Chapter 11. Mars and the Search for Life

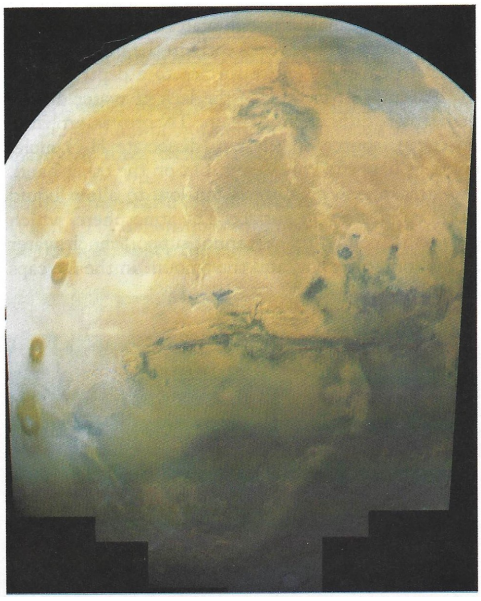


Figure 11.7. The surface of Mars, based on Viking orbiter images.

Note. In this section we survey physical properties of Mars.

Note. Some general facts about Mars include:

Orbital Period	687 days
Rotation Period	24 hours 37 minutes
Tilt of Axis	24°
Surface Gravity	0.38 of Earth's
Albedo	15% on average
Surface Temperature	130° K (−180° F) to 300° K (81° F)

Mars was first closely explored in 1971 by the Mariner 9 orbiter. In 1976 it was visited by Viking 1 and 2 which were both orbiters and landers.

Note. The surface pressure on Mars is 0.006 atmospheres. The air is 95% CO_2. Mars has *polar caps* which a layer of frozen CO_2 and a lower layer of water ice. The caps vary in size due to seasonal variations. Mars' orbit is rather elongated and the Sun's intensity is 1.45 greater at closest approach to the Sun than at aphelion. It is near the Sun in the northern hemisphere winter. This moderates the seasons in the northern hemisphere. During the southern summers, the extra heating creates strong winds that cause *global dust storms*.

Note. Mars' surface can can be classified into two types of terrain: (1) plains, which dominate the northern hemisphere and are covered with lava flows, and (2) rough terrain which is cratered regions and highlands and is older than the plains. One large uplifted region, *Tharsis*, covers nearly 1/4 of the surface. Some suggest tectonic activity created this. *Valles Marineris* is a valley system 4500 km long and up to 700 km across, and 7 km deep. The largest mountain in the solar system is *Olympus Mons* (see Figure 11.11); it is 27 km above the mean surface level with a base 700 km across (Mount Everest is 8.8 km above sea level) and it may be caused by a lack of continental drift over a hot spot.

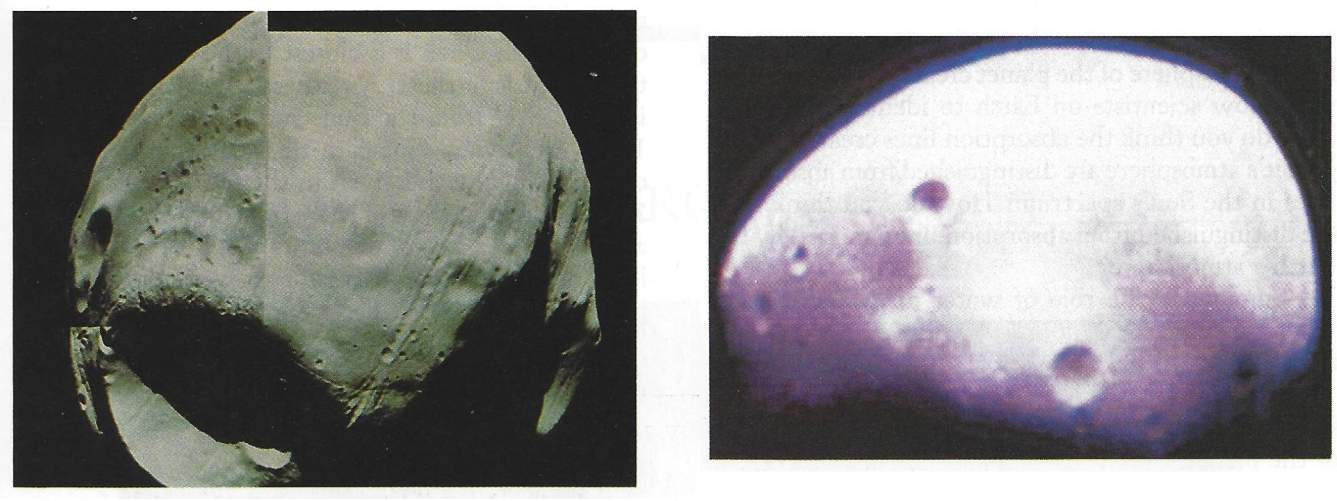
Figure 11.11. Olympus Mons.

Note. There is also *chaotic terrain* which is piles of rocks and rubble apparently indicative of landslides. Adjacent to this are large valleys and flood plains which appear to be due to flowing water. Water may now be in the subsurface rocks and permafrost or could have been lost when there was a change in the atmospheric pressure, or it may be in the polar ice caps. The soil is primarily from the breakdown of igneous rocks. There are high concentrations of silicon and iron. In fact, the iron in the form of iron oxide ("rust") is why Mars is reddish! Mars is not much differentiated; it was not molten for long and it has a thick crust.

Note. Two Martian moons were discovered in 1877: Phobos and Deimos. Some of their properties are:

	Period	**Size (km)**	**Albedo**
Phobos	7 hours 39 minutes	$27 \times 22 \times 19$	0.06
Deimos	30 hours 18 minutes	$15 \times 12 \times 11$	0.07

Both are irregularly shaped and in synchronous rotation with Mars. Phobos has one very large crater and has parallel grooves. These are thought to be the result of a large impact with some melting of subsurface rock (see Figure 11.21) Deimos is fairly smooth with small craters (see Figure 11.22). The origins of the moons of Mars are not understood.



Figures 11.21 and 11.22. The Martian moons Phobos (left) and Deimos (right). These are Viking orbiter images.

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