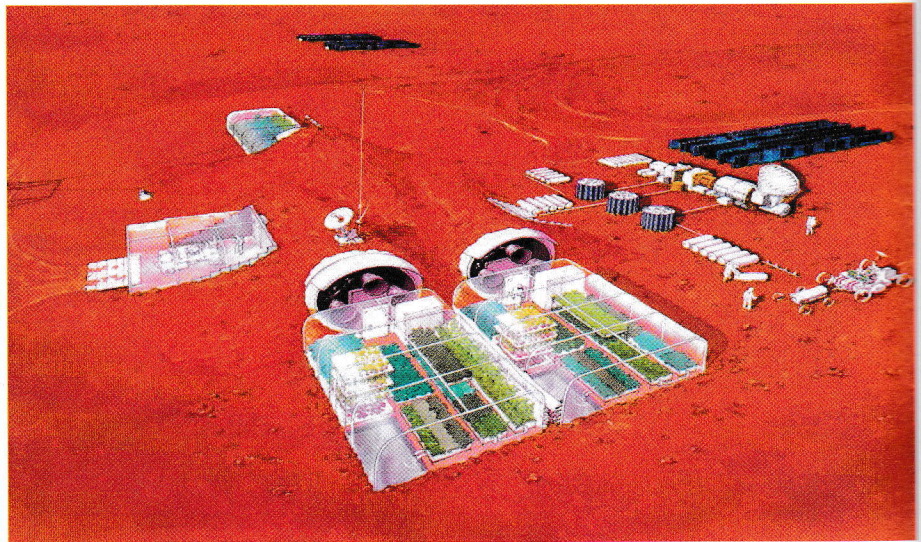


# Moving to Mars

Have you ever moved to a new home? It's difficult to get used to a new neighborhood and city. What if one day your parents tell you to pack up your stuff because you are moving to the fourth planet from the sun...Mars? It sounds farfetched, but that is what many scientists hope will happen one day. Because Mars is similar to the earth in some ways, scientists have dreamed about building a community on Mars where people can live.

Although this might sound like a neat idea, there are a lot of problems with it. God did not give Mars all the incredible features that make the earth such a wonderful place to live. Because of this, you would have to take things from the earth that you need for survival. These things would include water, air, heat, food, shelter, and clothing. In fact, you would have to bring just about everything, because there is very little on Mars that would help you to survive there! You would have to live in a special enclosed habitat that scientists have designed, called an artificial **ecosystem** (ee' koh sis tem). This habitat seals in the oxygen, allows the sun's light to come in, and maintains enough water to drink as well as grow plants. What do you think such an ecosystem might look like? This drawing shows one that NASA designed. The living space is underground.

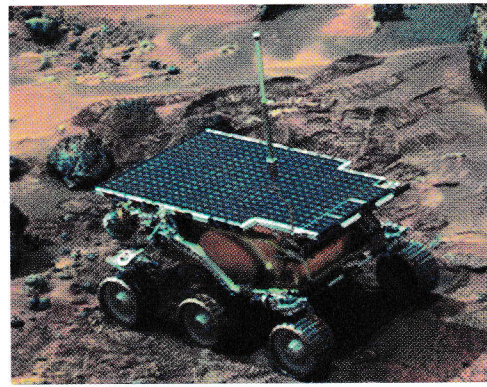


This is an artist's idea of what a man-made ecosystem on Mars might look like.

It will be many years before an ecosystem can be built on Mars, because no one has ever even been to Mars. NASA hopes to send people to Mars at some point, but it costs a great deal of money to send men to other planets. So far, only unmanned spacecraft have been to Mars. Some of these spacecraft have even landed on the surface of Mars and studied many things about the planet. As a result, we know a lot about Mars.

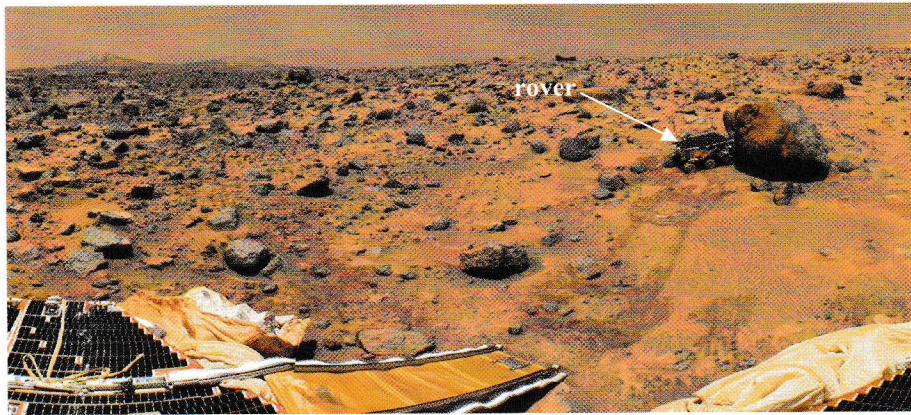
Mars has always been called "the red planet" because it looks red through a telescope, and even to the naked eye. When I say "naked eye," I mean that you are just using your eyes (no telescope, binoculars, or other equipment) to look at it. Robots that have landed on Mars have studied its red dirt, and they have found that it has an element called iron in it. Iron rusts, and that is what makes Mars look red! Mars is, in fact, a rusty planet.

The robots sent to Mars don't look like men walking around with stiff arms and legs, as you might imagine. They are actually little cars with wheels and are similar to toy remote control cars. They are called Mars rovers. These rovers are always bumping into rocks and cannot climb up the mountains of Mars, so engineers are trying to develop other kinds of robots. Some engineers are even working on a robot that looks like a spider. With legs rather than wheels, a spider-like robot might be able to get around better than the rovers.



This is a picture of the Sojourner rover on Mars.

Mars is a terrestrial planet, like earth. It has landforms like mountains, valleys, and volcanoes. One Martian (mar' shin) volcano called **Olympus Mons** (oh lim' pus) **Mons** (mahns) is the largest volcano in our whole solar system. We have never seen a Martian volcano erupt, but there is evidence that some



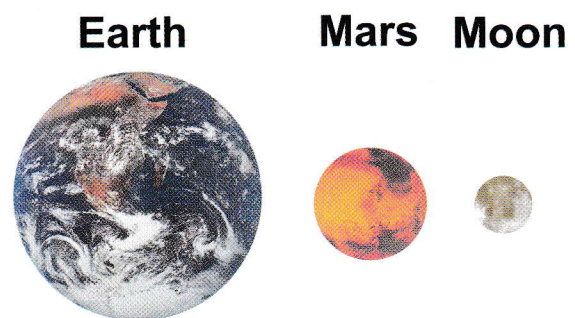
This is a picture of a rover on Mars. Notice how red and rocky the landscape is. Notice also that the rover is bumping against a rock.

of the volcanoes are active, which means that they *could* erupt. Scientists are not even sure what would come out of the volcanoes if they did erupt. If an ecosystem is ever built on Mars, it should be on level ground that is far from a volcano, don't you think?

*What do you remember about Mars so far? Explain in your own words the things you have learned.*

## Martian Gravity

Mars is bigger than our moon, but smaller than the earth. It's small for a planet, and its mass is significantly less than the mass of earth. Because its mass is small, the gravity on Mars is not very strong. What do you think it would be like to live with less gravity? What kinds of things would you have to be careful about if you lived on Mars? With less gravity, a baseball could probably go a lot further when you threw it. I guess you wouldn't want to throw a baseball very



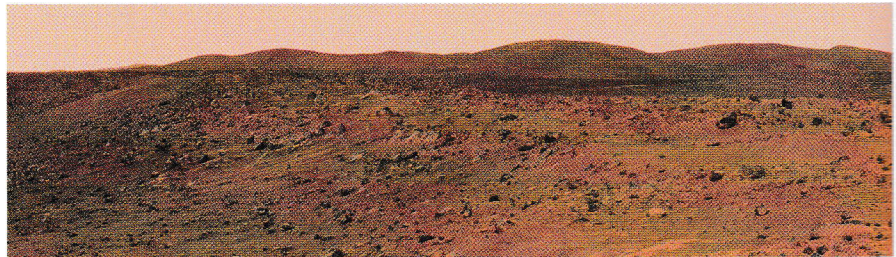
hard, or it might crash through the glass of the artificial ecosystem, letting all of the oxygen out!

How much would you weigh on Mars? Check the chart below. Moving to Mars might not be so bad if you weighed less. It wouldn't hurt as bad if you fell off your bike. It would also be easier to get around if you weighed less. You wouldn't get nearly as tired at the end of the day. Maybe moving to Mars isn't such a bad idea after all!

Your Weight on Earth	Your Weight on Mars	Your Weight on Earth	Your Weight on Mars
20 pounds	Over 7 pounds	70 pounds	Over 26 pounds
30 pounds	11 pounds	80 pounds	30 pounds
40 pounds	15 pounds	90 pounds	34 pounds
50 pounds	19 pounds	100 pounds	38 pounds
60 pounds	Over 22 pounds	150 pounds	Over 56 pounds

## Martian Atmosphere

Mars has a very thin atmosphere with no oxygen. That is why we would need to take our own air if we went to Mars. Flying through the atmosphere on Mars are millions of little dust particles, just like in our atmosphere. These dust particles reflect the yellow, red, and orange light from the sun. Guess what color the sky is on Mars. It's butterscotch, which is a yellow/brown color.



This is a photograph of Mars taken by the Spirit rover. Notice the sky color.

Of course, just like on earth, the sky does change colors when the sun rises and sets. The dust particles in the Martian atmosphere make the Martian sunset more of a blue color, as shown in this photograph, which was taken by the Pathfinder rover when it visited Mars.



A Martian Sunset

Do you remember that our atmosphere keeps meteors from hitting our planet? Mars' atmosphere is too thin to offer it much protection from flying space rocks. The bottom half of Mars is virtually covered with craters. The Northern Hemisphere of Mars is flat land with very few craters. If we send a spacecraft to Mars, it will probably be easier to find a good landing spot in the Northern Hemisphere.

All of the craters on Mars make it obvious that, at one time, Mars was being pelted with giant space rocks. When this happened, the force of the collisions probably sent many pieces of Mars flying out of its atmosphere and into space. Some of those pieces of Mars actually landed on the earth! We know this because we have actually found rocks on earth that have chemicals in them which are very similar to the chemicals found in Martian rocks. These rocks also look like they have fallen at high speeds through our atmosphere, so it is reasonable to assume that they actually came from Mars.



Can you tell why this large Maritan crater is called the “Happy Face Crater?”

It is likely that there are also pieces of the earth on Mars. If a giant meteorite hit the earth, the force would be strong enough to send pieces of the earth up into our atmosphere and out into space.



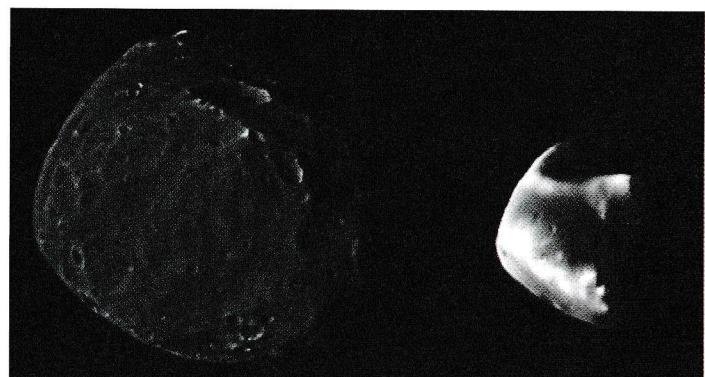
This is a photograph of a crater in the Arizona desert.

Since there are also craters on the earth, we know this has happened before. Now remember, there are not many craters on earth because earth’s atmosphere protects us from most space rocks. However, some space rocks are so large that the atmosphere cannot destroy them, and they land on the earth, making a huge crater. Creation scientists believe that if anyone ever finds signs of life on Mars, it will not be Martian life they find, but earth life that made it to Mars! After all, if a piece of earth left our atmosphere, it would take with it many cells and bacteria, which are living things.

If we do find life on Mars, then, it will most likely be life that traveled to Mars on space rocks.

## Moons

If you were standing on Mars at night, you would see not one moon up in the sky, but two! Mars is the only planet in our solar system that has two moons. Astronomers have given them names: **Phobos** (foh’ bohhs) and **Deimos** (dee’ mohs). They are two tiny potato shaped moons. They don’t look or act like anything God would have designed to be a moon. Astronomers believe that maybe they were rocks floating around in outer space that got caught in Mars’ gravitational pull. This is

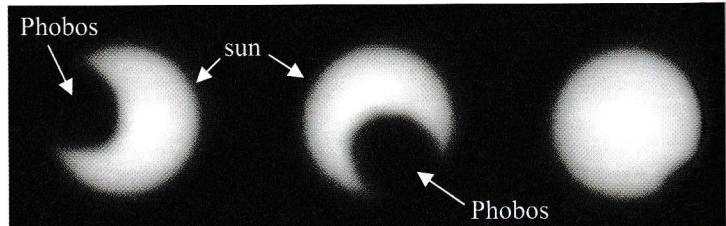


Phobos

Deimos

probably true since they don't orbit as a moon would. Unlike normal moons, Phobos and Deimos are getting closer and closer to Mars every day. At some point, they might actually end up being pulled right into Mars. At the speed they are moving towards Mars, however, it would take a long time (about a million years) for this to happen.

Do you remember what a solar eclipse is? It's when the moon blocks out the sun. Well, on Mars, the moons cannot completely block out the sun, because they are too small. However, they can partially block out the sun. While it was on Mars, the Opportunity rover took these photographs of the moon Phobos crossing in front of the sun. You can see that the moon is too small to block out the entire sun, but it does block some of it.



This is a photo of Phobos crossing between the sun and Mars.

If people moved to Mars, would the nights be as bright with two tiny moons as they are with one big moon? What would the night sky look like with a big potato shining down on you?

## Martian Orbit

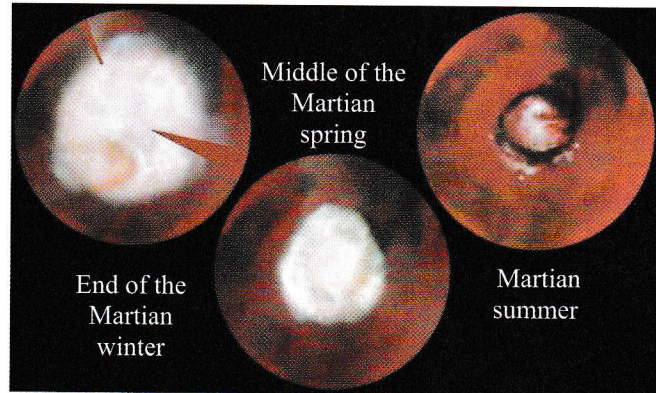
It takes almost two years for Mars to travel all the way around the sun. One year on Mars is 687 earth days. For those who move to Mars, will they count their birthday by earth days or Martian days? What about babies born on Mars? Will there be a different calendar for Martian colonists? If they decided to count time by Martian years, on your 10<sup>th</sup> birthday, you would really be 20 earth years old. If you lived on Mars, you could drive a car when you were only 8 Martian years old!

If people asked you what nationality you were, would you say, "I'm a Martian," even if your parents are Americans? Would the rest of us have to say we are "earthlings?"

## Martian Rotation

If you moved to Mars, possibly the only thing that would not be a huge adjustment for you would be the number of hours in a day. Mars rotates in 25 hours. Earth rotates in 24 hours. So, a day on Mars would be almost the same amount of time as a day on earth. That would really make the whole experience of moving to Mars a little better. It would just be too hard to move to a planet that had days and days of sunlight followed by days and days of darkness. Since Mars has days that are similar to earth, Mars would be an easier planet to live on than Mercury (where the day is 59 earth days long) or Venus (where the day is 243 earth days long).

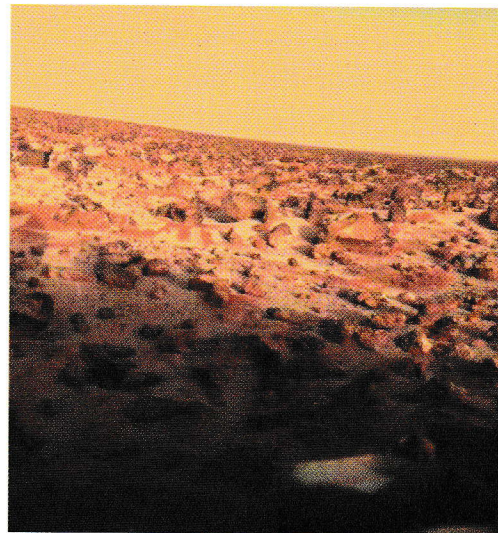
Mars rotates on a tilt, just as the earth does, so it has four different seasons; however, those seasons aren't much like those we enjoy on earth. Winter on Mars is freezing cold; spring is freezing cold; summer is freezing cold; and fall is freezing cold. That's because it is *always* freezing on Mars! It's just too far away from the sun to get much energy from the sun's light, and its atmosphere is just too thin to keep the heat inside. The average temperature on Mars is usually about 81 degrees below zero, but in the summer, the temperature can get up to about 32 degrees or so. Mars's weather is a lot like the weather in Antarctica (you know...the place where nobody permanently lives because it is far too cold).



In these three images of Mars's North Pole, the white is ice. Most of the ice is not water ice. It is dry ice (solid carbon dioxide). The fact that the amount of dry ice changes demonstrates that Mars has seasons.

Have you ever seen **dry ice**? Dry ice looks a lot like regular ice, but it is much colder. It is so cold that you would hurt your hands if you tried to hold onto it for very long. Dry ice is actually frozen carbon (kar' bun) dioxide (dye ox eyed'), a gas that you and I breathe out every day. Carbon dioxide has to get very cold to freeze, so when it is frozen, it is much colder than normal ice that you make from water. Well, it is so cold on Mars that carbon dioxide freezes in the winter, making a lot of dry ice.

Scientists think that all of the water on Mars is frozen. Some of it is frozen in **polar icecaps**, which are big slabs of ice at the North and South Poles of the planet. If you look at the picture at the top of this page, the ice that is left on the North Pole during the Martian summer is mostly frozen water. The summer gets warm enough to get rid of the dry ice, but it does not get warm enough to melt the ice that is made of water. Scientists think that the rest of the water on Mars is permanently frozen in the ground. Because the water is permanently frozen in the ground, they call it **permafrost** (pur' muh frost). That sounds like "permanent frost," doesn't it? Well, that's exactly what scientists think it is!



This is a photo of ice on a Martian landscape.

Mars is freezing, but it's closer to the earth's temperature than any other planet in the solar system. This is the reason Mars is the only planet that we could consider sending humans to. It is also the reason that some scientists dream of building a habitat or artificial ecosystem that will protect a community where people can live, work, and grow food. Inside the artificial ecosystem, the

temperature would be kept warm. Would you like to live on Mars for a few years? What would you miss about the earth? Would you miss the blue sky? Would you miss the warm breezy summer days? Would you miss swimming in the ocean? If you were to build a protected community on Mars, would you build an imitation ocean for people to swim in? Would you build it around one of Mars' mountains, planting trees and grass on the mountain and providing fake snow in the winter, so people could go mountain climbing and skiing?

## Liquid Water on Mars?

Although we know that there is a lot of frozen water on Mars, we do not know whether there is any liquid water on the planet. On earth, there is both liquid water (in lakes, oceans, and streams) and frozen water (in snow and ice). So far, scientists have been able to find frozen water on Mars, but they have not been able to find liquid water there. Right now, as I am writing this book, there are two rovers that are on the surface of Mars. Their names are Spirit and Opportunity. Both of them are exploring the planet, helping scientists learn a lot of things. One thing they are trying to determine is whether or not there is or ever was liquid water on Mars.

What's the big deal? Why worry about whether or not there is liquid water on Mars? Well, liquid water is essential for life, and some people want to believe that there was (and perhaps still is) life on Mars. If they cannot find any liquid water on Mars, or if they cannot find evidence that there *used to be* liquid water on Mars, it will be very hard for them to continue to believe that life once existed on Mars. Of course, if they *do* find liquid water on Mars (or at least evidence that it was there at one time), that does not mean life did exist on Mars. It only means that it would have been *possible* for some form of life to have existed on Mars. Of course, if liquid water did exist on Mars at one time, that means Mars must have been a lot warmer sometime in its past.

How can we tell if liquid water used to exist on Mars? Well, there are some rock formations that are usually made in the presence of water. Also, there are certain chemicals that tend to form in liquid water. Spirit and Opportunity have found both of these things on Mars. The picture on the right is of a rock formation that the Opportunity rover found on Mars. On earth, you see this kind of texture in rock if the rock has been soaking in salty water. The Spirit rover also found traces of a mineral called "jarosite." On earth, this mineral forms in liquid water. So, there is some evidence that liquid water did, at one time, exist on Mars. As far as we know, however, there is no liquid water there now.



This is a photo of rocks on Mars. The texture indicates that the rocks might have been in liquid water.

Once again, it is important to realize that even if liquid water existed on Mars at one time, that does not mean that there was life on Mars. Liquid water is necessary for life, but so are many, many other things. You learned in Lesson 5 that the earth has been perfectly designed for life. Mars does not have most of the design features that the earth has, so it is hard to understand how life could have existed on Mars, even if there was liquid water there. You also need to remember that since space rocks have hit the earth and thrown parts of earth into space, it is possible that there are rocks from the earth on Mars. If that is the case, there may, indeed, be some kind of life on Mars (like bacteria), but that life might have actually come from earth.

## Finding Mars in the Sky

Mars is fairly easy to locate in the night sky. It is brighter than most stars, and it has a distinctly orange/red color. In fact, that's how it got its name. The Romans saw that Mars was red and were reminded of blood. As a result, they named it after their god of war, Mars.

Mars moves around quite a bit in the sky, so if you want to find out where it is at any given time, you should go to the website I told you about in the introduction to this course. On that website, you will find links that will take you to websites that will help you find Mars.

## What Do You Remember?

What do you remember about Mars? What makes Mars look red? What is the atmosphere like on Mars? What is the surface like on Mars? What is the name of the biggest volcano in our solar system? What do you remember about the moons of Mars? Can you remember how long it takes Mars to revolve and rotate? What is the weather like on Mars? Why do some astronomers think Mars would be a good place to visit and perhaps live?

## Assignment

Illustrate a picture for the Mars chapter of your notebook. You can put anything you desire in the illustration. Be certain to label your illustration so others will know what you have drawn. Write down all that you know about Mars and place that in your notebook as well.