

## Mars: The Red Planet

Mars is the fourth planet from the Sun and the second-smallest planet in the Solar System, being larger than only Mercury. Often referred to as the "Red Planet," its distinctive reddish appearance is due to the high prevalence of iron oxide (rust) on its surface and in its thin atmosphere, which gives it a dusty, coppery hue. Mars is a terrestrial (or rocky) planet, sharing this classification with Mercury, Venus, and Earth.

### Atmosphere and Climate

The Martian atmosphere is extremely thin, with a surface pressure only about 0.6% of Earth's. It is composed primarily of carbon dioxide (CO<sub>2</sub>) at 95.3%, followed by nitrogen (N<sub>2</sub>) at 2.6% and argon (Ar) at 1.9%. This thin atmospheric blanket is insufficient to retain much of the Sun's heat, leading to dramatic temperature fluctuations. Surface temperatures can range from a relatively mild 20°C (70°F) at the equator during summer to a frigid -153°C (-243°F) at the poles.

Mars experiences significant weather patterns, including the largest dust storms in the Solar System. These storms can start in a small region and grow to encompass the entire planet, lasting for weeks and blocking out the Sun. Mars also has distinct seasons, similar to Earth, due to the tilt of its rotational axis.

### Surface Geology and Features

The geology of Mars is diverse and fascinating. It is home to some of the most extreme features in the Solar System:

**Olympus Mons:** A massive shield volcano that stands approximately 22 km (13.6 miles) high, making it the tallest known volcano and mountain on any planet.

**Valles Marineris:** A vast system of canyons that stretches over 4,000 km (2,500 miles) long, 200 km (120 miles) wide, and up to 7 km (4.3 miles) deep. It dwarfs Earth's Grand Canyon.

**Polar Ice Caps:** Mars has permanent ice caps at both poles, composed of a mixture of water ice (H<sub>2</sub>O) and frozen carbon dioxide ("dry ice"). The seasonal caps grow and recede with the changing seasons.

**Borealis Basin:** A massive impact basin in the northern hemisphere, covering 40% of the planet, which is thought to be the result of a colossal ancient impact.

### Search for Water and Life

One of the most compelling areas of Martian research is the search for water. Abundant geological evidence—such as dried riverbeds, deltas, and mineral deposits that only form in liquid water—suggests that Mars was once a much warmer and wetter planet.

Today, water exists almost exclusively as ice in the polar caps and buried underground. Missions like NASA's Curiosity rover (which landed in 2012) and the Perseverance rover (landed in 2021) are actively searching for signs of past microbial life (biosignatures) in areas like Gale Crater and Jezero Crater, which are believed to be ancient lakebeds.