

A comparison of the planets in the sol system

[Environment](#), [Earth](#)



A Comparison of the Planets in the Sol System Shaun J. Sci350 December 19, 2004 Introduction Beginning Mercury, this paper will compare the nine planets and major moons of our solar system and describe their individual characteristics. At the end of this discussion, the habitability factor of these different worlds will be discussed as compared to that of the Earth's. A Brief History of the Sol System By radiocarbon dating meteorites, we know that roughly 4.6 billion years ago our solar system began. This happens when a cloud of gas and dust were disturbed and squeezed by perturbations of the surrounding space, possibly caused by an exploding supernova. As the cloud began to contract and spin around a common center of gravity, it also began to heat. After about 10 million years of condensing and heating, our solar system began to take shape. Towards the center of the cloud, it was hot with cooler areas at the edge. It is possible that this heating and cooling was even within the cloud. A line called the frost line began to grow. Inside the frost line, planetesimals made of rocks and metals began meshing and colliding, becoming the terrestrial planets. Outside of the frost line, nebulae were accreting around ices and would become the Jovian planets. The cloud further contracted towards its center and eventually became hot enough to begin nuclear fusion. This is the birth of our star, the Sun, and of our solar system. Stellar winds from the ignition blew excess materials into the fringes of our newly formed solar system as well as the interstellar medium. The Nine Planets During the accretion phase of the birth of our solar system, hundreds to thousands of planetesimals congregated and coalesced. However, eight true planets have survived to this day with the ninth possibly being the largest of the Kuiper Belt objects. These planets are broken into

two sections, inner solar system and outer. The Inner Solar System Planets and Moons Mercury (The Messenger of the [Greek] gods) Mercury is the smallest of the inner solar system planets is also the closest to the sun. At .39 AU (1 AU = 93, 000, 000 miles), it orbits the sun every 87. 9 days, faster than any other planet in the solar system. Mercury is composed of rocks and metal (iron mostly) and has a day temperature of 797o F and a nighttime temperature of -240o F. There is no atmosphere, no volcanism, no signs of life and a heavily cratered surface. Mercury is about a 5th the size of Earth. Some curious features of Mercury are the cracks around its surface. Some of these cracks have created cliffs that are thought to be the product of planetary shrinkage, which may have happened early in Mercury's history when the core cooled and rather rapidly. Mercury has no moon. Venus (The goddess of Love) Venus is the second largest planet within the inner solar system and second from the sun at . 72 AU with an orbital period of 225 days it is second fastest around the sun. Venus is composed of rock and metal with an average temperature of 850o F. This is due to the greenhouse effect produced by an over abundance of carbon dioxide in its atmosphere. The atmosphere on Venus has no oxygen and the pressure of its atmosphere is nine times that of Earth's at ground level. There is evidence of volcanism in the past and the relative present. Also, Venus has no water and no signs of life. A curious feature of Venus is its squat volcanoes. This is possibly due to the massive pressure of Venus' atmosphere on the ground. It is thought that when lava erupts from within the planet, the pressure keeps the lava from spewing upwards. Instead, it oozes out like tooth paste being slowly ejected from its tube. Venus is just slightly smaller than Earth and has no moon.

Earth (ground, soil, dry land) Earth is the largest planet in the inner solar system at a distance of 1 AU from the sun with an orbit of one year and is third fastest around the sun. Earth is composed of rock and metal with a varying degree of temperature (depending upon where on Earth you are). The atmosphere is composed of nitrogen, oxygen and carbon dioxide and has a layer known as ozone which shields from solar radiation. Earth is volcanically active and has liquid water on its surface. A curious feature of Earth is its continental drift which has been explained by Plate Tectonics. Earth is the only planet we have detected life, and intelligent life, on. Earth has one moon (The Moon) which is one quarter the Earth's size. This is the largest planet to satellite ratio in the solar system. Earth's Moon: The moon effects tides on earth and creates a stabilizing effect on the planet by means of their mutual gravitational attraction. This effect keeps the Earth from wobbling in its orbital precession. The moon has no atmosphere and about little gravity. The moon is no longer volcanically active but once was during its past. The moon is heavily cratered and is being pushed away by the Earth's gravity by about one millimeter per year. Mars (The god of War) Mars is the third largest planet of the inner solar system and is 1. 52 AU from the sun with an orbital period of 1. 88 years making it the fourth around the sun in speed. Mars is composed of rock and metal. Mars is also the last of the inner solar system planets. Mars has less pressure than that of the highest peak on Earth and has very little atmosphere, though it has trace amounts of oxygen in it. There are seasons on Mars where the polls freeze and it snows carbon dioxide with a small mix of water ice. Mars is not volcanically active now but was in its past. There is no current sign of life but life may have

flourished on Mars billions of years ago when there was more of an atmosphere and liquid water. Mars has two moons, Phobos and Deimos and they are thought to be captured asteroids which will eventually crash into Mars. These moons do not effect Mars in any detectable way. The Outer Solar System Planets Jupiter (The Father of the Gods [Zeus]) Jupiter is the largest and most massive planet of the solar system and is 5. 2 AU from the sun with an orbital period of 11. 9 years. Incidentally, Jupiter has the fastest rotational period at just less than 10 hours. Jupiter is a gas giant and has a small rocky core but is composed of hydrogen, helium and hydrogen compounds. Jupiter has no ground like the terrestrial planets hence there would be no place to stand. Jupiter has about 60 moons, four being the largest and most well known - Io, Europa, Ganymede and Callisto. Jupiter's Moons: -Io is the most volcanically active place in the solar system yet discovered. Being closest to Jupiter and its huge gravitational tug, Io is constantly flexed. This creates what's called tidal heating. With the most volcanoes and most explosive volcanoes (some plumes to 49. 7 miles) into its thin atmosphere. -Europa is the frozen moon of the system. However, underneath the ice (which could be up to 49 miles deep) may be a subsurface ocean of liquid water which would continue another 63 miles to Europa's rocky core. Tidal heating is what is believed to keep all of Europa from freezing with ocean floor vents warming the ocean enough to sustain liquid water. Under Europa's thick ice coating may be the oceanic life. - Ganymede is a heavily cratered moon with dark and light regions thought to be young and old surfaces, respectively, caused by melted ice water erupting and covering older landscape and refreezing. Ganymede has a

magnetic field which suggests a salty subsurface ocean. However this is just a theory at present. -Callisto is heavily cratered and so no signs of volcanic activity. Like Ganymede, Callisto also has a magnetic field which is thought to arise from a salty ocean. Theory has it that Callisto may be retaining heat from radioactive decay which keeps a subsurface ocean of water liquid.

Saturn (The Father of [Zeus] God) Saturn is the second largest planet of the solar system with a distance of 9.54 AU from the sun with an orbital period of 29.4 years. Saturn's composition is the same as Jupiter and too is a gas giant. Like Jupiter, Saturn has no surface but does have a rocky core. Saturn weighs in with a mass that is 222.72m less than Jupiter though it is only 6,974 miles smaller in radius. Saturn's most notable quality is its rings which are composed of ices and rocks. Saturn has about 30 moons of which the largest is Titan. Saturn's Moon Titan: Titan, which is larger than Mercury, is one of six medium sized moons in Saturn's system and is also the second largest moon in the solar system. Titan is surrounded by smog with a thick atmosphere composed mainly of nitrogen. The remainder of the atmosphere is composed of methane, ethane and other hydrogen compounds. Although there are greenhouse gases present in Titan's atmosphere, its distance from the sun keeps the temperature at -292o F. There is gravity on Titan, 1.5G to Earth's. It is believed that Titan sports oceans of methane/ethane created by chemical reactions as a result of ultraviolet radiation. Recently, infrared images of Titan have shown light and dark areas which could be the seas themselves. Uranus (Father of the Titans) Uranus is the third largest planet of the solar system with a distance of 19.19 AU from the sun and has an orbital period of 83.8 years. Of the four gas giants, Uranus has the slowest

rotational speed. The most curious aspect of Uranus is that it rotates along its orbital axis. Looking at Uranus, it would appear to be rolling forward versus spinning around. The cause of this has been speculated as being a massive impact event early in Uranus' history (in the direction of the planet's current axial spin) from which the planet barely survived. This unique quality also produces 42 years of light and dark depending upon the planet's orientation to the sun. Uranus has five moons thought to be composed of ices. The Moons of Uranus: -Ariel shows signs of volcanism and tectonics recently, relatively. -Umbriel appears dead. -Titania appears to be or have been geologically active. -Oberon appears to have been geologically active, but not as much as Titania. -Miranda appears to have been highly active and has a relatively young surface. Neptune (The God of the Seas) Neptune is the fourth largest planet in the solar system with a distance of 30.06 AU from the sun and an orbital period of 164 years. Neptune and Uranus are near twins with just a 494 mile difference between their radii. Like the previous three gas giants, Neptune is composed of hydrogen, helium, and hydrogen compounds. A difference in color also separates the two in their appearance. Neptune has a rocky core and has eight moons, the largest being Triton. Neptune's Moon Triton: Triton is larger than Pluto with a surface that appears to have geysers which spew nitrogen gas. The most intriguing aspect of Triton is that it orbits Neptune opposite of Neptune's rotation - backwards. It has been speculated that Triton is actually an interstellar wanderer that was captured by Neptune's gravity. Eventually, Triton will spiral into Neptune as its retrograde orbit slows it further. Triton does have a thin atmosphere possibly due to the melting of ices and shows signs of geologic activity.

However, Triton has a surface temperature of -347o F. Pluto (The god of Wealth) Pluto, the last and smallest planet, orbits the sun once every 248 years at a distance of 39. 54 AU. Discovered by Clyde Tombaugh in 1930, it is now thought to be a large Kuiper Belt object and is composed of mainly ices. Pluto has a companion, Charon, which is half Pluto's size and an eight of Pluto's mass. It is also speculated that Pluto and Charon orbit a common center of gravity versus the moon orbiting the planet. Due to distance, no pictures of Pluto and Charon have been taken other than by the Hubble Space Telescope. It is also noteworthy to mention that Pluto's orbit takes it in past the orbit of Neptune for 20 years of its circuit around the sun. The Habitability Factor Of the worlds found in our solar system, the Earth is the only world where we know life can exist on. Within the inner solar system, Earth is the only planet with liquid water and free oxygen in the atmosphere. These two elements are essential (as we know it) for life to exist. The Earth is also the only planet where temperatures are moderate and temperate. The geological forces that are present on earth also help in the recycling of carbon dioxide unlike on Venus where CO₂ is free within the atmosphere. CO₂ is a greenhouse gas that tends to heat a planet beyond control (Venus). Earth also is just the right position from the sun to receive enough energy and not become too hot or too cold. Mars was too distant and less massive and froze. Venus, too close whereby the water vapors trapped the green house gases. Mercury is obviously too close to the sun. Incidentally, due to the nature of the outer solar system planets, life as we know it could never take hold. No gas giant has a solid surface, never mind the crushing pressures of their gaseous atmospheres. Unfortunately, even the moons of

our solar hold no chance of supporting life as we currently know it. No moon, regardless of geological activity or potential has oxygen and liquid water available in a temperate climate. The few moons where we suspect liquid water to exist is trapped under miles of ice or crust and mantle where atmospheres are thin. Thus far, only the Earth has presented us with ideal conditions for life as we know it. As our knowledge stands now of the solar system, and of the universe in general, life, to thrive, needs at least the basic conditions found here on planet Earth to survive and take hold. However, the phrase "life as we know it" is a disclaimer that discounts other forms of life that have evolved within ecosystems unlike those of Earth. Life forms that we have yet to discover. References The Cosmic Perspective, Third Edition Bennett, et al, 2004 [http://www. etymonline. com/](http://www.etymonline.com/) [http://www. onlineconversion. com/temperature. htm](http://www.onlineconversion.com/temperature.htm)