The Scaled Solar System 47942

VOCABULARY

Asteroid - a small, rocky, planet-like object in orbit around the sun.

Asteroid belt - a region between the orbits of Mars and Jupiter that encompasses the orbits of many asteroids.

Astronomical unit (AU) - the average distance between the Earth and the Sun. This distance is approximately 150 million kilometers.

Bow shock - marks the boundary where the supersonic solar wind is abruptly slowed to subsonic speed as it meets the magnetic field (or atmosphere) of a planet. Most of the particles from the solar wind are deflected around the planet, just as water is deflected around the bow of a ship. There is also a bow shock when the interstellar medium meets the heliosphere (the region under the Sun's influence).

Cosmic rays - high-energy charged particles traveling through interstellar space at nearly the velocity of light.

Heliosphere - the part of our galaxy that is swept by our solar wind.

Heliopause - the zone where the solar wind meets the interstellar medium and is deflected back toward the tail of the heliosphere; the outer boundary of the heliosphere.

Interstellar medium - gases and dust in interstellar space.

Kuiper belt - a disk-shaped region past the orbit of Neptune, roughly 30 to 500 AU from the Sun containing many small icy bodies. It is now considered to be the source of the short-period comets.

Kuiper belt objects - small icy bodies located within the Kuiper belt. Varuna and 2001 KX76 are Kuiper belt objects.

Orbit - the closed path traveled by a body that is under the influence of the gravity of another body in space. Some orbits are nearly circular, but the orbits of most planets are *ellipses*—shaped like ovals. Orbit comes from the Latin *orbis,* which means circle.

Orbital range - the distance between the closest and farthest points of an object's orbit from the body it is orbiting.

Solar wind - high speed charged particles, primarily protons and electrons, flowing outward from the Sun.

Solar system - the sun, planets and their natural satellites, asteroids, comets, and other objects that orbit the sun.

Termination shock - where the solar wind first starts to slow down and reverse due to its first encounters with pressure from interstellar space.

REFERENCES

Kaufmann, W.J. III, Freedman, R.A. *Universe*, 5th ed. W.H. Freeman & Co., 1999

	Mercury	Venus	Earth	Mars	
Average distance from Sun	5.79 x 10^7 km (0.387 AU)	1.082 x 10^8 km (0.723 AU)	1.496 x 10^8 km (1.000 AU)	2.279 x 10^8 km (1.524 AU)	
Minimum distance from Sun	4.60 x 10^7 km (0.307 AU)	1.075 x 10^8 km (0.718 AU)	1.471 x 10^8 km (0.983 AU)	2.067 x 10^8 km (1.381 AU)	7.3((4
Maximum distance from Sun	6.98 x 10^7 km (0.467 AU)	1.089 x 10^8 km (0.728 AU)	1.521 x 10^8 km (1.017 AU)	2.492 x 10^8 km (1.666 AU)	8.1((5
Orbital velocity	47.9 km/s	35.0 km/s	29.8 km/s	24.1 km/s	1
Orbital period	87.969 days	224.70 days (most circular orbit)	365.256 days	686.98 days	11
Rotational period	58.646 days	243.01 days (retrograde rotation)	23.9345 hours	24 hours 37 minutes 22 seconds	9 hrs. 5 (shorte
Equatorial diameter	4879 km (0.383 Earth)	12,104 km (0.949 Earth)	12,756 km (1.0 Earth)	6794 km (0.533 Earth)	14 (11
Mass	3.302 x 10^{23}kg	4.869 x 10^{24}kg	5.974 x 10^{24}kg	6.419 x 10^{23}kg	1.8
Average density	5430 kg/m^3	5240 kg/m^3	5515 kg/m^3	3940 kg/m^3	1
Surface gravity (Earth = 1)	0.39	0.91	1.0	0.38	
Average surface temperatures	Day 350 °C Night -170 °C	480 °C	Maximum 60 °C Minimum -90 °C	Maximum 20 °C Minimum -140 °C	
Surface	Heavily cratered with smooth plains between the craters. Scarps (long cliffs up to 500 km long and 3 km high) give it a wrinkled appearance.	Flat with rolling hills. Has 2 major continents and many large volcanoes.	70% water with 7 major continents. Active continental drift and sea-floor rift valleys.	Many flat-bottomed craters, several huge inactive volcanoes, rift valley 4000 km long, dried up riverbeds. No liquid water. Polar ice caps composed of frozen H_2O & CO_2.	rotates fa poles be nature.
Interior	Has an iron core that is 75% of the planet's diameter. Probably partially liquid.	Molten interior.	Inner solid metallic core, partially liquid outer core creating magnetic field, somewhat plastic rocky mantle, and thin crust.	Composed of crust, mantle, and solid core (mostly iron).	Rocky co diameter surround metallic (40,000 finally H2 20,000 k
Atmosphere	Extremely thin, containing sodium and potassium.	Atmospheric pressure = 90Atm. 96% CO_2 & 4% mostly N_2. Covered by clouds of H_2SO_4 & other sulfur compounds. Greenhouse effect.	21% O_2, 77% N_2, 2% CO_2 and other gases.	Cold & thin, made up of 95% CO_2, 37% N_2, 2% other gases. Dust storms cause its pinkish tint.	80% H_2, other ele ovals, su Red Spo Distinct
Moons* (natural satellites)	None	None	The Moon (1)	Deimos (16 x 12 x 10 km) orbits in 30 hours & 18 min. & is the smaller moon. Phobos (28 x 23 x 20 km) orbits in 7 hrs & 39 min. Both resemble large asteroids. (2)	Jupiter h satellites first to b Galileo i Ganyme system), Europa.
Successful missions & launch dates	Mariner 10, launched 1973, collected info and pictures in 1974 during a flyby of Mercury.	1962 Mariner 2 1967 Mariner 5 1974 Mariner 10 1967 - 1983 Venera 4-16 (Soviet Union) 1978 Pioneer Venus 1 & 2 1984 Vega 1 & 2 (Soviet Unoin) 1989 Magellan	Many satellites - military, communications, weather, navigational, and scientific. Many spacecraft have been sent to the Moon, including Apollo manned missions.	1960s Mariner 4, 6, and 7 1971 Mariner 9 1975 Viking Orbiters & Landers 1996 Mars Global Surveyor 1996 Mars Pathfinder 1998 Nozomi (Japan)	1972 Pic 1973 Pic 1979 Vo 1979 Vo 1989 Ga Galileo Jupiter's

Information on this chart was taken from NASA websites and the 5th edition of *Universe* by W.J. Kaufmann III &, R.A. Freedman.
*Discovery of moons is ongoing. For an up-to-date listing of moons, go to http://ssd.jpl.nasa.gov/sat_props.html.

	Jupiter	Saturn	Uranus	Neptune	Pluto
	7.783 x 10^8 km (5.203 AU)	1.429 x 10^9 km (9.554 AU)	2.875 x 10^9 km (19.22 AU)	4.504 x 10^9 km (30.11 AU)	5.916 x 10^9 km (39.54 AU)
	7.306 x 10^8 km (4.950 AU)	1.350 x 10^9 km (9.025 AU)	2.742 x 10^9 km (18.33 AU)	4.464 x 10^9 km (29.84 AU)	4.442 x 10^9 km (29.70 AU)
	8.160 x 10^8 km (5.455 AU)	1.509 x 10^9 km (10.085 AU)	3.008 x 10^9 km (20.11 AU)	4.545 x 10^9 km (30.38 AU)	7.389 x 10^9 km (49.39 AU)
	13.1 km/s	9.7 km/s	6.8 km/s	5.5 km/s	4.7 km/s
	11.86 years	29.42 years	83.75 years	167.73 years	248.0 days
utes	9 hrs. 50 min. 28 sec. (shortest of all planets)	10 hrs. 13 min. 59 sec.	17.24 hours (axis of rotation is 98°) (retrograde rotation)	16.11 hours	6.387 days (retrograde rotation)
	142,984 km (11.209Earth)	120,536 km (9.449Earth)	51,118 km (4.007 Earth)	49,528 km (3.883 Earth)	2300 km (0.180 Earth)
g	1.899 x 10^{27} kg	5.685 x 10^{26} kg	8.663 x 10^{25} kg	1.028 x 10^{26} kg	1.3 x 10^{22} kg
	1330 kg/m^3	690 kg/m^3	1290 kg/m^3	1640 kg/m^3	2030 kg/m^3
	2.5	1.1	0.90	1.1	0.07
0 °C 40 °C	-110 °C	-180 °C	-218 °C	-218 °C	-223 °C
craters, e up water. osed of	The visible surface is the atmosphere. Differential rotation - the equator rotates faster than the poles because of its fluid nature.	The visible surface is the atmosphere. Differential rotation - the equator rotates faster than the poles because of its fluid nature.	The visible surface is the atmosphere. Differential rotation.	The visible surface is the atmosphere.	Icy, rocky body similar to Kuiper belt or Oort cloud object. Surface covered with methane ice, nitrogen ice, and carbon monoxide ice.
mantle, ly iron).	Rocky core (20,000 km diameter), surrounded by liquid metallic hydrogen (40,000 to 50,000 km), finally H_2 gas 10,000 to 20,000 km thick).	Rocky core, surrounded by a liquid metallic H layer, surrounded by a gaseous H layer. Emits more radiation than it receives.	Rocky core surrounded by highly compressed water. Outer layer of liquid hydrogen & liquid helium.	Rocky core surrounded by highly compressed water. Outer layer of liquid hydrogen & liquid helium.	Rock and ice.
o of :s	80% H_2, 19% He, 1% other elements. Colored ovals, such as the Great Red Spot, are giant storms. Distinct bands of clouds.	88% H_2, 11% He, 1% other elements. Hazy cloud banding. Spectacular rings made of particles of dirty ice.	84% H_2 and 14% He, and 2% CH_4. Faint bands. Narrow dark rings of carbon compounds.	84% H_2 and 14% He, and 2 % CH_4. Faint bands, more pronounced than Uranus. Narrow dark rings of carbon compounds. Huge dark storm area. High altitude white clouds of methane ice crystals.	Very thin atmosphere composed of N_2, and CO.
0 km) 18 min. on. 0 km) nin.	Jupiter has 28 natural satellites. The largest and first to be discovered, by Galileo in 1610, are Ganymede (largest in solar system), Io, Callisto, and Europa. Currently (79)	Titan (2nd largest in solar system), Mimas, Enceladus, Tethys, Dione, Rhea, Iapetus, Phoebe, & 22 additional natural satellites. (82)	Titania, Oberon, Ariel, Umbriel, Miranda and 15 additional natural satellites. (27)	Triton, Neried, and six additional natural satellites, discovered by Voyager 2. (14)	Charon is Pluto's moon. Pluto has a highly elliptical orbit, at times closer to the Sun than Neptune. Pluto & Charon are exceptionally similar in mass, size, & density. (5)
and 7 er n)	1972 Pioneer 10 1973 Pioneer 11 1979 Voyager 1 1979 Voyager 2 1989 Galileo (orbiter) Galileo dropped probe into Jupiter's atmosphere and took reading for an hour before being crushed. 1990 Ulysses (flyby)	1973 Pioneer 11 1977 Voyager 1 1977 Voyager 2 1997 Cassini (will arrive Saturn in 2004) with Huygens (a probe that will enter Titan's atmosphere.)	1977 Voyager 2 (flyby in 1986)	1977 Voyager 2 (flyby in 1989)	None

A. Freedman.

Websites:

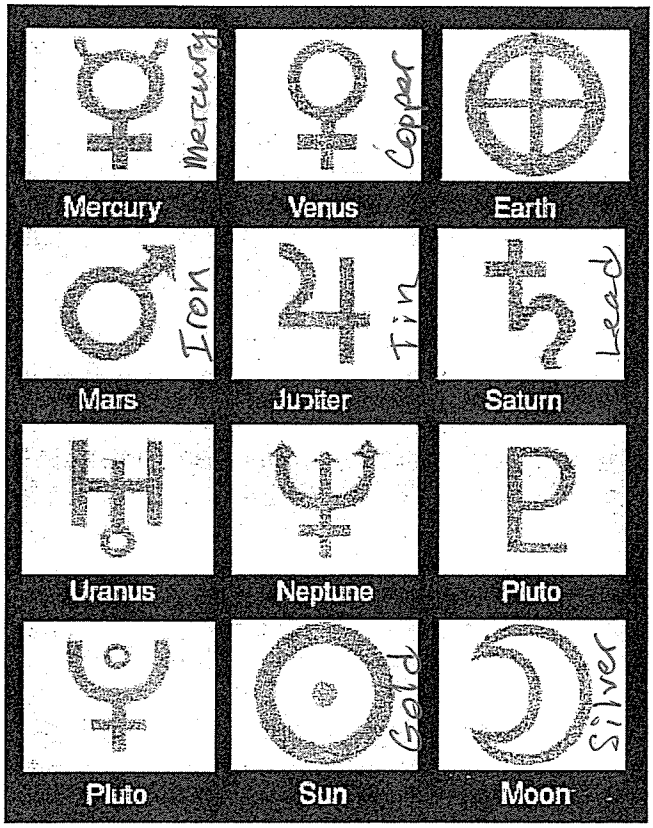
GOES-M	www.earth.nasa.gov/missions/ref_web/mgoes.htm
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Hubble Space Telescope	http://hubble.gsfc.nasa.gov/ http://hubble.stsci.edu/ http://hubble.esa.int/
Chandra	http://chandra.nasa.gov/ http://www1.msfc.nasa.gov/NEWSROOM/background/facts/cxoquick.htm
Cassini	http://www.jpl.nasa.gov/missions/current/cassini.html http://www.jpl.nasa.gov/cassini/Mission/ http://www.jpl.nasa.gov/cassini/
Galileo	http://www.jpl.nasa.gov/missions/current/galileo.html
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Mars Global Surveyor	http://www.jpl.nasa.gov/missions/current/marsglobalsurveyor.html http://mars.jpl.nasa.gov/mgs/
Stardust	http://www.jpl.nasa.gov/missions/current/stardust.html http://stardust.jpl.nasa.gov/ http://neo.jpl.nasa.gov/missions/stardust.html
Mars Odyssey	http://www.jpl.nasa.gov/missions/current/2001marsodyssey.html http://mars.jpl.nasa.gov/odyssey/index.html
Genesis	http://www.jpl.nasa.gov/missions/current/genesis.html http://genesismission.jpl.nasa.gov/
SOHO	http://sohowww.nascom.nasa.gov/
FUSE	http://fuse.pha.jhu.edu/
COBE	http://space.gsfc.nasa.gov/astro/cobe/ http://www.gsfc.nasa.gov/gsfc/spacesci/sentinel/cobe.htm
HETE-2	http://space.mit.edu/HETE/
NEAR	http://neo.jpl.nasa.gov/missions/near.html
Space Science	http://map.gsfc.nasa.gov/ http://www.nasa.gov/ http://spacescience.nasa.gov/missions/index.htm http://www.jpl.nasa.gov/index.html
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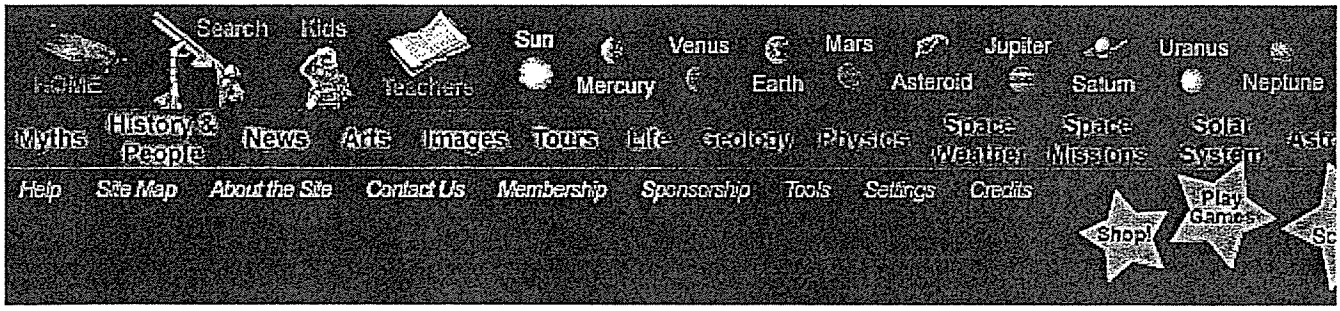
What are the most commonly used symbols for the planets, the Sun, and the Moon? What is the symbol for Venus?



Here they are!

Submitted by Ardith (age 45), and Ashley (age 10)
(January 26, 1999)

* Greek-Roman Symbols for the Planets,
* Also used to represent metals by Alchemists in the Middle Ages,
* Also used in Astrology today.



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