Basic properties of Mars

Distance from Sun: 1.52 AU

recall: $F \propto \frac{1}{a^2}$ …so Mars gets ~45% of the sunlight compared to the earth

Orbital eccentricity: e - 0.09 (20% difference between nearest and furthest distance from the Sun)

Orbital period: 1.9 years

Martian day: 24 hours 37 minutes

Radius: 3400km

Mass: ~11% of the mass of the Earth

Immediate implications for habitability:

Less Solar radiation: colder on average on the surface

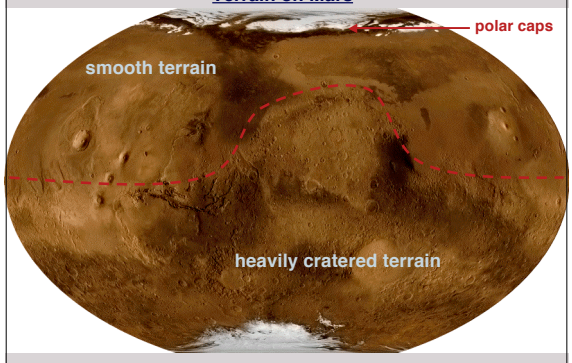
Lower surface gravity:

$$g = \frac{GM}{R^2}$$ G = 6.8 x 10^{-11} Nm^2kg^{-2}

…on the Earth g = 9.8 ms^{-2}, on Mars g = 3.7 ms^{-2}

More difficult for Mars to retain an atmosphere than the Earth

Terrain on Mars

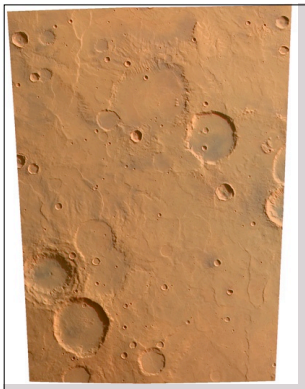


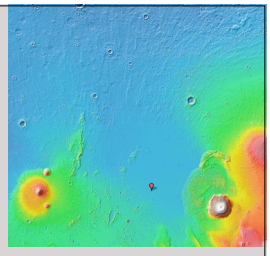
Appearance of the surface correlates with the typical elevation…

Southern hemisphere: heavily cratered (old) surface, with a high mean elevation

Northern hemisphere: less craters (young), with a low mean elevation

Map at www.google.com/mars





Two very different hemispheres on Mars

Geological eras on Mars:

Noachian: 4.6 - 3.8 billion years ago… some of the heavily cratered surface dates from this time

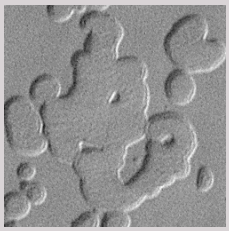
Hesperian: 3.8 - 1.0 billion years ago

Amazonian: 1.0 billion years ago to present

Some, but not all, of the Martian surface has been resurfaced by volcanic activity in relatively recent times

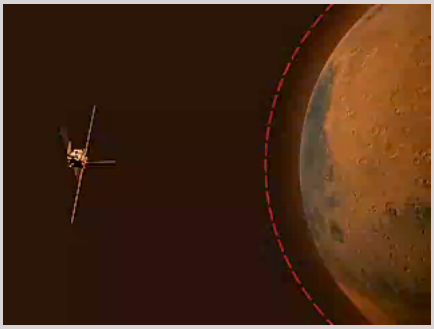
Polar caps

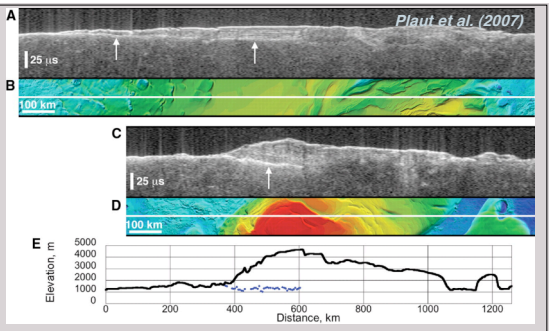
Martian polar caps vary with the seasons - in winter extending to about 60 degrees latitude



Contain water ice, plus a layer of CO_2 ice which thickens in winter and sublimes in summer

Mars Express orbiter has ground penetrating radar that can map the subsurface of the poles





Radar on *Mars Express* suggests a water ice thickness of several km - equivalent to 11m of water spread over surface

Martian atmosphere

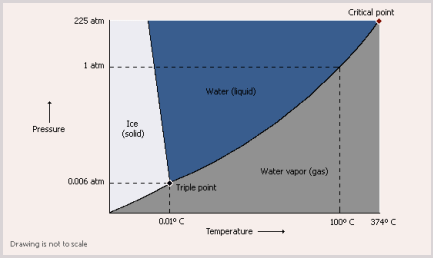
Pressure: ~6 millibar (< 1% of Earth's pressure)

Temperature at surface: 130-300K

Composition: 95% CO_2, 3% N_2, 2% Argon

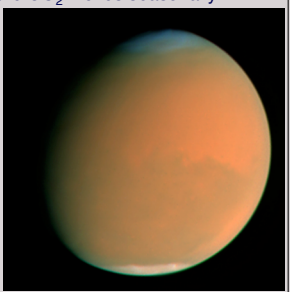
Ozone is present at ~0.01 parts per million - compared with 10 ppm for Earth

Surface is not shielded from solar UV radiation



Martian pressure is quite close to the triple point of water - liquid water on the surface would be short lived… typically water exists only in ice or vapor phases

Martian winds blow from the summer pole to the winter pole: significant fraction of the CO_2 moves seasonally



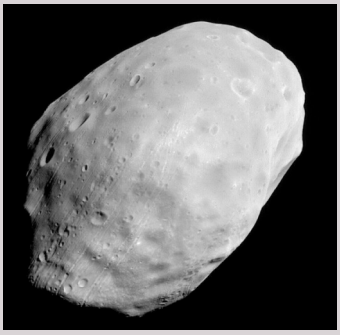
…dust storms on Mars

Satellites

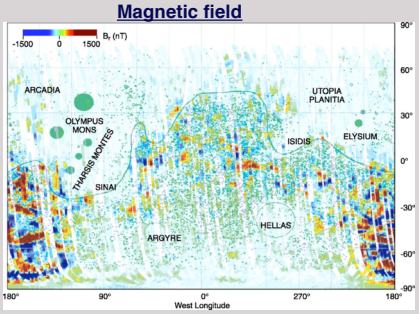
Two small moons: Phobos and Deimos

About 10km across, with density similar to that of some asteroids

May be objects captured from the asteroid belt



Magnetic field



Map of Martian magnetic field from *Mars Global Surveyor* (Acuna et al. 1999)

Old terrain (in the south) appears to be magnetized
Younger terrain (in the north) is unmagnetized

Idea: early in Mars' history the planet supported a magnetic dynamo like the Earth. This early magnetic field became frozen into and preserved within rocks as they cooled… still see that in the old southern region. Region to the north has been melted more recently, after the dynamo ceased… no magnetic field is preserved there.