

## Physical Characteristics of Some Solar System Objects

Object	Physical Characteristics
Mercury	No appreciable atmosphere. No liquid water. Evidence for volcanic activity in distant past. Many impact craters. Surface temperature variations are the largest in the solar system, from $-300^{\circ}\text{F}$ to $800^{\circ}\text{F}$ , depending on whether the surface is facing toward or away from the Sun. No protection from the Sun's ultraviolet light. Life not likely.
Venus	Thick atmosphere, mostly carbon dioxide. No liquid water. Evidence of extensive volcanism in past; not clear if Venus is still volcanically active. Surface temperature close to $900^{\circ}\text{F}$ . Atmospheric pressure at surface of Venus is about 90 times that at Earth's surface (similar to pressure 1 km under water on Earth). Life unlikely.
Moon	No atmosphere. No liquid water. Many impact craters. Volcanoes active in distant past. Small amount of water ice may be found in craters near poles on far side. No protection from the Sun's ultraviolet light. Life not likely.
Mars	Thin atmosphere, mostly carbon dioxide. Water ice in polar ice caps and possibly underground in permafrost. No liquid water now, but evidence of liquid water in past. Surface temperature ranges widely, from $-207^{\circ}\text{F}$ at the winter pole to almost $80^{\circ}\text{F}$ on the day side during summer. Atmospheric pressure at surface is about $1/100^{\text{th}}$ that at the surface of the Earth. Evidence for active volcanism in the past, but now geologically inactive. No protection from the Sun's ultraviolet light at surface. Life possible especially underground or in polar ice caps.
Jupiter	Thick atmosphere, mostly hydrogen. No distinct surface. No volcanism. No liquid water. Temperature at top of clouds is $-240^{\circ}\text{F}$ , but rises as you go deeper into atmosphere (reaching tens of thousands of degrees deep in interior). Atmospheric pressure increases from about the pressure at the surface of the Earth at top of Jupiter's clouds to hundreds of thousands of times the Earth's surface atmosphere deep in interior. Life not likely.
Io	Moon of Jupiter. Very thin atmosphere (about a billion times less dense than Earth's atmosphere) of mostly sulfur dioxide gas. No liquid water. Very active volcanically, with geyser-like eruptions of sulfur dioxide and liquid sulfur flowing, like lava, from volcanoes. Surface temperature averages $-220^{\circ}\text{F}$ , although volcanic vents can be much hotter. Subject to bombardment by charged particles from Jupiter's magnetic field. No protection from Sun's ultraviolet light. Life not likely.
Europa	Moon of Jupiter. Extremely thin atmosphere of oxygen (ozone). Surface covered in thin (ten kilometers or less) crust of water ice. Surface ice fractured by cracks, and jumbled crust resembling icebergs. Surface temperature $-250^{\circ}\text{F}$ . Very likely ocean of liquid water under ice, perhaps 100 km deep, heated by molten core. Lava eruptions possible on ocean floor. Subject to bombardment by charged particles from Jupiter's magnetic field. No protection from Sun's ultraviolet light at surface. Life possible in ocean.
Ganymede	Moon of Jupiter. Extremely thin atmosphere of oxygen (ozone). No liquid water. Surface temperature $-250^{\circ}\text{F}$ . Surface riddled with grooves and ridges. Icy surface crust may overlay a mantle of rock, with a molten iron or iron/sulfur core. Subject to bombardment by charged particles from Jupiter's magnetic field. No protection from Sun's ultraviolet light at surface. Life not likely.

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Callisto	Moon of Jupiter. Extremely thin atmosphere of carbon dioxide. Heavily cratered. No liquid water. Mixture of ice and rock on surface and throughout the moon (not differentiated into different layers like Earth and other moons like Europa and Ganymede). Surface temperature $-250^{\circ}\text{F}$ . Subject to bombardment by charged particles from Jupiter's magnetic field. No protection from Sun's ultraviolet light at surface. Life not likely.
Saturn	Thick atmosphere, mostly hydrogen. No distinct surface. No volcanism. No liquid water. Temperature at top of clouds is $-220^{\circ}\text{F}$ , but rises as you go deeper into atmosphere. At the top of Saturn's clouds, the atmospheric pressure is about that of Earth's at sea level. The pressure is a thousand times greater deep in the cloud interior. Life not likely.
Titan	Moon of Saturn. Thick atmosphere, mostly nitrogen. No liquid water. Atmosphere contains many hydrocarbons, including methane and ethane. Atmospheric pressure at the surface is 1.5 times that at the surface of the Earth. Surface temperature is $-290^{\circ}\text{F}$ . Lakes or oceans of liquid methane and ethane may exist on Titan's surface. Areas of rock, like continents, may exist among the oceans or lakes. Scientists think Titan's atmosphere may resemble that on the Earth when life first began, and before life put oxygen into Earth's atmosphere. Life possible, but probably not water-based life.
Uranus	Thick atmosphere, mostly hydrogen, some helium. No distinct surface. No volcanism. No liquid water. Temperature at top of clouds is $-320^{\circ}\text{F}$ , but rises as you go deeper into atmosphere. Atmosphere may rest above an icy or liquid mixture of water, ammonia, and methane, which in turn surrounds a "rocky" core, about the size of the Earth. Life not likely.
Miranda	Moon of Uranus. No appreciable atmosphere. No liquid water. Relatively few impact craters, but has huge cliffs and canyons. Large impact at some time in the past may have shattered Miranda, which then reassembled, leaving a jumbled heap of odd-shaped fragments that we see as cliffs and canyons. Surface temperature is $-335^{\circ}\text{F}$ . Life not likely.
Neptune	Thick atmosphere, mostly hydrogen and helium. No distinct surface. No volcanism. No liquid water. Temperature at top of clouds is $-330^{\circ}\text{F}$ , but rises as you go deeper into atmosphere. Atmosphere may rest above an icy or liquid mixture of water, ammonia, and methane, which in turn surrounds a "rocky" core, about the size of the Earth. Life not likely.
Triton	Moon of Neptune. Extremely thin atmosphere, mostly nitrogen. Surface temperature of $-391^{\circ}\text{F}$ is the coldest of any planet or moon in solar system (average surface temperature is $-355^{\circ}\text{F}$ ). No liquid water. Surface consists of ices of nitrogen, methane, carbon dioxide and carbon monoxide. Active geyser-like eruptions spew nitrogen gas and dark dust particles several kilometers into the atmosphere. Life not likely.

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Pluto	Extremely thin atmosphere of nitrogen and methane present when Pluto is closest to the Sun (atmospheric pressure about 1/100,000 <sup>th</sup> that at surface of Earth). Atmosphere freezes out onto surface when Pluto moves away from Sun. Surface temperature of $-373^{\circ}\text{F}$ . Surface ices of nitrogen, with methane and traces of carbon monoxide. No liquid water. Life not likely.
Comet	Composed of water ice, frozen carbon dioxide (dry ice), and rock. When close to Sun, ice turns into gas that trails out from comet in a "tail" hundreds of thousands of kilometers long. Tail contains gases of water vapor, carbon dioxide, carbon monoxide, and other organic molecules, plus dust particles. No liquid water. Contains precursors of life and may have brought them to Earth in collisions with young Earth. Life possible, but not likely.
Asteroid	No appreciable atmosphere. Composed of rock and/or iron and nickel. Contain some organic molecules, including some precursors of life and may have brought them to Earth in collisions with young Earth. Life possible, but not likely. No liquid water. Life not likely.