Earth

Earth is the third planet from the Sun, and the densest and fifth-largest of the eight planets in the Solar System. It is also the largest of the Solar System's four terrestrial planets. It is sometimes referred to as the world, the Blue Planet,[22] or by its Latin name, *Terra*.[note 6]

Earth's crust is divided into several rigid segments, or tectonic plates, that migrate across the surface over periods of many millions of years. About 71% of the surface is covered by salt water oceans, with the remainder consisting of continents and islands which together have many lakes and other sources of water that contribute to the hydrosphere. Earth’s poles are mostly covered with ice that is solid ice of the Antarctic ice sheet and the sea ice that is polar ice packs.

The Moon is Earth's only natural satellite.

The planet is home to millions of species, including humans.[29] Both the mineral resources of the planet and the products of the biosphere contribute resources that are used to support a global human population.

Chronology (How earth is formed?)

Formation

By 4.54±0.04 bya[23] the primordial Earth had formed. The formation and evolution of the Solar System bodies occurred in tandem with the Sun. In theory a solar nebula partitions a volume out of a molecular cloud by gravitational collapse, which begins to spin and flatten into a circumstellar disk, and then the planets grow out of that in tandem with the star. A nebula contains gas, ice grains and dust (including primordial nuclides). In nebular theory planetesimals commence forming as particulate accrues by cohesive clumping and then by gravity.

Earth's atmosphere and oceans formed by volcanic activity and out gassing that included water vapor. The origin of the world's oceans was condensation augmented by water and ice delivered by asteroids, proto-planets, and comets.

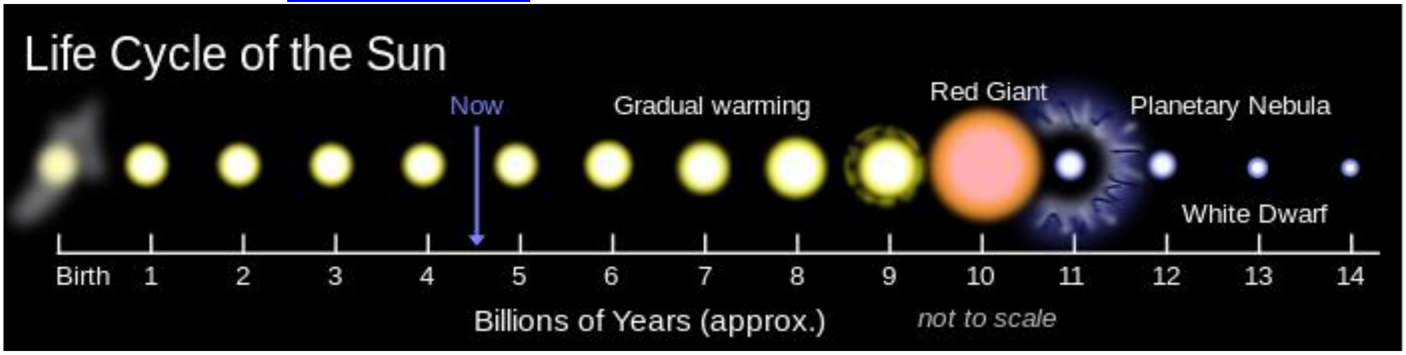
Crust

A crust formed when the molten outer layer of the planet Earth cooled to form a solid as the accumulated water vapor began to act in the atmosphere.

Continents

Continents formed by plate tectonics, a process ultimately driven by the continuous loss of heat from the earth's interior.

Future:Main article: Future of the Earth



The life cycle of the Sun

The Sun, as part of its evolution, will become a red giant in about 5 byr. Models predict that the Sun will expand out to about 250 times its present radius, roughly 1 AU (150,000,000 km).[59][63] Earth's fate is less clear. As a red giant, the Sun will lose roughly 30% of its mass, so, without tidal effects, the Earth will move to an orbit 1.7 AU (250,000,000 km) from the Sun when the star reaches it maximum radius. The planet was therefore initially expected to escape envelopment by the expanded Sun's sparse outer atmosphere, though most, if not all, remaining life would have been destroyed by the Sun's increased luminosity (peaking at about 5000 times its present level).[59] A 2008 simulation indicates that Earth's orbit will decay due to tidal effects and drag, causing it to enter the red giant Sun's atmosphere and be vaporized.[63] After that, the Sun's core will collapse into a white dwarf, as its outer layers are ejected into space as a planetary nebula. The matter that once made up the Earth will be released into interstellar space, where it will one day become incorporated into a new generation of planets and other celestial bodies.

Composition and structure

Earth is a terrestrial planet, meaning that it is a rocky body, rather than a gas giant like Jupiter. It is the largest of the four solar terrestrial planets in size and mass. Of these four planets, Earth also has the highest density, the highest surface gravity, the strongest magnetic field, and fastest rotation,[64] and is probably the only one with active plate tectonics.[65]

Shape

The shape of the Earth approximates an oblate spheroid, a sphere flattened along the axis from pole to pole such that there is a bulge around the equator.

Chemical composition

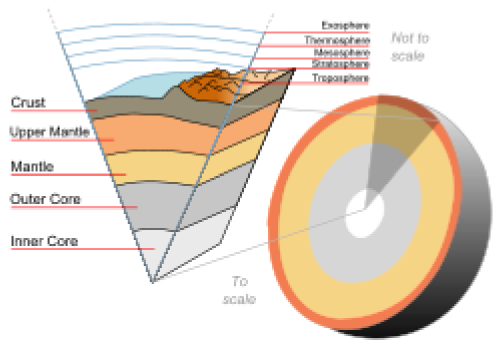
The mass of the Earth is approximately 5.98×10^{24} kg. It is composed mostly of iron (32.1%), oxygen (30.1%), silicon (15.1%), magnesium (13.9%), sulfur (2.9%), nickel (1.8%), calcium (1.5%), and aluminium (1.4%); with the remaining 1.2% consisting of trace amounts of other elements. Due to mass segregation, the core region is believed to be primarily composed of iron (88.8%), with smaller amounts of nickel (5.8%), sulfur (4.5%), and less than 1% trace elements.[76]

Internal structure

The interior of the Earth, like that of the other terrestrial planets, is divided into layers by their chemical or physical (rheological) properties, but unlike the other terrestrial planets, it has a distinct outer and inner core.

The outer layer of the Earth is a chemically distinct silicate solid crust, which is underlain by a highly viscous solid mantle. The crust is separated from the mantle by the Mohorovičić discontinuity, and the thickness of the crust varies: averaging 6 km (kilometers) under the oceans and 30-50 km on the continents. The crust and the cold, rigid, top of the upper mantle are collectively known as the lithosphere, and it is of the lithosphere that the tectonic plates are comprised. Beneath the lithosphere is the asthenosphere, a relatively low-viscosity layer on which the lithosphere rides. Important changes in crystal structure within the mantle occur at 410 and 660 km below the surface, spanning a transition zone that separates the upper and lower mantle. Beneath the mantle, an extremely low viscosity liquid outer core lies above a solid inner core.[78] The inner core may rotate at a slightly higher angular velocity than the remainder of the planet, advancing by 0.1–0.5° per year.[79]

Geologic layers of the Earth[80]



Earth cutaway from core to exosphere. Not to scale.

Depth[81] **km**	**Component Layer**	**Density g/cm³**
0–60	Lithosphere[note 8]	—
0–35	Crust[note 9]	2.2–2.9
35–60	Upper mantle	3.4–4.4
35–2890	Mantle	3.4–5.6
100–700	Asthenosphere	—
2890–5100	Outer core	9.9–12.2
5100–6378	Inner core	12.8–13.1

Heat

Earth's internal heat comes from a combination of residual heat from planetary accretion (about 20%) and heat produced through radioactive decay (80%).[82] The major heat-producing isotopes in the Earth are potassium-40, uranium-238, uranium-235, and thorium-232.

Tectonic plates

The mechanically rigid outer layer of the Earth, the lithosphere, is broken into pieces called tectonic plates. These plates are rigid segments that move in relation to one another at one of three types of plate boundaries:

- Convergent boundaries, at which two plates come together,
- Divergent boundaries, at which two plates are pulled apart,
- and Transform boundaries, in which two plates slide past one another laterally.

Earthquakes, volcanic activity, mountain-building, and oceanic trench formation can occur along these plate boundaries.[91] The tectonic plates ride on top of the asthenosphere, the solid but less-viscous part of the upper mantle that can flow and move along with the plates,[92] and their motion is strongly coupled with convection patterns inside the Earth's mantle.

As the tectonic plates migrate across the planet, the ocean floor is subducted under the leading edges of the plates at convergent boundaries. At the same time, the upwelling of mantle material at divergent boundaries creates mid-ocean ridges. The combination of these processes continually recycles the oceanic crust back into the mantle.

The seven major plates are the Pacific, North American, Eurasian, African, Antarctic, Indo-Australian, and South American. Other notable plates include the Arabian Plate, the Caribbean Plate, the Nazca Plate off the west coast of South America and the Scotia Plate in the southern Atlantic Ocean.

- **Hydrosphere**

The abundance of water on Earth's surface is a unique feature that distinguishes the "Blue Planet" from others in the Solar System. The Earth's hydrosphere consists chiefly of the oceans, but technically includes all water surfaces in the world, including inland seas, lakes, rivers, and underground waters down to a depth of 2,000 m. The deepest underwater location is Challenger Deep of the Mariana Trench in the Pacific Ocean with a depth of −10,911.4 m.

Sea water has an important influence on the world's climate, with the oceans acting as a large heat reservoir.

Atmosphere

The atmospheric pressure on the surface of the Earth averages 101.325 kPa, with a scale height of about 8.5 km.[3] It is 78% nitrogen and 21% oxygen, with trace amounts of water vapor, carbon dioxide and other gaseous molecules. The height of the troposphere varies with latitude, ranging between 8 km at the poles to 17 km at the equator, with some variation resulting from weather and seasonal factors.[115]

Earth's biosphere has significantly altered its atmosphere. Oxygenic photosynthesis evolved 2.7 bya, forming the primarily nitrogen-oxygen atmosphere of today. This change enabled the proliferation of aerobic organisms as well as the formation of the ozone layer which blocks ultraviolet solar radiation, permitting life on land. Other atmospheric functions important to life on Earth include transporting water vapor, providing useful gases, causing small meteors to burn up before they strike the surface, and moderating temperature.[116] This last phenomenon is known as the greenhouse effect: trace molecules within the atmosphere serve to capture thermal energy emitted from the ground, thereby raising the average temperature. Water vapor, carbon dioxide, methane and ozone are the primary greenhouse gases in the Earth's atmosphere. Without this heat-retention effect, the average surface would be −18 °C, in contrast to the current +15 °C, and life would likely not exist.[98]

Biosphere

The planet's life forms are sometimes said to form a "biosphere". This biosphere is generally believed to have begun evolving about 3.5 bya. The biosphere is divided into a number of biomes, inhabited by broadly similar plants and animals. On land, biomes are separated primarily by differences in latitude, height above sea level and humidity. Terrestrial biomes lying within the Arctic or Antarctic Circles, at high altitudes or in extremely arid areas are relatively barren of plant and animal life; species diversity reaches a peak in humid lowlands at equatorial latitudes.