

Mercury

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
3.285 $\times 10^{23}$ kg	2,439 km	5.427 g/cm ³	3.7 m/s ²	59 Days	88 Days

Atmosphere:

- Mercury's atmosphere is nearly non-existent & considered only a thin exosphere
- Composed of small amounts of hydrogen (H₂), helium (He₂), and oxygen (O₂), and trace amounts of other gases
- Solarwinds replenish Mercury's thin exosphere which gravitationally holds onto some gases & materials before they escape into space
- Mercury's magnetic field is distorted by the solar wind, which compresses the magnetic field on the dayside and stretches it out to form a long tail on the nightside

Average High Temperature	Average Low Temperature
700°K, 426°C, 800°F	100°K, -173°C, -279°F

Interior & Surface:

- Mercury's interior contains a large molten iron (Fe) core, along with a mantle & crust
- Far more metal and sulfur rich than Earth, with 70% metallic & 30% silicate materials
- Covered in craters, Mercury shows evidence for volcanism in its past
- Mercury is the smallest planet in the Solar System, but the second densest planet

Key Features / Interesting Facts:

- Huge crater called "Caloris Basin" surrounded by "Weird Terrain"
- Water (H₂O) ice discovered in deep craters near the poles where sunlight doesn't reach
- Mercury has the most elliptical orbit of any planet in the solar system

Missions to Mercury:

- Mariner 10 - American robotic space probe launched by NASA on November 3, 1973, to fly by the planets Mercury and Venus
- Messenger - a NASA robotic spacecraft that orbited the planet Mercury between 2011 and 2015

Venus

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
4.867 $\times 10^{24}$ kg	6,052 km	5.3 g/cm ³	8.9 m/s ²	243 Days *Retrograde Rotation!	225 Days

Atmosphere:

- Composed of 96% carbon dioxide (CO₂), 3% nitrogen (N), and 1% sulfur dioxide (SO₂), argon (Ar), water vapor (H₂O), and other trace gases
- Strongest greenhouse effect in the solar system & clouds of sulfuric acid (H₂SO₄)
- Venus' troposphere exhibits a phenomenon of super-rotation, with strong winds, and contain anticyclonic structures called polar vortices near the poles

Average Temperature
735°K, 462°C, 864°F

Interior & Surface:

- 2nd most spherical object in the solar system with an orbit that's almost a perfect circle
- Similar in size to Earth, its interior contains a partly molten metallic core, rocky mantle, & crust
- Venus has no internally generated magnetic field, instead it has an "induced magnetosphere"
- Covered in over 900 impact craters
- Volcanism- roughly 167 inactive volcanoes & 80% of the surface is cooled lava plains

Key Features / Interesting Facts:

- Scientists believe that Venus once possessed large amounts of water or oceans, but its extreme greenhouse effect boiled the water off long ago
- The sulfur clouds within Venus' atmosphere can produce lightning
- 3rd naturally brightest object in the sky, Venus is often referred to as the morning/ evening star
- Due to its high albedo, it is often mistaken for a unidentified flying object or UFO
- Venus rotates in a clockwise direction opposite most other planets, in what's referred to as retrograde rotation

Missions to Venus:

- Venera 7 - Soviet spacecraft that was the first spacecraft to land on another planet and the first to transmit data back to Earth

Earth

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
5.972 $\times 10^{24}$ kg	6,378 km	5.51 g/cm ³	9.807 m/s ²	24 Hours	365 Days

Atmosphere:

- Composed of 78% nitrogen (N), 21% oxygen (O₂), & 1% argon (Ar), carbon dioxide (CO₂), water (H₂O), and other trace gases
- Atmospheric layers divided by temperature inversion: troposphere, stratosphere, mesosphere, thermosphere, and exosphere
- The ozone layer & ionosphere protect Earth from harmful UV rays & X-rays
- Various weather occurs due to global wind systems and convection currents

Average High Temperature	Average Low Temperature
331°K, 58°C, 136°F	184°K, -89°C, -128°F

Interior & Surface:

- Composed of a solid inner core, liquid outer core, mantle, and crust
- Plate tectonics & seafloor spreading constantly recycle Earth's crust, causing natural disasters such as earthquakes, volcanoes, and tsunamis, and producing mountain ranges, deep sea trenches, mid-ocean ridges, and rift valleys
- Weathering, erosion, & deposition wear down and relocate materials across Earth's surface

Key Features / Interesting Facts:

- Life exists on Earth
- Formed roughly 4.6 billion years ago, Earth's moon was the result of an impact with a protoplanet called "Theia" that occurred during the Hadean Eon
- The majority of Earth's volcanoes exist around the Ring of Fire at the edges of the Pacific Plate
- Convection currents drive most of Earth's internal & external systems

Missions to Earth:

- International Space Station - The ISS serves as a microgravity and space environment research laboratory in which crew members conduct experiments in biology, human biology, physics, astronomy, meteorology, and other fields

Mars

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
6.39 $\times 10^{23}$ kg	3,389 km	3.93 g/cm ³	3.711 m/s ²	24 Hours & 39 Minutes	687 Days

Atmosphere:

- Composed of 95% carbon dioxide (CO₂), 3% nitrogen (N), 1.6% argon (Ar), and trace amounts of oxygen (O₂), water vapor (H₂O), and other gases
- Thin atmosphere that does not protect Mars from the Sun's radiation, nor does it retain heat at the surface
- Turbulent dust storms that can last for up to months at a time & can cover the entire planet

Average High Temperature	Average Low Temperature
293°K, 20°C, 70°F	148°K, -125°C, -193°F

Interior & Surface:

- The surface of Mars has an orange-reddish color because its soil has iron oxide or rust particles in it
- Similar to Earth, scientists believe Mars has both a solid inner core & a liquid outer core of iron
- Besides silicon and oxygen, the most abundant elements in the Martian crust are iron, magnesium, aluminum, calcium, and potassium
- Geographically, the surface is rocky, with canyons, volcanoes, dry lake beds and craters

Key Features / Interesting Facts:

- The Tharsis Plateau, located near Mars' equator, is home to 4 gigantic shield volcanoes
- The largest volcano on Mars is Olympus Mons, the base of which is larger than the state of Colorado & the top is 3x higher than Mount Everest
- In the next 20-40 million years Mars' largest moon Phobos will be torn apart by gravitational forces leading to the creation of a ring that could last up to 100 million years.

Missions to Mars:

- 2001 Mars Odyssey - U.S. spacecraft that studied Mars from orbit and served as a communication relay for the Mars Exploration Rovers and Phoenix
- Curiosity Rover - the most technologically advanced rover ever built, & landed in Mars' Gale Crater the evening of August 5, 2012 → <https://www.facebook.com/MarsCuriosity/>

Jupiter

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
1.898 $\times 10^{27}$ kg	69,911 km	1.33 g/cm ³	24.79 m/s ²	10 Hours	12 Years

Atmosphere:

- Composed of 86% hydrogen (H₂) & 13.6% helium (He₂), along with trace amounts of water (H₂O), ammonia (NH₃) & methane (CH₄) -compounds that arise when you mix oxygen, nitrogen and carbon in a hydrogen-rich atmosphere
- Layered cloud system indicating violent winds
- The Great Red Spot is a persistent high-pressure region in the atmosphere of Jupiter, producing an anticyclonic storm, the largest in the Solar System, 22° South of the planet's equator. It has been continuously observed since 1830

Average High Temperature	Average Low Temperature
294°K, 21°C, 70°F	128°K, -145°C, -229°F

Interior & Surface:

- Jupiter has a large, complex, and intense magnetic field that is thought to arise from electrical currents in the rapidly spinning metallic hydrogen interior
- Below Jupiter's atmosphere is a layer of liquid hydrogen, followed by a layer of liquid metallic hydrogen which can only exist under high pressure

Key Features / Interesting Facts:

- Jupiter rotates very rapidly for its size, spinning once on its axis every 10 hours
- Its 4 large moons are called Galilean Satellites
- Io undergoes constant volcanic eruptions
- Europa might have a subsurface ocean of liquid water

Missions to Jupiter:

- Juno - NASA space probe orbiting the planet Jupiter. Juno's primary goal is to reveal the story of Jupiter's formation and evolution, and study the gas giant's atmosphere, magnetosphere and gravitational field
- Galileo - to study Jupiter and its mysterious moons. Galileo provided the only direct observations of a comet colliding with a planet

Saturn

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
5.683 $\times 10^{26}$ kg	58,232 km	0.69 g/cm ³	10.44 m/s ²	10 Hours & 14 Minutes	29 Years

Atmosphere:

- Composed of 75% hydrogen (H₂) & 25% helium (He₂), along with trace amounts of water ice (H₂O) & methane (CH₄)
- One of the windiest places in the Solar System, with wind speeds at 1800 kilometers per hour at the equator
- Saturn's troposphere has three regions or "cloud decks," the top deck made of ammonia (NH₃) clouds, the middle deck made of ammonium hydrosulphide (NH₄⁺ HS) clouds, and the lowest deck made of water ice clouds (H₂O)

Average Temperature

95°K, -178°C, -288°F

Interior & Surface:

- Saturn's internal structure is fluid throughout except for a small, molten core
- A layer of liquid metallic hydrogen sits below a layer of liquid hydrogen similar to Jupiter
- Saturn's magnetic field is aligned with its rotational axis, which is highly unusual

Key Features / Interesting Facts:

- Saturn's most notable feature is its 7 bright rings and sit along Saturn's equatorial plane
- The ring particles are mostly water ice, with a trace component of rocky material
- Its largest moon, Titan, has a dense atmosphere made of nitrogen & methane
- Another moon, Enceladus, has geysers that erupt icy water particles and gas from the moon's surface which supplies material to Saturn's E-ring

Missions to Saturn:

- Cassini - the most ambitious efforts ever mounted in planetary exploration. A joint endeavor of NASA, ESA, and ASI, Cassini was a sophisticated robotic spacecraft sent to study Saturn and its complex system of rings and moons in unprecedented detail

Uranus

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
8.681 $\times 10^{25}$ kg	25,362 km	1.27 g/cm ³	8.87 m/s ²	17 Hours & 14 Minutes	84 Years

Atmosphere:

- Composed of 83% hydrogen (H₂) & 15% helium (He₂), 2% methane (CH₄), along with trace amounts of water ice (H₂O) & ammonia (NH₃)
- Winds are retrograde at the equator, blowing in the reverse direction of the planet's rotation
- Methane gives Uranus its signature blue color
- The planet's upper clouds are made of hydrogen-sulfide (H₂S) ice, the molecule that gives rotten eggs their terrible odor
- Uranus does not have distinctive clouds, atmospheric belts, and zones like the other gas giants

Average Temperature

49°K, -224°C, -371°F

Interior & Surface:

- The surface is a mixture of ice slush & solid ice below its methane cloud deck
- Scientists believe Uranus has a solid core
- Uranus's magnetic field cycles from open to closed to open on a daily basis

Key Features / Interesting Facts:

- Uranus spins on its side, due to an axial tilt of 98° and also exhibits retrograde rotation
- The first planet discovered with the use of a telescope
- Uranus has the coldest atmospheric temperatures in the Solar System
- Its moons are named after characters created by William Shakespeare & Alexander Pope, including Titania, Oberon, Ariel, Miranda, Ophelia, Juliet, Ferdinand, Prospero, & Rosalind

Missions to Uranus:

- Voyager 2 - NASA's spacecraft which made its closest approach to Uranus on January 24, 1986. It discovered 10 moons, studied the planet's cold atmosphere, and examined its ring system, discovering two new rings.

Neptune

Mass	Radius	Density	Gravity	Rotation Period	Orbital Period
1.024 $\times 10^{26}$ kg	24,622 km	1.64 g/cm ³	11.15 m/s ²	16 Hours	165 Years

Atmosphere:

- Composed 80% hydrogen (H₂) & 19% helium (He₂), along with trace amounts of methane (CH₄), water ice (H₂O), ammonia (NH₃), and other ices
- Neptune's atmosphere is broken up into distinct bands of storms
- The Great Dark Spot was a large storm that eventually dissipated by 1994
- Home to the Fastest winds in the Solar System at 2,400 km/h
- Upper level clouds occur at the point where pressures are low enough for methane to condense

Average Temperature

55°K, -218°C, -360°F

Interior & Surface:

- The gas of Neptune's atmosphere transitions into a slushy ice and water layer. This water-ammonia ocean serves as the planet's mantle
- Neptune's rocky core consisting of silicates and metals
- Hydrocarbon snowflakes form in Neptune's atmosphere, but they melt before reaching the liquid surface due to the planet's high pressure

Key Features / Interesting Facts:

- Similar to Earth, Neptune is tilted at 28° allowing Neptune to experience seasons
- Neptune's largest moon, Triton, is the only moon in the solar system to orbit its planet in the opposite direction to the planet's rotation
- Neptune has five known rings that are thought to be relatively young and short lived

Missions to Neptune:

- Voyager 2 - In the summer of 1989 it became the first spacecraft to observe the planet Neptune, its final planetary target. Voyager observed Neptune almost continuously from June to October 1989.