PLANET EARTH

Earth formed about 4.5 billion years ago, but it was a very different place then. Its surface was a hot inferno of mostly molten rock, with little or no liquid water and no oxygen in the atmosphere. Since then Earth has developed oceans, continents, an oxygen-rich atmosphere—and life.

THE CHANGING EARTH

Look at a map and it will show you the position of the continents, but in fact our world is always changing. Earth's surface is split up into large slabs called tectonic plates. The plates steadily shift around, carrying continents and oceans with them. When they collide, new mountain ranges are pushed up. Afterward, over millions of years, wind, water, and ice gradually wear the mountains down.

250 MILLION YEARS AGO, EARTH'S CONTINENTS ALL **JOINED TOGETHER, FORMING** AN ENORMOUS SUPERCONTINENT **KNOWN AS PANGAEA.**

UNIQUE PLANET

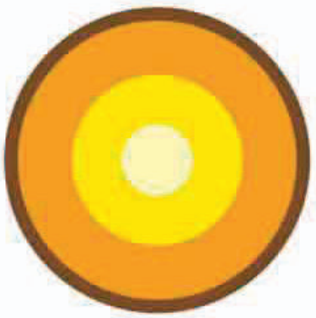
Earth is the only place in the Universe known to support life. It is thought that life developed after water began to collect on the Earth's surface. Eventually, tiny life forms evolved that could survive on water, sunlight, and chemicals in the water. These microbes added oxygen to the atmosphere—an essential step for the development of plants and animals.

Inside our planet

Earth's interior has layers. Scientists discovered this by studying the paths by which earthquake waves pass through the planet.

Thickness

- 3.7–56 miles (6–90 km)
- 1,790 miles (2,880 km)
- 1,400 miles (2,255 km)
- 755 miles (1,215 km)



CRUST
Different types of crust make up Earth's surface and its ocean floor. The crust under the surface is thicker and contains more rock types.

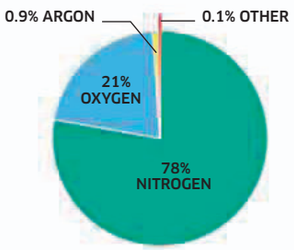
MANTLE
This rocky layer is denser than the crust. It is mostly solid, although it can very slowly deform and flow.

OUTER CORE
The only liquid layer, the outer core is mainly iron but also contains some nickel and small amounts of other substances.

INNER CORE
This is solid, and is mostly iron with some nickel. Its temperature is very hot—about 9,900°F (5,400°C).

Earth's atmosphere

The atmosphere of Earth is made up of several different gases.



NITROGEN – 78%
A gas that can be fixed in the soil as well as loose in the atmosphere. Plants need nitrogen from the soil to survive.

OXYGEN – 21%
Essential for animals to breathe, oxygen was absent until microbes evolved that could use sunlight to turn carbon dioxide and water into carbohydrates, releasing oxygen.

ARGON – 0.9%
An inert gas (one that doesn't react with other substances).

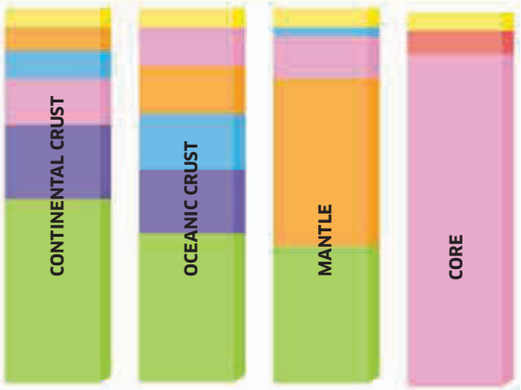
OTHER – 0.1%
These include carbon dioxide (CO_2), which was once abundant, but is now mostly incorporated into materials such as limestone rock.

What's in a layer?

Earth's crust and mantle are mostly made of minerals called silicates, which are a combination of silicon dioxide and metal oxides. The mantle is rich in magnesium-containing silicates, while the two different types of crust have less magnesium and more aluminum and calcium. The core is dominated by metallic iron. No part of it has ever been brought to the surface, but its composition has been worked out by scientific methods such as studying earthquake waves.

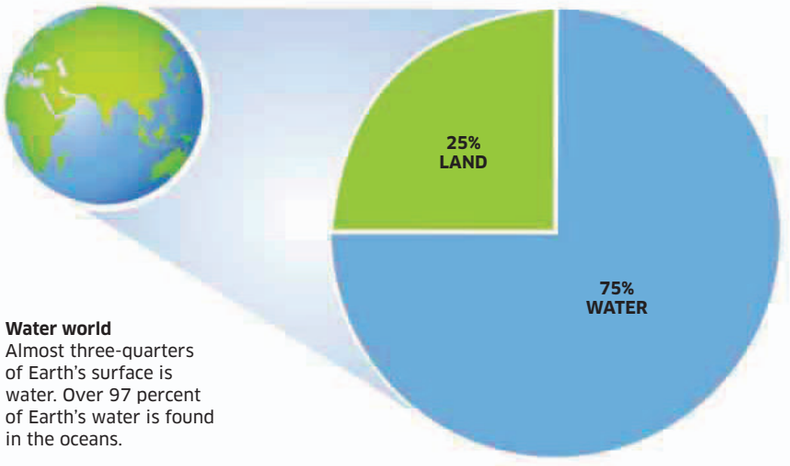
Key

- Silicon dioxide
- Aluminum oxide
- Iron and iron oxides
- Calcium oxide
- Magnesium oxide
- Nickel
- Other



The oceans

Earth's surface and atmosphere contain the equivalent of 333 million miles^3 (1.39 billion km^3) of water. There are regions of deep ocean as well as shallow seas that cover areas around the edges of the continents—these are called continental shelves. Earth's surface has not always been as dominated by liquid water. In the past, during ice ages when the polar ice caps were much thicker and more extensive, so much water became locked up in them that sea level was at least 400 ft (120 m) lower than it is today, exposing the continental shelves as dry land.



Water world
Almost three-quarters of Earth's surface is water. Over 97 percent of Earth's water is found in the oceans.

Continental drift

Over millions of years, tectonic plates have moved, shifting around the continents on Earth's surface. Chunks of continents split away and push into each other, creating new land masses and moving the oceans in a process called "continental drift."

200 MILLION YEARS AGO
The supercontinent Pangaea has just begun to break into two main landmasses.

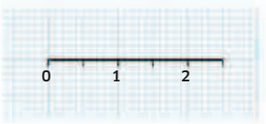
130 MILLION YEARS AGO
India has escaped from the southern landmass, and is slowing moving north, toward Asia.

70 MILLION YEARS AGO
South America has split from Africa, while in the north, North America is splitting from Europe.

TODAY
Australia has separated from Antarctica, and India has collided with Asia, forming the Himalayas.

Plate movement

The continents get rearranged because they are carried along as parts of moving plates. This process has been going on for billions of years, and is thought to be caused by slow, heat-driven movements in Earth's mantle.



Yearly shift
Plates typically move at a rate of about 1 in (2.5 cm) in a year. That's about as fast as your fingernails grow. Some move faster—up to 4 in (10 cm) a year.

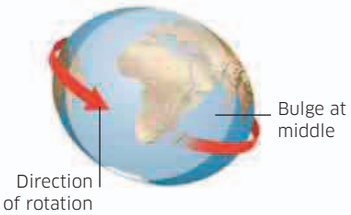
LOOKING AT EARTH

Our planet is far from smooth—its continents and ocean floors are scarred and pitted with marks caused by movement of plates. Earth's place in space also affects its shape, as constantly spinning makes it bulge out around the middle so it is not a perfect sphere. Spinning also creates a magnetic safety field around the planet.

MOUNTAINS MAKE UP ABOUT **ONE-FIFTH** OF THE EARTH'S LANDSCAPE.

A spinning planet

Earth's gravity would pull it into the shape of a sphere, but its rotation makes it bulge slightly. This means its diameter at the equator is 25 miles (41 km) more than the distance between its poles.

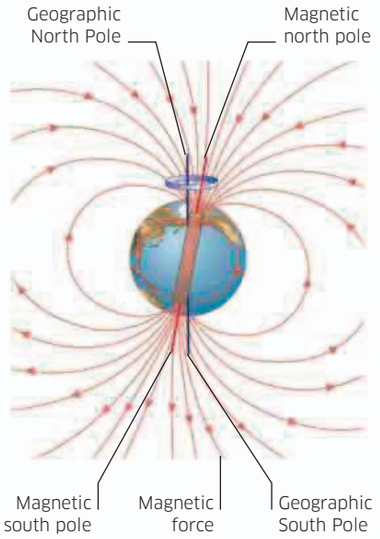


Not quite round
At the moment, scientists think that Earth's equatorial bulge is growing at a rate of 0.3 in (7 mm) every 10 years.

Magnetic Earth

Because Earth's outer core is liquid, the planet's rotation stirs it into motion. This motion causes electric currents to develop in the liquid iron itself. Any pattern of electric currents creates a magnetic field, and in Earth's case, the field is similar to what would be produced by a large bar magnet inside the planet. The field protects Earth from damage by harmful, energetic particles that come from the Sun.

The magnetic field
The magnetic poles do not coincide exactly with the geographic (rotational) poles, and they gradually change position over time.



Earth's surface

The solid surface of the Earth ranges from about 35,750 ft (10,900 m) below sea level in the Challenger Deep (part of the Pacific's Mariana trench) to 29,029 ft (8,848 m) above sea level at the summit of Everest, which may be rising at about 0.16 in (4 mm) per year. The surface of most land areas is less than 1,650 ft (500 m) above sea level.

Elevation
- Over 13,125 ft (4,000 m)
- 6,500–13,125 ft (2,000–4,000 m)
- 3,300–6,500 ft (1,000–2,000 m)
- 1,600–3,300 ft (500–1,000 m)
- 800–1,600 ft (250–500 m)
- 300–800 ft (100–250 m)
- 0-300 ft (0–100 m)

Sea depth
- 0–800 ft (0–250 m)
- 800–6,500 ft (250–2,000 m)
- 6,500–13,000 ft (2,000–4,000 m)
- Below 13,000 ft (4,000 m)

Mountains and trenches
Earth's solid surface is far from flat. This map shows its elevations and depths—from the highest mountain peaks to the deepest ocean trenches.