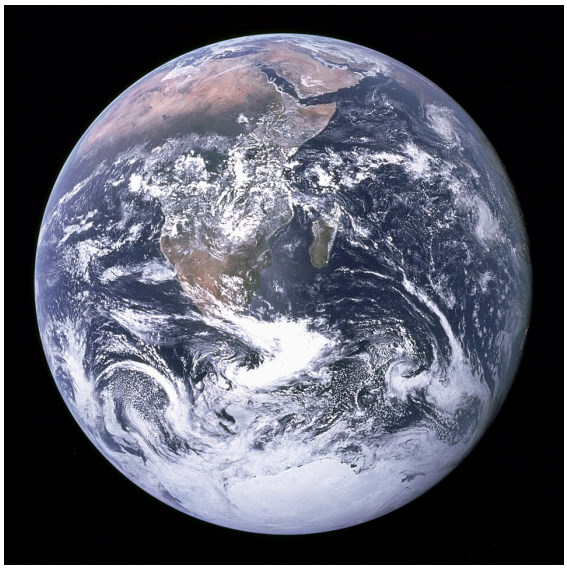
Earth

Earth is the third planet from the Sun and the only astronomical object known to harbor life. This is enabled by Earth being an ocean world, the only one in the Solar System sustaining liquid surface water. Almost all of Earth's water is contained in its global ocean, covering 70.8% of Earth's crust. The remaining 29.2% of Earth's crust is land, most of which is located in the form of continental landmasses within Earth's land hemisphere. Most of Earth's land is at least somewhat humid and covered by vegetation, while large sheets of ice at Earth's polar deserts retain more water than Earth's groundwater, lakes, rivers, and atmospheric water combined. Earth's crust consists of slowly moving tectonic plates, which interact to produce mountain ranges, volcanoes, and earthquakes. Earth has a liquid outer core that generates a magnetosphere capable of deflecting most of the destructive solar winds and cosmic radiation.

Earth has a dynamic atmosphere, which sustains Earth's surface conditions and protects it from most meteoroids and UV-light at entry. It has a composition of primarily nitrogen and oxygen. Water vapor is widely present in the atmosphere, forming clouds that cover most of the planet. The water vapor acts as a greenhouse gas and, together with other greenhouse gases in the atmosphere, particularly carbon dioxide (CO_2), creates the conditions for both liquid surface water and water vapor to persist via the capturing of energy from the Sun's light. This process maintains the current average surface temperature of 14.76 °C (58.57 °F), at which water is liquid under normal atmospheric pressure. Differences in the amount of captured energy between geographic regions (as with the equatorial region receiving more sunlight than the polar regions) drive atmospheric and ocean currents, producing a global climate system with different climate regions, and a range of weather phenomena such as precipitation, allowing components such as nitrogen to cycle.

Earth



The Blue Marble, Apollo 17, December 1972

Designations

Alternative names	The world · The globe · Terra · Tellus · Gaia · Mother Earth · Sol III
Adjectives	Earthly · Terrestrial · Terran · Tellurian
Symbol	⊕ and ♁

Orbital characteristics

Epoch J2000[n 1]

Aphelion	152 097 597 km
Perihelion	147 098 450 km[n 2]
Semi-major axis	149 598 023 km[1]
Eccentricity	0.016 7086[1]
Orbital period (sidereal)	365.256 363 004 d[2] (1.000 017 420 96 a_j)
Average orbital speed	29.7827 km/s[3]
Mean anomaly	358.617°
Inclination	7.155° – Sun's equator;

Earth is rounded into an ellipsoid with a circumference of about 40,000 kilometres (25,000 miles). It is the densest planet in the Solar System. Of the four rocky planets, it is the largest and most massive. Earth is about eight light-minutes away from the Sun and orbits it, taking a year (about 365.25 days) to complete one revolution. Earth rotates around its own axis in slightly less than a day (in about 23 hours and 56 minutes). Earth's axis of rotation is tilted with respect to the perpendicular to its orbital plane around the Sun, producing seasons. Earth is orbited by one permanent natural satellite, the Moon, which orbits Earth at 384,400 km (238,900 mi)—1.28 light seconds—and is roughly a quarter as wide as Earth. The Moon's gravity helps stabilize Earth's axis, causes tides and gradually slows Earth's rotation. Tidal locking has made the Moon always face Earth with the same side.

Earth, like most other bodies in the Solar System, formed about 4.5 billion years ago from gas and dust in the early Solar System. During the first billion years of Earth's history, the ocean formed and then life developed within it. Life spread globally and has been altering Earth's atmosphere and surface, leading to the Great Oxidation Event two billion years ago. Humans emerged 300,000 years ago in Africa and have spread across every continent on Earth. Humans depend on Earth's biosphere and natural resources for their survival, but have increasingly impacted the planet's environment. Humanity's current impact on Earth's climate and biosphere is unsustainable, threatening the livelihood of humans and many other forms of life, and causing widespread extinctions.[23]

	1.578 69° – invariable plane;[4]
	0.000 05° – J2000 ecliptic
Longitude of ascending node	–11.260 64° – J2000 ecliptic[3]
Time of perihelion	2023-Jan-04[5]
Argument of perihelion	114.207 83°[3]
Satellites	1, the Moon
Physical characteristics	
Mean radius	6 371.0 km[6]
Equatorial radius	6 378.137 km[7][8]
Polar radius	6 356.752 km[9]
Flattening	1/298.257 222 101 (ETRS89)[10]
Circumference	40 075.017 km equatorial[8]
	40 007.86 km meridional[11][n 3]
Surface area	510 072 000 km^2[12][n 4]
	Land: 148 940 000 km^2
	Water: 361 132 000 km^2
Volume	$1.083\,21 \times 10^{12}$ km^3[3]
Mass	$5.972\,168 \times 10^{24}$ kg[13]
Mean density	5.513 g/cm^3[3]
Surface gravity	9.806 65 m/s^2[14]
	(exactly 1 g_0)
Moment of inertia factor	0.3307[15]
Escape velocity	11.186 km/s[3]
Synodic rotation period	1.0 d (24h 00 m 00s)
Sidereal rotation period	0.997 269 68 d[16] (23h 56 m 4.100s)
Equatorial rotation velocity	0.4651 km/s[17]
Axial tilt	23.439 2811°[2]
Albedo	0.434 geometric[3]
	0.294 Bond[3]

Etymology

The Modern English word *Earth* developed, via Middle English, from an Old English noun most often spelled *eorðe*.[24] It has cognates in every Germanic language, from which Proto-Germanic **erþō* has been reconstructed. In its earliest attestation, the word *eorðe* was used to translate the many senses of Latin *terra* and Greek *gē*: the ground, its soil, dry land, the human world, the surface of the world (including the sea), and the globe itself. As with Roman Terra (or Tellus) and

Greek Gaia, Earth may have been a personified goddess in Germanic paganism: late Norse mythology included Jörð ('Earth'), a giantess often given as the mother of Thor.[25]

Historically, *Earth* has been written in lowercase. During the Early Middle English period, its definite sense as "the globe" began being expressed using the phrase *the earth*. By the period of Early Modern English, capitalization of nouns began to prevail, and *the earth* was also written *the Earth*, particularly when referenced along with other heavenly bodies. More recently, the name is sometimes simply given as *Earth*, by analogy with the names of the other planets, though *earth* and forms with *the earth* remain common.[24] House styles now vary: Oxford spelling recognizes the lowercase form as the more common, with the capitalized form an acceptable variant. Another convention capitalizes *Earth* when appearing as a name, such as a description of the "Earth's atmosphere", but employs the lowercase when it is preceded by *the*, such as "the atmosphere of the earth". It almost always appears in lowercase in colloquial expressions such as "what on earth are you doing?"[26]

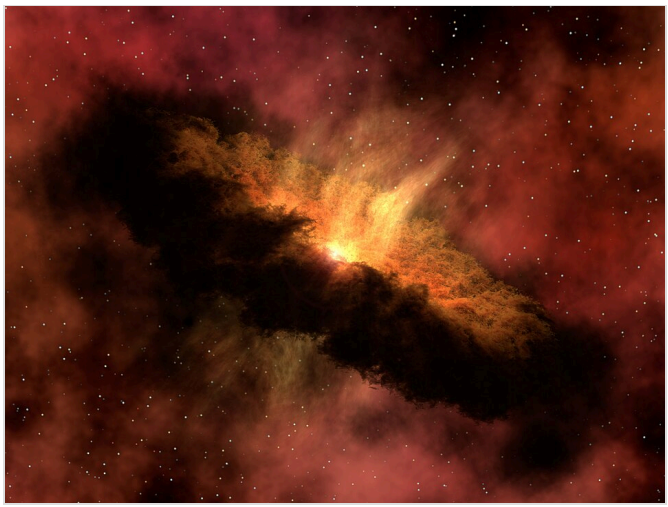
Temperature	255 K (–18 °C) (blackbody temperature)[18]		
Surface temp. [n 5]	**min**	**mean**	**max**
	–89.2 °C	14.76 °C	56.7 °C
Surface equivalent dose rate	0.274 μSv/h[22]		
Absolute magnitude *(H)*	–3.99		
Atmosphere			
Surface pressure	101.325 kPa (at sea level)		
Composition by volume	78.08% nitrogen (dry air) 20.95% oxygen (dry air) ≤1% water vapor (variable) 0.9340% argon 0.0415% carbon dioxide 0.00182% neon 0.00052% helium 0.00017% methane 0.00011% krypton 0.00006% hydrogen Source:[3]		

The name *Terra* /ˈtɛrə/ *TERR-ə* is occasionally used in scientific writing; it also sees use in science fiction to distinguish humanity's inhabited planet from others,[27] while in poetry *Tellus* /ˈtɛləs/ *TELL-əs* has been used to denote personification of the Earth.[28] *Terra* is also the name of the planet in some Romance languages, languages that evolved from Latin, like Italian and Portuguese, while in other Romance languages the word gave rise to names with slightly altered spellings, like the Spanish *Tierra* and the French *Terre*. The Latinate form *Gaea* (English: /ˈdʒiːə/ *DJEE-ə*) of the Greek poetic name *Gaia* ([gâi̯.a] or [gâj.ja]) is rare, though the alternative spelling *Gaia* has become common due to the Gaia hypothesis, in which case its pronunciation is /ˈgaɪ.ə/ *GYE-ə* rather than the more traditional English /ˈgeɪ.ə/ *GAY-ə*.[29]

There are a number of adjectives for the planet Earth. The word *earthly* is derived from *Earth*. From the Latin *Terra* comes *terran* /ˈtɛrən/ *TERR-ən*,[30] *terrestrial* /təˈrɛstriəl/ *tərr-EHST-ree-əl*,[31] and (via French) *terrene* /təˈriːn/ *tə-REEN*,[32] and from the Latin *Tellus* comes *tellurian* /tɛˈlʊəriən/ *teh-LUURR-ee-ən*[33] and *telluric*.[34]

Natural history

Formation



A 2012 artistic impression of the early Solar System's protoplanetary disk from which Earth and other Solar System bodies were formed

The oldest material found in the Solar System is dated to 4.5682 $^{+0.0002}_{-0.0004}$ Ga (billion years) ago.[35] By 4.54 ± 0.04 Ga the primordial Earth had formed.[36] The bodies in the Solar System formed and evolved 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 disk with the Sun. A nebula contains gas, ice grains, and dust (including primordial nuclides). According to nebular theory, planetesimals formed by accretion, with the primordial Earth being estimated as likely taking anywhere from 70 to 100 million years to form.[37]

Estimates of the age of the Moon range from 4.5 Ga to significantly younger.[38] A leading hypothesis is that it was formed by accretion from material loosed from Earth after a Mars-sized object with about 10% of Earth's mass, named Theia, collided with Earth.[39] It hit Earth with a glancing blow and some of its mass merged with Earth.[40][41] Between approximately 4.0 and 3.8 Ga, numerous asteroid impacts during the Late Heavy Bombardment caused significant changes to the greater surface environment of the Moon and, by inference, to that of Earth.[42]

After formation

Earth's atmosphere and oceans were formed by volcanic activity and outgassing.[43] Water vapor from these sources condensed into the oceans, augmented by water and ice from asteroids, protoplanets, and comets.[44] Sufficient water to fill the oceans may have been on Earth since it formed.[45] In this model, atmospheric greenhouse gases kept the oceans from freezing when the newly forming Sun had only 70% of its current luminosity.[46] By 3.5 Ga, Earth's magnetic field was established, which helped prevent the atmosphere from being stripped away by the solar wind.[47]

As the molten outer layer of Earth cooled it formed the first solid crust, which is thought to have been mafic in composition. The first continental crust, which was more felsic in composition, formed by the partial melting of this mafic crust.[49] The presence of grains of the mineral zircon of Hadean age in Eoarchean sedimentary rocks suggests that at least some felsic crust existed as early as 4.4 Ga, only 140 Ma after Earth's formation.[50] There are two main models of how this initial small volume of continental crust evolved to reach its current abundance:[51] (1) a relatively steady growth up to the present day,[52] which is supported by the radiometric dating of continental crust globally and (2) an initial rapid growth in the volume of continental crust during the Archean, forming the bulk of the