

Solar System Physical Data

Physical Properties of Solar System Members

	Equatorial Diameter		Mass ¹	Density ²	Gravity ³	Albedo ⁴
	miles	km	Earth=1	H ₂ O=1	Earth=1	
SUN	865,278 miles	1,392,530 km	332,946	1.41	27.9	n/a
MERCURY	3,032 miles	4,879 km	0.055	5.43	0.38	11%
VENUS	7,521 miles	12,104 km	0.815	5.25	0.90	65%
EARTH	7,926 miles	12,756 km	1	5.52	1.00	37%
MARS	4,228 miles	6,805 km	0.107	3.95	0.38	15%
JUPITER	88,844 miles	142,980 km	317.8	1.33	2.53	52%
SATURN	74,900 miles ⁵	120,540 km ⁵	95.2	0.69	1.06	47%
URANUS	31,764 miles	51,120 km	14.5	1.29	0.90	51%
NEPTUNE	30,777 miles	49,530 km	17.2	1.64	1.14	41%
PLUTO	1,433 miles	2,306 km	0.0025	2.03	0.08	30%

¹Earth's mass is 1.32×10^{25} pounds (5.97×10^{24} kg). ²Density per unit volume as compared to water. For comparison, the density of aluminum is 2.7 and iron is 7.7. ³Gravity at equator. ⁴Albedo is the amount of sunlight reflected by the Planet. ⁵Saturn without rings. Visible rings are approximately 170,000 miles (273,600 km) in diameter.

	Rotational Period	Escape Velocity ¹		Oblateness ²	Inclination
	(Planet's Day)	miles/s	km/s		to Orbit ³
SUN	25 to 35 days ⁴	384 miles/s	617.5 km/s	0	7.2 ⁵
MERCURY	58.7 days	2.6 miles/s	4.2 km/s	0	0.0 [∞]
VENUS	243.0 days	6.5 miles/s	10.4 km/s	0	177.4 [∞]
EARTH	1 day	6.96 miles/s	11.2 km/s	0.34%	23.4 [∞]
MARS	24.62 hours	3.1 miles/s	5.0 km/s	0.74%	25.2 [∞]
JUPITER	9.84 hours	37 miles/s	59.5 km/s	6.5%	3.1 [∞]
SATURN	10.23 hours	22.1 miles/s	35.5 km/s	9.8%	25.3 [∞]
URANUS	17.9 hours	13.2 miles/s	21.3 km/s	2.3%	97.9 [∞]
NEPTUNE	19.2 hours	14.6 miles/s	23.5 km/s	1.7%	28.3 [∞]
PLUTO	6.4 days	0.8 miles/s	1.3 km/s	unknown	123 [∞]

¹At equator. ²Bulging at the equator caused by rotation of Planet on axis. Percentage indicates the amount of extra equatorial diameter as compared to the polar diameter. ³Inclination of Planet's rotational axis to Planet's orbit around Sun. ⁴Sun rotates about 10 days faster at its equator than at its poles. ⁵Inclination of Sun's rotational axis to Earth's orbit.

Facing page. A closeup of the Great Red Spot and surrounding clouds on Jupiter. The Great Red Spot is at the top of this picture and is physically larger than Earth. This hurricane-type vortex spans 25,000 miles (40,000 kilometers).

Solar System Orbital Data

Solar System Atmospheres

Orbital Properties of Solar System Members

Atmospheres of Solar System Members

	Average Distance from Sun ¹			Eccentricity ³
	Astronomical Units (AU) ²	Miles	Kilometers	
MERCURY	0.387	35,980,000	57,910,000	2.2%
VENUS	0.723	67,230,000	108,200,000	0.003%
EARTH	1.000	92,955,800	149,597,870	0.015%
MARS	1.524	141,640,000	227,940,000	0.44%
JUPITER	5.203	483,630,000	778,330,000	0.16%
SATURN	9.539	886,680,000	1,426,980,000	0.16%
URANUS	19.191	1,783,950,000	2,870,990,000	0.12%
NEPTUNE	30.061	2,794,350,000	4,497,070,000	0.004%
PLUTO	39.529	3,674,490,000	5,913,520,000	3.3%

	Description of Atmosphere	Temperature
MERCURY	No atmosphere ¹	800 [∞] F Day (427 [∞] C) -300 [∞] F Night (-184 [∞] C)
VENUS	96% Carbon Dioxide, 3.5% Nitrogen <i>Atmospheric Pressure: 90 bars</i>	Averages 900 [∞] F (482 [∞] C)
EARTH	77% Nitrogen, 21% Oxygen, 1% Water, 1% Argon <i>Atmospheric Pressure: 1 bar</i>	Averages 59 [∞] F (15 [∞] C) Highest 136 [∞] F (58 [∞] C) Lowest -129 [∞] F (-89 [∞] C)
MARS²	95% Carbon Dioxide, 2.7% Nitrogen, 1.6% Argon, 0.2% Oxygen <i>Atmospheric Pressure: 0.007 bar</i>	Averages -67 [∞] F (-55 [∞] C) High 80 [∞] F (27 [∞] C) Low -207 [∞] F (-133 [∞] C)
JUPITER³	90% Hydrogen Gas, 10% Helium Gas	-243 [∞] F (-153 [∞] C) just below cloudtops
SATURN³	97% Hydrogen Gas, 3% Helium Gas	-301 [∞] F (-185 [∞] C) just below cloudtops
URANUS³	83% Hydrogen Gas, 15% Helium Gas 2% Methane Gas	-323 [∞] F (-197 [∞] C) just below cloudtops
NEPTUNE³	74% Hydrogen Gas, 25% Helium Gas 1% Methane Gas	-373 [∞] F (-225 [∞] C) just below cloudtops
PLUTO	100% Methane Gas? Some Nitrogen? <i>Extremely low atmospheric pressure</i>	-419 [∞] F (-233 [∞] C)

¹The Planets' orbits around the Sun are ellipses, not circles. Thus, they have a closest and farthest distance to the Sun. ²One astronomical unit is the average distance of the Earth to the Sun, 92,955,800 miles. ³Eccentricity is normally expressed as a decimal and represents the elongation of a Planet's elliptical orbit. Ellipses have both a major (longer) and minor (shorter) axis. For clarity, I have expressed eccentricity as a percentage indicating how much longer the major axis is as compared to the minor axis. Although the Planets' orbits are ellipses, all nine have orbits that are very close to circles. Seven of the Planets have eccentricities less than 1%.

¹Mercury has no atmosphere in the conventional sense, however, there are trace quantities of Helium, Sodium and Oxygen and an atmospheric pressure of 10⁻¹⁵ bars. ²Since the atmospheric pressure on Mars is low, temperature can decrease by as much as 18 F[∞] (10 C[∞]) from the surface to a height of just 3 feet (1 meter). ³Jupiter, Saturn, Uranus and Neptune are Gas Giants and thus do not have, in the conventional sense, a surface below the clouds. Therefore, they do not have a reference point from which to measure a standard atmospheric pressure.

	Revolution Around Sun (Planet's Year)	Average Orbital Velocity		Inclination of Orbit to Earth's Orbit
MERCURY	87.97 days	29.76 miles/s	47.89 km/s	7.00 [∞]
VENUS	224.70 days	21.77 miles/s	35.03 km/s	3.39 [∞]
EARTH	365.26 days	18.51 miles/s	29.79 km/s	0.00 [∞]
MARS	686.98 days	14.99 miles/s	24.13 km/s	1.85 [∞]
JUPITER	11.86 years	8.12 miles/s	13.06 km/s	1.31 [∞]
SATURN	29.42 years	5.99 miles/s	9.64 km/s	2.49 [∞]
URANUS	83.75 years	4.23 miles/s	6.81 km/s	0.77 [∞]
NEPTUNE	163.73 years	3.37 miles/s	5.43 km/s	1.77 [∞]
PLUTO	248.03 years	2.95 miles/s	4.74 km/s	17.15 [∞]

Solar System Moons

Major Moons of the Planets¹

	Moon Name	Average Distance from Planet ²	Revolution Period ³	Diameter	Visual Magnitude ⁴
MERCURY	<i>Mercury has no moons</i>				
VENUS	<i>Venus has no moons</i>				
EARTH	<i>Earth has 1 moon</i>				
	Moon	238,920 miles 384,500 km	27.3 days	2,160 miles 3,476 km	-12.7
MARS	<i>Mars has 2 moons</i>				
	Phobos	5,830 miles 9,380 km	7.7 hours	17x13 miles 27 x 21 km	11.6
	Deimos	14,580 miles 23,460 km	1.3 days	10 x 8 miles 16 x 13 km	12.7
JUPITER	<i>Jupiter has 63 known moons⁵ (This count will most likely rise)</i>				
	Io	262,000 miles 421,600 km	1.77 days	2,255 miles 3,629 km	5.0
	Europa	416,900 miles 670,900 km	3.55 days	1,950 miles 3,138 km	5.3
	Ganymede	664,900 miles 1,070,000 km	7.16 days	3,270 miles 5,261 km	4.6
	Callisto	1,171,000 miles 1,885,000 km	16.69 days	2,980 miles 4,800 km	5.6
SATURN	<i>Saturn has 56 known moons⁶ (This count will most likely rise)</i>				
	Mimas	116,200 miles 187,000 km	0.9 days	242 miles 390 km	12.5
	Enceladus	147,900 miles 238,000 km	1.4 days	311 miles 500 km	11.8
	Tethys	183,300 miles 295,000 km	1.9 days	659 miles 1,060 km	10.3
	Dione	234,900 miles 378,000 km	2.7 days	699 miles 1,120 km	10.4
	Rhea	326,800 miles 526,000 km	4.5 days	951 miles 1,530 km	9.7
	Titan	758,100 miles 1,221,000 km	15.9 days	3,200 miles 5,150 km	8.4
	Iapetus	2,212,700 miles 3,561,000 km	79.3 days	907 miles 1,460 km	11.0



Facing page. Titan, Saturn's largest moon has a nitrogen/methane atmosphere. The inset shows Titan's surface as imaged by the Huygen's probe in 2005.

Solar System Moons

Solar System Comparison

Major Moons of the Planets¹

Moon Name	Average Distance from Planet ²	Revolution Period ³	Diameter	Visual Magnitude ⁴
URANUS <i>Uranus has 27 known moons⁷ (This count will most likely rise)</i>				
Ariel	118,600 miles 190,900 km	2.5 days	721 miles 1,160 km	14.0
Umbriel	165,300 miles 266,000 km	4.1 days	739 miles 1,190 km	14.9
Titania	271,100 miles 436,300 km	8.7 days	1,000 miles 1,610 km	13.9
Oberon	362,500 miles 583,400 km	13.5 days	963 miles 1,550 km	14.1
NEPTUNE <i>Neptune has 13 known moons⁸ (This count will most likely rise)</i>				
Triton	220,000 miles 354,000 km	5.9 days	1,678 miles 2,700 km	13.6
Nereid¹	3,423,800 miles 5,510,000 km	365.2 days	211 miles 340 km	19.7
PLUTO¹⁰ <i>Pluto has 3 known moons⁹ (This count could rise)</i>				
Charon	11,900 miles 19,100 km	6.4 days	746 miles 1,200 km	17

NOTE: All moon data and counts are current as of June, 2006.

¹Data for only the major moons are provided because the lesser moons are small and require large telescopes and photographic means to identify. A typical example of these lesser moons is Nereid, Neptune's second largest moon, which is listed in this table. ²Distance measured from center of Planet. ³Orbit around Planet. ⁴Visual magnitude from Earth at Planet's closest approach. ⁵The named moons of **JUPITER** are (from innermost to outermost): Metis,Adrastea, Amalthea, Thebe, Io, Europa, Ganymede, Callisto, Themisto, Leda, Himalia, Lysithea, Elara, Carpo, Euporie, Thelxinoe, Euanthe, Helike, Orthosie, Iocaste, Ananke, Praxidike, Harpalyke, Hermippe, Orthosie, Thyone, Mneme, Aitne, Kale, Taygete, Chaldene, Erinome, Aoede, Kallichore, Kalyke, Eurydome, Pasithee, Cyllene, Eukelade, Hegemone, Arche, Isonoe, Pasipaë, Sinope, Sponde, Autonoe, Callirrhoe and Megaclite. ⁶The named moons of **SATURN** are (from innermost to outermost): Pan, Daphnis, Atlas, Prometheus, Pandora, Epimetheus & Janus, Mimas, Methone, Pallene, Enceladus, Tethys & Telesto & Calypso, Dione & Polydeuces & Helene, Rhea, Titan, Hyperion, Iapetus, Kiviuq, Ijiraq, Phoebe, Paaliaq, Skathi, Albiorix, Erriapo, Siarnaq, Tarvos, Mundilfari, Narvi, Suttungr, Thrymr and Ymir. ⁷The named moons of **URANUS** are (from innermost to outermost): Cordelia, Ophelia, Bianca, Cressida, Desdemona, Juliet, Portia, Rosalind, Cupid, Belinda, Perdita, Puck, Mab, Miranda, Ariel, Umbriel, Titania, Oberon, Francisco, Caliban, Stephano, Trinculo, Sycorax, Margaret, Prospero, Setebos and Ferdinand. ⁸The named moons of **NEPTUNE** are (from innermost to outermost): Naiad, Thalassa, Despina, Galatea, Larissa, Proteus, Triton, Nereid and Psamathe. ⁹The named moons of **PLUTO** are (from innermost to outermost): Charon, Nix and Hydra.

¹⁰See page 155 for a discussion about Pluto's planetary status.

QUICK COMPARISON of Solar System Members

	Distance from Sun ¹		Diameter ³	Mass ⁴	Volume ⁵
	Earth = 1	Light T ime ²	Earth = 1	Earth = 1	Earth = 1
SUN	n/a	n/a	109	333,000	1,300,000
MERCURY	0.4	3.2 minutes	0.4	0.06	0.06
VENUS	0.7	6 minutes	0.95	0.8	0.9
EARTH	1	8.3 minutes	1	1	1
MARS	1.5	12.7 minutes	0.5	0.1	0.15
JUPITER	5.2	43.3 minutes	11.2	318	1,326
SATURN	9.5	1h 19min	9.5	95	771
URANUS	19	2h 40min	4	15	63
NEPTUNE	30	4h 10min	3.8	17	58
PLUTO	39.5	5h 29min	0.2	0.003	0.006

¹The average distance from the Earth to the Sun is 92,955,800 miles (149,597,870 km) and is also known as 1 astronomical unit (AU). ²The time it takes for light to travel from the Sun to the respective Planet. Light travels at 186,282 miles/sec (299,792 km/sec). ³Earth's equatorial diameter is 7,926 miles (12,756 km). ⁴Earth's mass is 1.32×10^{25} pounds (5.97×10^{24} kg). ⁵Earth's volume is 2.6×10^{11} cubic miles (1.1×10^{12} km³).

The eight Planets as imaged by spacecraft. The top four, known as the Terrestrial Planets, are Mercury, Venus, Earth (our Moon is to the right of Earth) and Mars. The bottom four are the Gas Giants — Jupiter Saturn, Uranus and Neptune. Planet sizes are not to scale.



Minor Planets or Asteroids

Major Asteroids¹

Name	Longest Length ²		Average Distance from Sun ³	Orbital Period	Orbital Inclination ⁴
CERES	594 miles	957 km	2.77 AU	4.60 years	10.6°
PALLAS	325 miles	524 km	2.77 AU	4.62 years	34.8°
VESTA	318 miles	512 km	2.36 AU	3.63 years	7.1°
HYGIEA	276 miles	444 km	3.14 AU	5.56 years	3.8°
INTERAMNIA	204 miles	329 km	3.06 AU	5.36 years	17.3°
DAVIDA	203 miles	326 km	3.17 AU	5.63 years	15.9°
EUNOMIA	199 miles	320 km	2.64 AU	4.30 years	11.7°
EUROPA	188 miles	302 km	3.10 AU	5.46 years	7.5°
JUNO	170 miles	274 km	2.67 AU	4.36 years	13.0°
SYLVIA	162 miles	261 km	3.49 AU	6.52 years	10.9°
EUPHROSYNE	159 miles	256 km	3.15 AU	5.59 years	26.3°
PSYCHE	149 miles	239 km	2.92 AU	5.00 years	3.1°
THISBE	144 miles	232 km	2.77 AU	4.60 years	5.2°
CYBELE	143 miles	230 km	3.43 AU	6.36 years	3.5°
BAMBERGA	142 miles	228 km	2.68 AU	4.39 years	11.1°
PATIENTIA	140 miles	225 km	3.06 AU	5.35 years	15.2°

¹Presented here are the 16 largest asteroids in the asteroid belt between Mars and Jupiter. It is estimated that there are billions of asteroids having a total mass about 1/1,000 of Earth's mass and a total volume equal to half the diameter of our Moon. ²Ceres is the only asteroid that is spherical in shape. These lengths may change with new research. ³For comparison, Mars is 1.5 AU from the Sun and Jupiter is 5.2 AU from the Sun. ⁴Inclination to Earth's orbit.

Near-Earth Asteroids. There are three types of asteroids that approach Earth and are categorized as Aten, Apollo and Amor. **Aten** asteroids, which total about 300 asteroids, orbit inside of Earth's orbit. **Apollo** asteroids have orbits that are slightly larger than Earth's, and **Amor** asteroids orbit inside of Mars' orbit. About 3,200 known Amor-Apollo asteroids could potentially cross Earth's orbit.

Facing page. The asteroid *Ida*, the second asteroid ever to be imaged. This view of *Ida* was returned by the *Galileo* spacecraft in August 1992 on its journey to Jupiter. *Ida* is about 32 miles in length (52 km) and has a small moon, named *Dactyl*, revolving around it. *Dactyl* is about one mile in diameter (1.7 km).

Page 32. Orion is one of the most easily and widely recognized constellations. Many of the constellations that we recognize today were also used in ancient times. The Egyptians not only recognized the stars that make up Orion, they used the three belt stars as a pattern for the alignment and size of the three pyramids at Giza.

