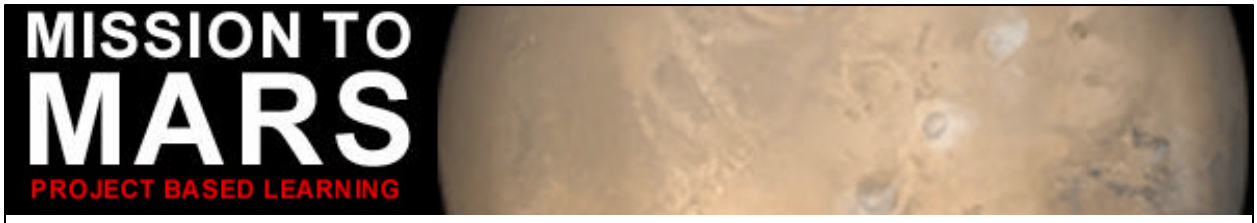

Mission to Mars: Project Based Learning

Conditions on Mars

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

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Conditions on Mars

By: Elisabeth Ambrose

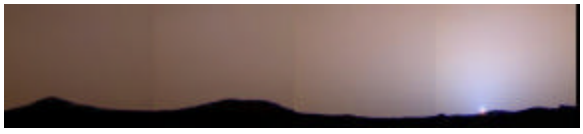
Gravity, etc.

The acceleration due to gravity on the surface of Mars is 3.72 m/s^2, or about 0.38 times of Earth. The surface magnetic field is about 800 times smaller than that of Earth.

Atmosphere (content, density, sky appearance)

Mars has a very thin atmosphere. With a mass of only about 2.4E19 grams, it is about 200 times less massive than the atmosphere of the Earth. Of the entire planet, only about 4 parts out of 100 million are in the atmosphere. The surface pressure on Mars due to the atmosphere is only 7 millibars, or about 0.007 times the pressure of one atmosphere on Earth. Mars' atmosphere is made up of 95.3% carbon dioxide, 2.7% nitrogen, 1.6% argon, 0.13% oxygen, 0.07% carbon monoxide, and about 0.03% water vapor. Mars has 70 times more carbon dioxide than the Earth.

It would not be possible for a person to survive by breathing the Martian atmosphere. The atmosphere is too thin and does not contain enough oxygen to sustain human life. Any astronauts present on the surface would need life support equipment such as space suits to survive. Space suits would also protect the astronauts from harmful radiation that can reach the surface through the thin atmosphere, and from the extremely cold temperatures.

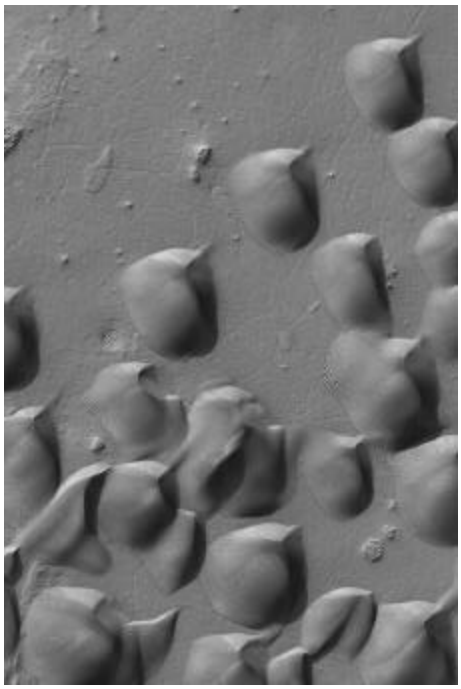


Sunset on Mars. NASA, JPL.

Weather, winds, storms

Storms and carbon dioxide clouds do form on Mars. Evidence of winds on Mars can be seen in this image of dunes formed on the Martian surface. The wind that formed these dunes was blowing from the bottom left to the top right of the image. The image was taken by a camera on the Mars Global Surveyor, and is about 3 km wide.

Unlike Earth, it does not rain on Mars. It is possible for clouds to form in the thin atmosphere, but temperatures are too low to allow liquid water to form. However, water ice fog is often created in the bottoms of Martian canyons in early morning, and frost can form in many places on the surface.



Martian sand dunes. NASA/JPL.

Temperatures, seasons, climate

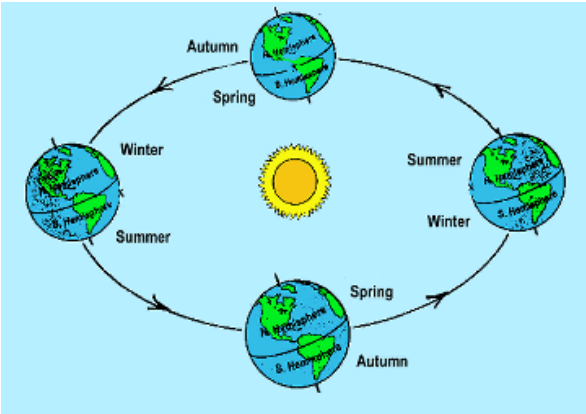
The average surface temperature on Mars ranges from 180 to 270 K, or –93 degrees C to –3 degrees C (-135 degrees F to 26 degrees F). Daytime temperatures range from 216-226 K (-57 to -47 degrees C, or –71 to –53 degrees F), and nighttime temperatures range from 153-208 K (-120 to –65 degrees C, or –184 to –85 degrees F).

Like Earth, Mars experiences changes of seasons. On any planet,

changes of season are caused by the tilt of the planet's axis. As a result of a planet's axial tilt, the north pole of a planet's axis points toward the Sun at times in its orbit around the Sun, and at other times, it points away from the Sun.

As an example, when the north pole of Earth's axis is pointing toward the Sun, the northern hemisphere receives the most direct rays of sunlight. The Sun travels very high in the sky during this time, and the number of daylight hours per day is increased. With longer days and more direct sunlight, the northern hemisphere is heated, causing summer. At the same time, the opposite is true for the southern hemisphere. That part of the Earth receives the least amount of direct rays of sunlight, the sun is very low in the sky, and the days are very short. This causes the southern hemisphere to experience winter.

Conversely, when the north pole of the Earth's axis is pointing away from the Sun, the northern hemisphere receives the least direct rays of sunlight. The Sun travels is very low in the sky during this time, and the number of daylight hours per day is decreased. With shorter days and less direct sunlight, the northern hemisphere is cooled, causing winter. At the same time, the opposite is true for the southern hemisphere. That part of the Earth receives the most amounts of direct rays of sunlight, the sun is very high in the sky, and the days are very long. This causes the southern hemisphere to experience summer.



The axial tilt of a planet causes seasons.

The length and severity of seasons on a planet are determined by the amount of the planet's axial tilt. A planet with no axial tilt would have no seasons, while one with a 90 degree axial tilt (such as Uranus!) would have very extreme seasons. Seasons on Earth are moderate because Earth's axis is tilted by 23.45 degrees. Mars has seasons that are very similar to Earth's because Mars' axis is tilted by 23.98 degrees.

On Earth, the axial tilt is the only reason we have seasons. The Earth's orbit is very nearly circular, so the seasons are not influenced by the small amount that the Earth is closer to or farther from the Sun over the course of a year. (If Earth's distance from the Sun was what caused the seasons, the entire Earth would experience the same season at the same time, which, of course, isn't true!)

Seasons on Mars are a little more complicated. Mars has a more elliptical orbit than Earth, so the small amount that the planet is closer to or farther from the Sun over the course of a year do make a difference in the amount of sunlight that reaches Mars. However, for the most part, the seasons are caused by the tilt of Mars' axis.

In terms of Mars' climate history, Mars is much colder now than it was in its early days. More than 2 billion years ago, Mars was much warmer, and consequently, wetter.

Length of year

It takes Mars 1.88 Earth tropical years to orbit the Sun once. This means that one year on Mars is about 687 Earth solar days long.

Length of day

It takes Mars 1.026 Earth solar days to rotate once on its axis. This means that one day on Mars is about 24 hours and 37 minutes long.

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

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