

MISSION TO MARS

PROJECT BASED LEARNING



Mission to Mars: Project Based Learning Mars as a Solar System Body

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<http://www.edb.utexas.edu/missiontomars/bench/bench.html>

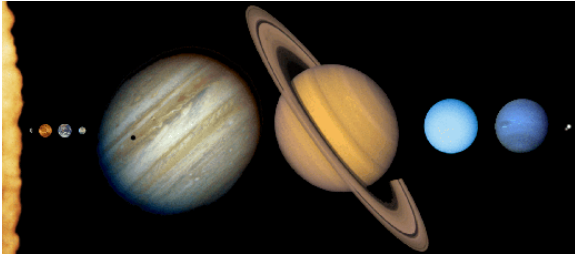
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Mars as a Solar System Body

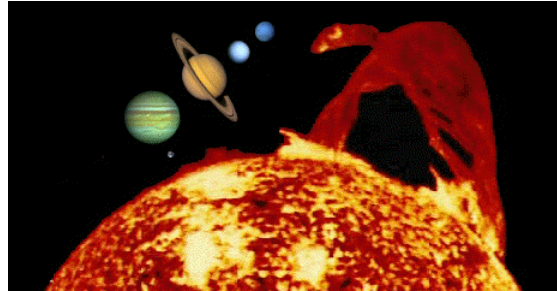
By: Elisabeth Ambrose

Place in the Solar System



The Solar System. NASA/JPL.

This picture depicts the correct relative sizes of the 9 planets of the Solar System in the correct order. The planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. Mars is the fourth planet from the Sun. It is one of the four inner planets. Mars orbits at a distance of 1.52 Astronomical Units (227,940,000 km) from the Sun. One Astronomical Unit is equal to 1.496×10^8 km, the average distance from the Earth to the Sun. Astronomical Units are abbreviated A.U. Its orbit is situated between those of Earth and the Asteroid Belt.

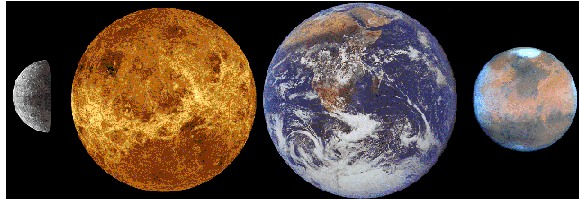


Sun and planets. NASA/JPL.

This picture depicts the four gas giant planets (Jupiter, Saturn, Uranus, and Neptune), Earth, and the Sun. Earth is the tiny dot between Jupiter and the Sun. The relative sizes of the objects are to scale, with 3200 km corresponding to one pixel of the image.

If the relative sizes of the planets were shrunk to be one billionth of its actual size, the Earth would be the size of a large marble (2 cm diameter), Mars would be the size of a pea (1 cm diameter), Jupiter would be the size of a grapefruit, Saturn would be the size of an orange, Uranus and Neptune would each

be the size of lemons, and the Sun would be the size of a tall man.



The relative sizes of the Mercury, Venus, Earth, and Mars. NASA/JPL.

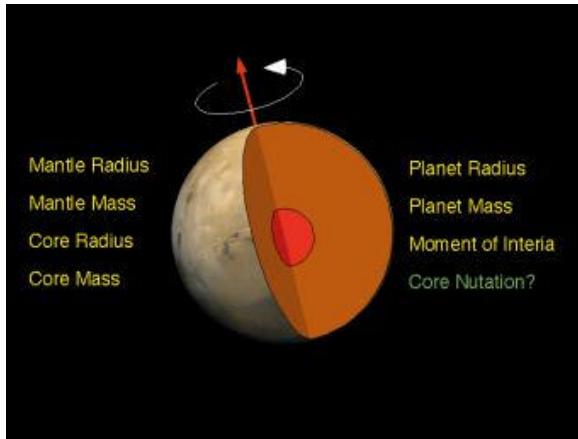
While it is easy to compare the relative sizes of the planets in an image, it is more difficult to compare their relative distances from the Sun. If the Solar System was shrunk to one billionth of its actual size, the Moon would be about 30 centimeters away from the Earth. The Sun would be 150 meters (one and a half football fields) away from the Earth. Mars would be 325 meters away (three football fields), Jupiter would be 750 meters away (5 city blocks), Saturn would be 1500 meters away (10 city blocks), and the nearest star would be more than 40,000 km away (twice the circumference of the Earth!)

From the Earth, Mars looks like a big, reddish star. A somewhat closer view as in this image taken as the Mars Climate Orbiter was approaching the planet, shows the brightly lit side of Mars that is facing the Sun.

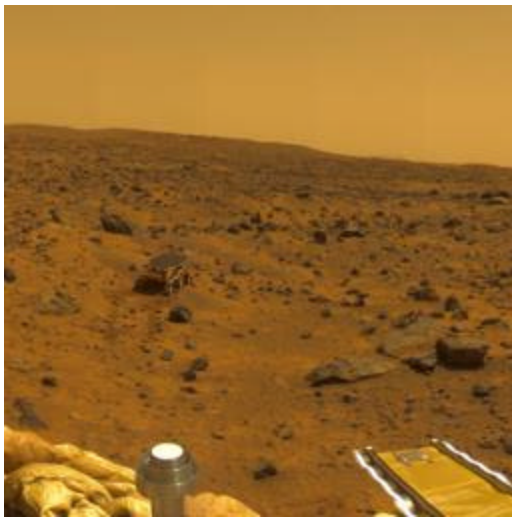
Physical Properties and Composition

Mars has a mass of 6.4×10^{23} kg, or about 100 times less than the mass of Earth. It has a diameter of 6,000 km, or about half that of Earth. The surface area of Mars is about the same as the land area of Earth. There is no evidence of current plate tectonic activity or active volcanism on Mars, although there is evidence to suggest that such phenomena have been present in the past. Mars is made of an inner core with a 1700 km radius, a molten mantle, and a very thin crust that ranges from 80 km to 30 km thick in places. The planet is made mostly of iron. In fact, iron oxide (rust) on the surface of Mars is what

makes the so-called “Red Planet” appear red.



The interior of Mars. NASA/JPL.



The surface of Mars. NASA/JPL.

Because Mars is not very massive, it can retain only a thin atmosphere of mostly carbon dioxide. Carbon dioxide makes up 95.3 percent of the atmosphere, while nitrogen at 2.7 percent, argon at 1.6 percent, oxygen at 0.15 percent, and water at 0.03 percent

make up the remainder. The carbon dioxide on Mars does produce a small greenhouse effect that raises the temperature on the planet about five degrees. The atmosphere is thick enough to produce very large dust storms that can be seen from Earth.



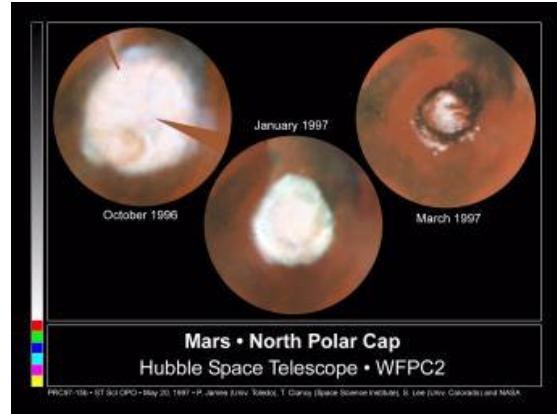
A dust devil on Mars, taken by the Mars Global Surveyor. NASA/JPL.



A Martian sunset, taken by the Imager for Mars Pathfinder. NASA/JPL.

The red and blue colors in this Martian sunset are caused by absorption and scattering of light by dust in the atmosphere.

Mars also has ice caps on both its north and south poles. The ice caps grow and shrink with the seasons, and they are made of both carbon dioxide ice (“dry ice”) and water ice. The ice caps can be seen from Earth.



Martian North Polar Cap. NASA/JPL.

The Moons of Mars

Mars has two moons named Phobos and Deimos, Greek for fear and panic. Phobos is the closer of the two, orbiting Mars 9378 km above the planet’s center. It is very small – the diameter of the moon is only 22 km. It is very odd-shaped, and has a mass of just 1.1×10^{16} kg. It is composed mostly of carbon-rich rock and is heavily cratered. Most astronomers think that Phobos is a captured asteroid.

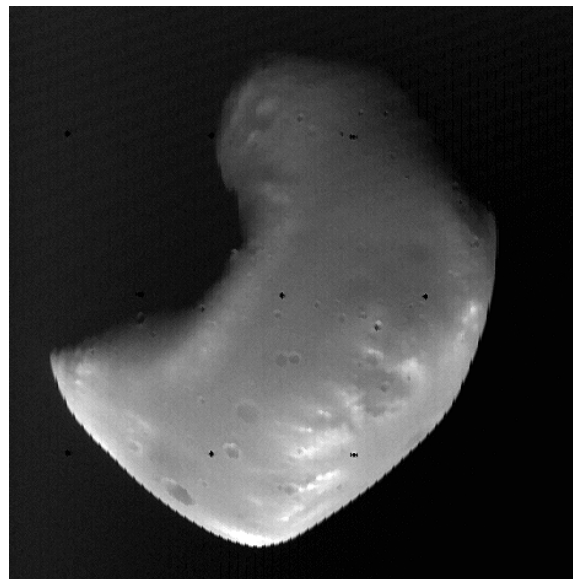
Phobos orbits Mars very quickly. It usually rises, transverse the Martian sky, and sets twice every Martian day. The moon is also very close to Mars’

surface. Just as an airplane flying over the Earth's equator cannot be seen above the horizon for an observer in the United States, Phobos is so close to Mars' surface that it cannot be seen above the horizon from all points on Mars. As it orbits, it slowly spirals in towards the Martian surface. Phobos loses 1.8 meters of altitude per century, and in 50 million years it will either crash into the surface or be destroyed in the atmosphere.



Phobos taken from the Viking 1 Orbiter. NASA/JPL.

Deimos orbits farther out than Phobos, and it is even smaller, with a diameter of only 12.6 km and a mass of 1.8×10^{15} kg. In fact, Deimos is the smallest known moon in the Solar System. Like Phobos, Deimos is made of mostly cratered carbon-rich rock, is very amorphous, and is thought to be a captured asteroid. Like our own Moon, Deimos orbits far enough away from Mars that it is being slowly pushed farther and farther away from the planet.



Deimos, taken from the Viking 2 Orbiter. NASA/JPL.

The Benchmark Lessons were developed with the help of the following sources:

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