials collided and compacted, they released a lot of energy in the form of heat. Some of that original heat is still trapped deep inside, especially in the core.

2. Radioactive Decay

Inside Earth’s mantle and crust, there are unstable elements like uranium, thorium, and potassium-40. Over time, these atoms break down, releasing energy in the form of heat. This process, called radioactive decay, is one of the main sources of heat in the mantle.

🔁 How Heat Drives Convection Currents

All that heat doesn’t just sit still. It moves upward—but not through empty space. Instead, it travels through the mantle, a thick layer of semi-solid rock that can very slowly flow over time.

This creates convection currents:

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- Hotter, less dense mantle rock rises toward the surface.
- Cooler, denser rock sinks back down toward the core.

This cycle of rising and sinking rock is similar to how warm air rises and cool air sinks in the atmosphere.

🌋 Why It Matters

These slow-moving currents in the mantle push and pull Earth's tectonic plates, causing:

- Earthquakes when plates grind past each other
- Volcanoes when hot mantle rises and melts
- Continents to drift across Earth's surface

Even though we can't see these convection currents directly, scientists use seismic wave data, heat flow maps, and computer models to show they're real—and powerful.

🧠 In Summary:

- Earth's internal heat comes from leftover formation heat and radioactive decay.
- That heat causes convection currents in the mantle.
- These currents drive the movement of tectonic plates and shape Earth's surface over time.

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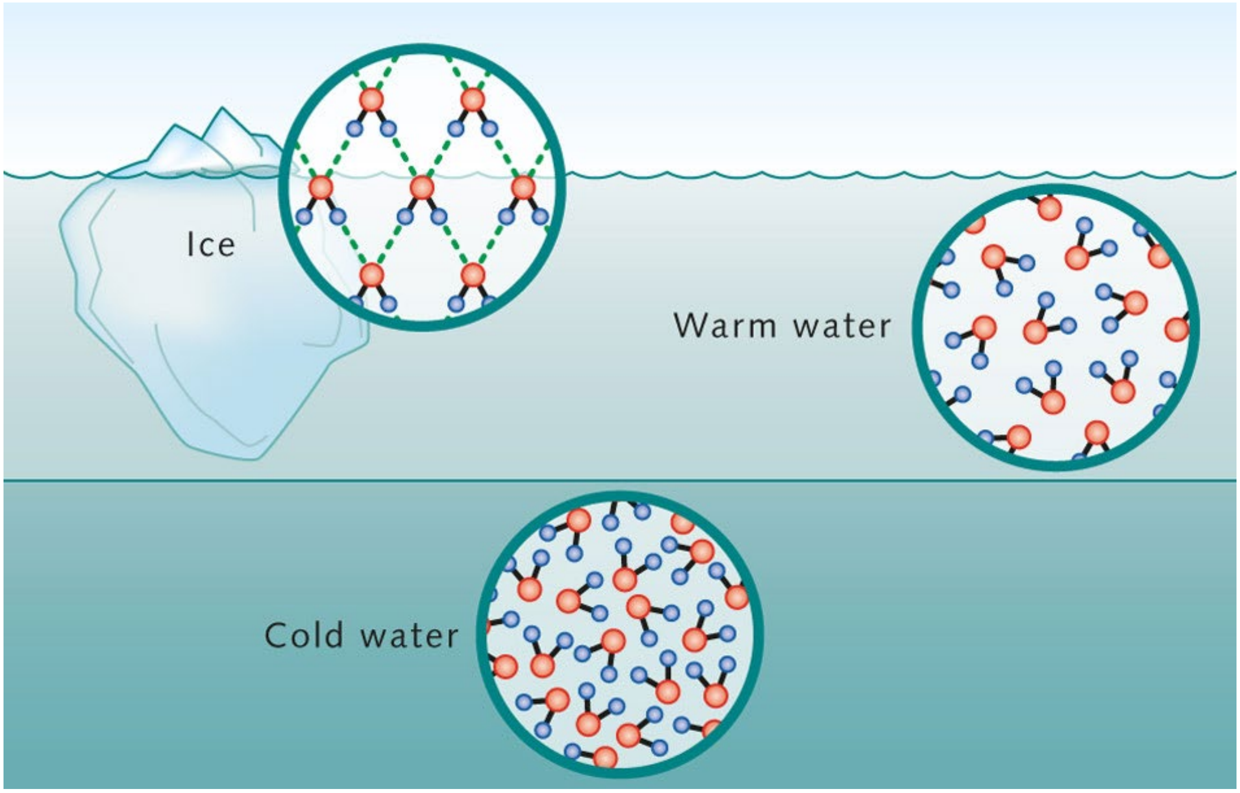

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🌍 What Are P-Waves and S-Waves?

When an earthquake happens, it sends energy through the Earth. That energy travels in the form of seismic waves—vibrations that move through the ground. There are two main types of seismic body waves that travel through the Earth: P-waves and S-waves.

◇ P-Waves (Primary Waves)

P-waves are the fastest seismic waves. They move through the Earth by pushing and pulling the ground in the same direction the wave is moving, kind of like how a slinky moves when you push one end. Because of their speed, P-waves are the first to be detected by seismographs after an earthquake.

P-waves can travel through both solids and liquids, and they move in a straight line unless the material changes beneath them.

◇ S-Waves (Secondary Waves)

S-waves are slower than P-waves. Instead of pushing and pulling, S-waves move the ground side to side or up and down, shaking it at a right angle to the direction the wave is traveling—imagine shaking one end of a rope.

Unlike P-waves, S-waves can only travel through solids. They stop when they reach liquids, and this makes a big difference in how they move through the Earth.

🌐 Why Does This Matter?

Seismologists (scientists who study earthquakes) use data from P-waves and S-waves to learn about what's inside the Earth. As waves travel through different materials, they change speed, bend, or even stop. By carefully studying these changes, scientists can figure out a lot about the layers deep beneath the surface—even though no one has ever been there.

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