**Mars Planet**

MARS [Mars] in astronomy, 4th planet from the sun, with an orbit next in order beyond that of the earth.

**Physical Characteristics**

Mars has a striking red appearance, and in its most favorable position for viewing, when it is opposite the sun, it is twice as bright as Sirius, the brightest star. Mars has a diameter of 4,200 mi (6,800 km), just over half the diameter of the earth, and its mass is only 11% of the earth's mass. The planet has a very thin atmosphere consisting mainly of carbon dioxide, with some nitrogen and argon. Mars has an extreme day-to-night temperature range, resulting from its thin atmosphere, from about 80°F (27°C) at noon to about -100°F (-73°C) at midnight; however, the high daytime temperatures are confined to less than 3 ft (1 m) above the surface.

**Surface Features**

A network of linelike markings first studied in detail (1877) by G. V. Schiaparelli was referred to by him as canali, the Italian word meaning "channels" or "grooves." Percival Lowell, then a leading authority on Mars, created a long-lasting controversy by accepting these "canals" to be the work of intelligent beings. Under the best viewing conditions, however, these features are seen to be smaller, unconnected features. The greater part of the surface area of Mars appears to be a vast desert, dull red or orange in color. This color may be due to various oxides in the surface composition, particularly those of iron. About one fourth to one third of the surface is composed of darker areas whose nature is still uncertain. Shortly after its perihelion Mars has planetwide dust storms that can obscure all its surface details.

Photographs sent back by the Mariner 4 space probe show the surface of Mars to be pitted with a number of large craters, much like the surface of our moon. In 1971 the Mariner 9 space probe discovered a huge canyon, Valles Marineris. Completely dwarfing the Grand Canyon in Arizona, this canyon stretches for 2,500 mi (4,000 km) and at some places is 125 mi (200 km) across and 2 mi (3 km) deep. Mars also has numerous enormous volcanoes—including Olympus Mons (c.370 mi/600 km in diameter and 16 mi/26 km tall), the largest in the solar system—and lava plains. In 1976 the Viking spacecraft landed on Mars and studied sites at Chryse and Utopia. They recorded a desert environment with a reddish surface and a reddish atmosphere. These experiments analyzed soil samples for evidence of microorganisms or other forms of life; none was found. In 1997, Mars Pathfinder landed on Mars and sent a small rover, Sojourner, to take soil samples and pictures. Among the data returned were more than 16,000 images from the lander and 550 images from the rover, as well as more than 15 chemical analyses of rocks and extensive data on winds and other weather factors. Mars Global Surveyor, which also reached Mars in 1997, has returned images produced by its systematic mapping of the surface. The European Space Agency's Mars Express space probe went into orbit around Mars in late 2003 and sent the Beagle 2 lander to the surface, but contact was not established with the lander. The American rovers Spirit and Opportunity landed successfully in early 2004.

Analysis of the satellite data indicates that Mars appears to lack active plate tectonics at present; there is no evidence of recent lateral motion of the surface. With no plate motion, hot spots under the crust stay in a fixed position relative to the surface; this, along with the lower surface gravity, may be the explanation for the giant volcanoes. However, there is no evidence of current volcanic activity. There is evidence of erosion caused by floods and small river systems. The possible identification of rounded pebbles and cobbles on the ground, and sockets and pebbles in some rocks, suggests conglomerates that formed in running water during a warmer past some 2-4 billion years ago, when liquid water was stable and there was water on the surface, possibly even large lakes or oceans. Rovers have identified minerals that only form in the presence of liquid water. There is also evidence of flooding that occurred less that several million years ago, most likely as the result of the release of water from aquifers deep underground. Data received beginning in 2002 from the Mars Odyssey space probe suggests that there is water in sand dunes found in the northern hemisphere.

**Seasonal Changes**

Because the axis of rotation is tilted about 25° to the plane of revolution, Mars experiences seasons somewhat similar to those of the earth. One of the most apparent seasonal changes is the growing or shrinking of white areas near the poles known as polar caps. These polar caps, which are are composed of water ice and dry ice (frozen carbon dioxide). During the Martian summer the polar cap in that hemisphere shrinks and the dark regions grow darker; in winter the polar cap grows again and the dark regions become paler. The seasonal portion of the ice cap is dry ice.

**Astronomical Characteristics**

The mean distance of Mars from the sun is about 141 million mi (228 million km); its period of revolution is about 687 days, almost twice that of the earth. At those times when the sun, earth, and Mars are aligned (i.e., in opposition) and Mars is at its closest point to the sun (perihelion), its distance from the earth is about 35 million mi (56 million km); this occurs every 15 to 17 years. At oppositions when Mars is at its greatest distance from the sun (aphelion) it is about 63 million mi (101 million km) from the earth. It rotates on its axis with a period of about 24 hr 37 min, a little more than one earth day.

**Satellites of Mars**

Mars has two natural satellites, discovered by Asaph Hall in 1877. The innermost of these, Phobos, is about 7 mi (11 km) in diameter and orbits the planet with a period far less than Mars's period of rotation (7 hr 39 min), causing it to rise in the west and set in the east. The outer satellite, Deimos, is about 4 mi (6 km) in diameter.