

Red Planet Mars

Chapter Thirteen

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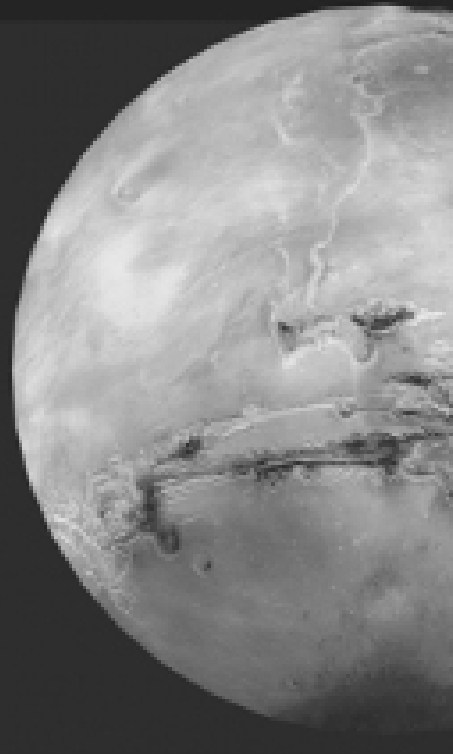
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table 13-1	Mars Data
Average distance from Sun:	1.524 AU = $2.279 \times 10^8$ km
Maximum distance from Sun:	1.666 AU = $2.492 \times 10^8$ km
Minimum distance from Sun:	1.381 AU = $2.067 \times 10^8$ km
Eccentricity of orbit:	0.093
Average orbital speed:	24.1 km/s
Orbital period:	686.98 days = 1.88 years
Rotation period:	$24^{\circ} 39^{\prime} 22^{\prime\prime}$
Inclination of equator to orbit:	$28.19^{\circ}$
Inclination of orbit to ecliptic:	$1.86^{\circ}$
Diameter (equatorial):	4214 km = 0.533 Earth diameter
Mass:	$6.419 \times 10^{23}$ kg = 0.107 Earth mass
Average density:	3934 kg/m <sup>3</sup>
Escape speed:	5.0 km/s
Surface gravity (Earth = 1):	0.38
Albedo:	0.15
Surface temperatures:	Maximum: $20^{\circ}\text{C} = 70^{\circ}\text{F} = 293$ K Mean: $-62^{\circ}\text{C} = -62^{\circ}\text{F} = 220$ K Minimum: $-146^{\circ}\text{C} = -230^{\circ}\text{F} = 133$ K
Atmospheric composition (by number of molecules):	95.3% carbon dioxide (CO <sub>2</sub> ) 2.7% nitrogen (N <sub>2</sub> ) 0.03% water vapor (H <sub>2</sub> O) 2% other gases




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### Guiding Questions

1. When is it possible to see Mars in the night sky?
2. Why was it once thought that there are canals on Mars?
3. How are the northern and southern hemispheres of Mars different from each other?
4. What is the evidence that there was once liquid water on Mars?
5. Why is the Martian atmosphere so thin?
6. What have we learned about Mars by sending spacecraft to land on its surface?
7. What causes the seasonal color changes on Mars?
8. As seen from Mars, how do the Martian moons move across the sky?

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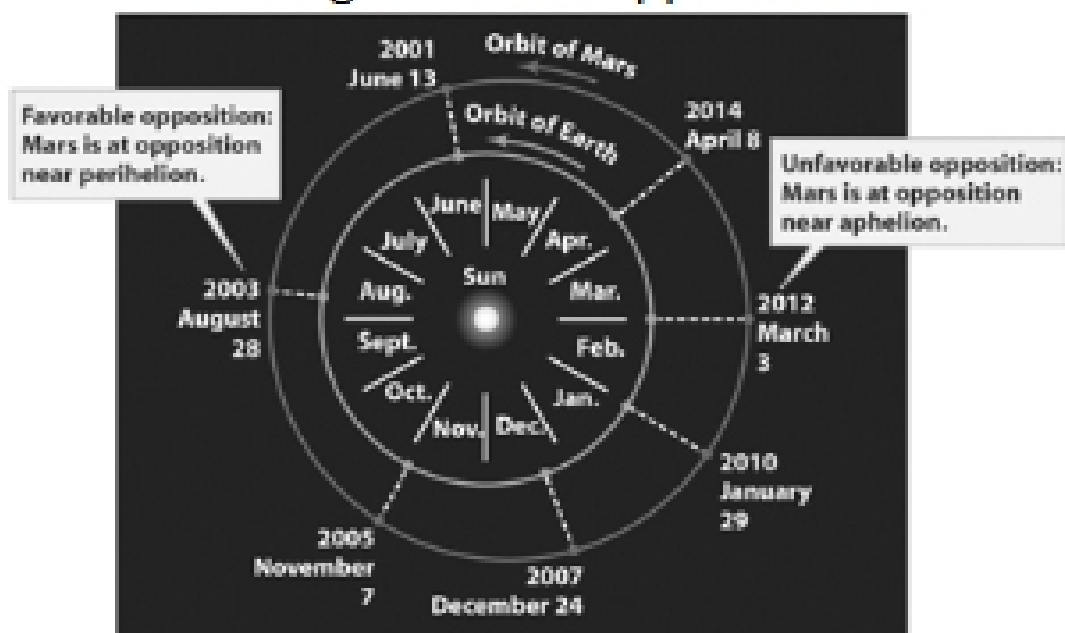
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Earth-based observations of Mars are best made during favorable oppositions



The best Earth-based views of Mars are obtained when Mars is simultaneously at opposition and near perihelion

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Earth-based Observations

- A solar day on Mars is nearly the same length as on Earth
- Mars has polar caps that expand and shrink with the seasons
- The Martian surface undergoes seasonal color changes

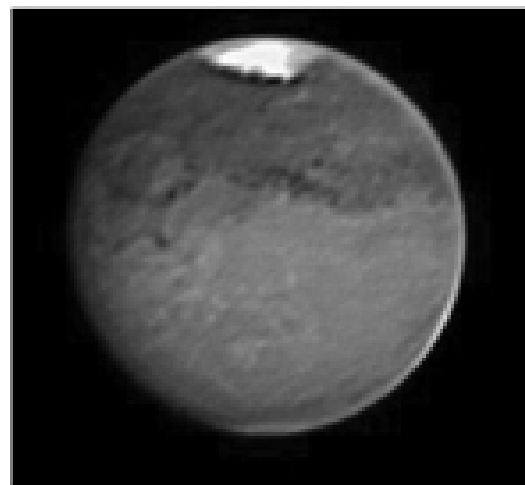


Table 13-2 Oppositions of Mars, 2004-2008

Date of opposition	Earth-Mars distance		Angular diameter (arcsec)
	(AU)	(10 <sup>6</sup> km)	
2005 November 7	0.464	69.4	20.2
2007 December 24	0.589	88.1	15.9

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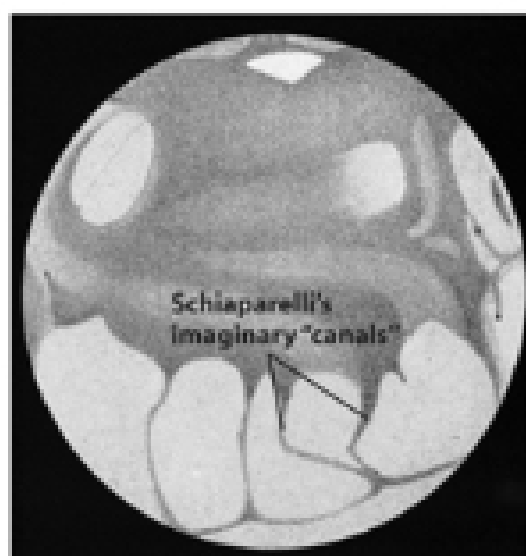
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Earth-based observations were once thought to show evidence of intelligent life on Mars



- A few observers reported a network of linear features called canals
- These observations, which proved to be illusions, led to many speculations about Martian life

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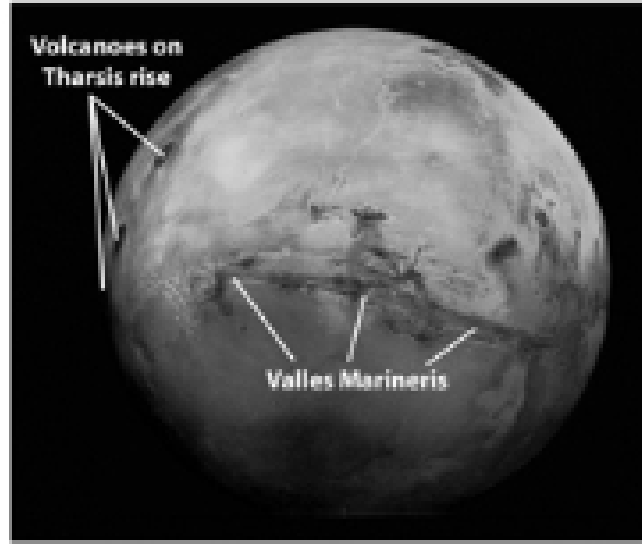
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### Unmanned spacecraft found craters, volcanoes, and canyons on Mars

- The Martian surface has numerous craters, several huge volcanoes, a vast rift valley, and dried-up riverbeds— but no canals
- Martian volcanoes and the Valles Marineris rift valley were formed by upwelling plumes of magma in the mantle



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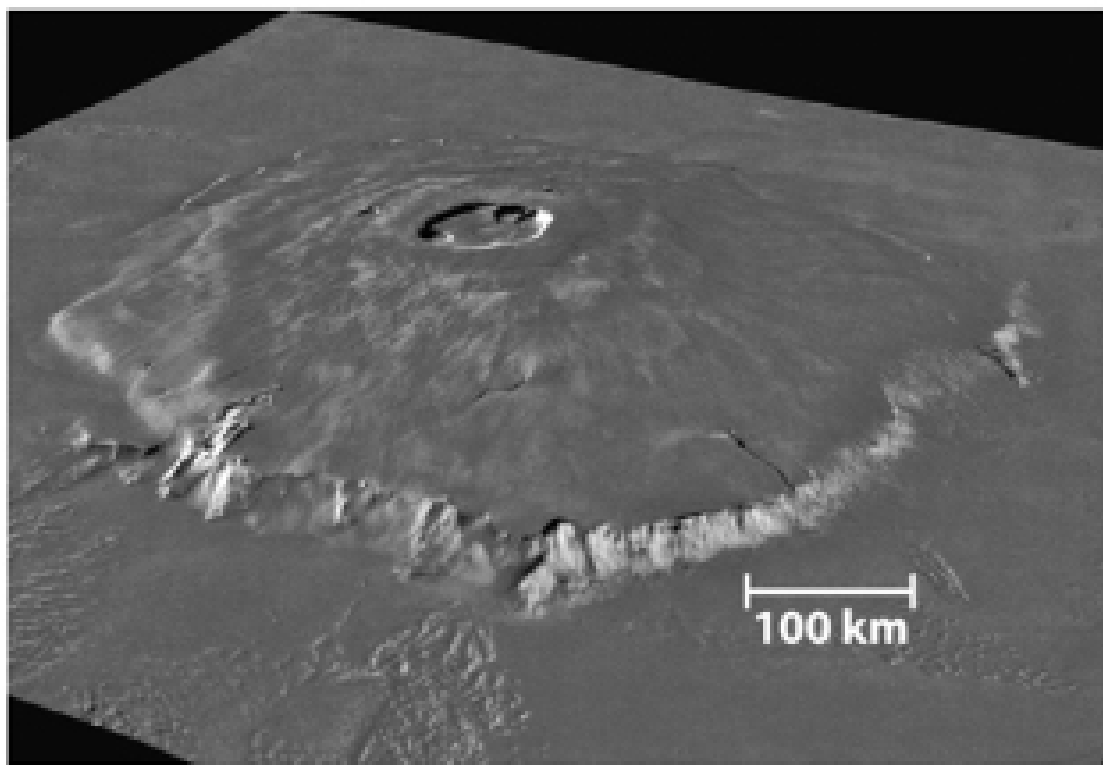
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### Olympus Mons



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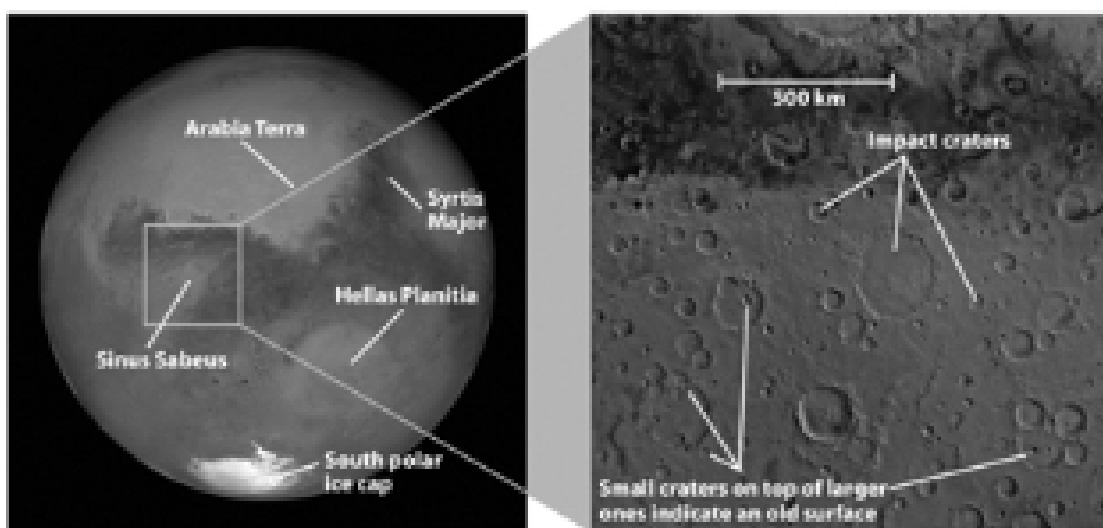
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(a) Mars from the Hubble Space Telescope

(b) Closeup of Sinus Sabeus region

- For reasons that are not understood, the chemical composition of ancient Martian lava is different from that of more recent lava
- Mars has no planet wide magnetic field at present but may have had one in the ancient past

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