

# Activity Guide

## Tour the Moon or Mars with Google Earth

Participants use the Google Earth computer software to explore the landscapes in their own area on Earth before “visiting” the same latitude and longitude on the Moon or Mars. They use the Google Earth computer software’s built-in tools to experience global perspectives of the Earth and the Moon or Mars, as well as “tour” different landscapes, view 3D models of spacecraft, and read information about the various locations.



Credit: NASA

## Key Concepts

After doing this activity, participants will be able to generally describe the Moon’s global appearance and some features on its surface.

## Background Information

The Google Earth software allows learners to move back and forth between a global perspective and views of landscapes on the surface. The combination of these two perspectives provides context for exploring how the Moon and Mars are different from – and similar to – Earth. This activity is intended to be flexible and can set the stage for other activities.



Credit: NASA

### Recommended Ages:

**Families** or other mixed-age groups, including children as young as 8 years old *with assistance from an older child, teen, or adult*

**School-aged children**

**Tweens**

**Teens**

**Adults**

### Preparation Time:

40 minutes to 1 hour

### Activity Time:

20-40 minutes

# Materials

- Google Earth 5 or above, downloaded from [www.google.com/earth/](http://www.google.com/earth/)
- Optional (recommended): projector and video to provide additional information:
  - NASA | Tour of the Moon <https://www.youtube.com/watch?v=2iSZMv64wuU>
  - Note: Consider facilitating this activity in a computer lab, where participants can view a projected image of Google Earth on a large screen, while also controlling their own experience at a computer. Google Earth can also be projected onto a screen setup in a community room or other programming space.

## Preparation

1. Watch a tutorial on using Moon in Google Earth at <https://www.google.com/earth/explore/showcase/moon.html>.
2. Install Google Earth 5 or above from [www.google.com/earth/](http://www.google.com/earth/).
3. Open Google Earth, type your city and state into the search field, or specifically search for your location by entering the name of your location into the search field.
4. In Google Earth, find the icon that looks like a pushpin on the top bar. Click on the pushpin icon. A window will open. At the top, it will say "Name" with a field box that says "Untitled Placemark." Re-name the Placemark with the name of your location or city and state. The pin is located at the exact latitude and longitude of your location on Earth.
5. Locate the icon that looks like Saturn on the top toolbar and select "Moon" or "Mars" from the drop-down menu. Practice the procedure below to provide a streamlined "tour" of points of interest on the Moon or Mars.

## Procedure

1. **Share ideas and knowledge.**
  - Introduce yourself. Help the participants learn each other's names (if they don't already).
2. **In Google Earth, explore your area of Earth with program participants to provide context for touring landscapes on other worlds.**
  - Discuss what the area looks like, making note of major geologic features including lakes, oceans, and streams.
  - Facilitate discussion about features in the city or surrounding area.
3. **Use your Placemark to begin your tour of the Moon or Mars:**
  - In Google Earth, on the top bar, click on the symbol that looks like Saturn and select "Moon" or "Mars" from the drop-down menu.
  - The pin that you put into Google Earth marking your location on Earth will also appear on the world that you have chosen.
  - In the left "Layers" bar, check the boxes "Featured Satellite Images" and "Place Names."
  - Zoom into the surface to locate the pin, and discuss the major differences visible on the surface compared with the same latitude and longitude as on Earth. Icons will appear on the surface indicating spacecraft imagery, the locations of landers, or information about geologic features. Click on these icons as desired.

Facilitate a conversation with the participants about their observations. For example, in Google Moon, discuss the major differences visible on the lunar surface. Icons will appear on the surface indicating spacecraft imagery, the locations of Apollo landers, or information about geologic features.

Additionally, at your same latitude and longitude, are you on the side of the Moon visible from Earth, or the far side of the Moon? Discuss with your participants by using the imagery provided in this activity.

## Procedure (continued)

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- You can check or un-check layers from the left bar to unclutter your view, or to add data to the view.
  - If you wander too far away from your Placemark, double click on the name of your Placemark in the left-hand bar.
  - If you wish to return to Earth in Google Earth, you may do so at any time by clicking on the icon that looks like Saturn in the top bar, and selecting Earth from the drop-down menu.
  - You can check or un-check layers from the left bar to unclutter your view, or to add data to the view.
4. Conclude the tour with a short video that provides more in-depth information (see above for recommendations).

## Connections to Other *STAR Net* Activities

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### Build a Space Colony

<https://goo.gl/r85uZ8>

### Planet Party

<https://goo.gl/QL3P1K>

### How Big? How Far? How Hot? Sorting Games

<https://goo.gl/Ptz1dJ>

### Jump to Jupiter

<https://goo.gl/VugMYS>

# Destination Mars



Credit: NASA

Mars is a dry, desolate place without flowing water or vegetation. The surface is covered by fine, dusty sand, similar to a desert on Earth. Children may believe that because it is red-colored, Mars is hot. In fact, it is quite cold. Since it's farther from the Sun than Earth—about 78 million kilometers (48.5 million miles) farther out—it's also very cold at the surface. Average temperatures hover around -80 degrees Fahrenheit (-60 degrees Celsius), but the temperature can drop as low as -225 Fahrenheit (-153 degrees Celsius). Even at noon at the equator on a summer day, the warmest temperatures are usually only up to about 70 degrees Fahrenheit (about 20 degrees Celsius). The temperature drops dramatically just a few feet above the surface, so your feet would be much warmer than your head!

The diameter of Mars is 6,800 kilometers across—about half the diameter of Earth. It has only ten percent the mass of Earth. Because of the small diameter and low mass, the surface gravity on Mars is only about 1/3 the gravity on Earth (0.38 to be exact). If you weighed 45 kilograms (100 pounds) on Earth, you would weigh 17 kilograms (38 pounds) on Mars.

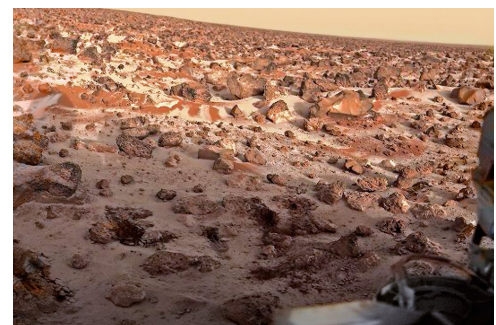
The thin atmosphere of Mars has very little oxygen, and unlike on Earth, its atmosphere does not trap much heat. The atmospheric pressure is 1/100 of Earth's. Huge sandstorms sometimes cover the face of the entire planet, but because of the low atmospheric pressure, the winds are very weak (just enough to stir up the dust). Mars has some of the same types of weather as on Earth, including dust devils, clouds, frost, and sunny days. It may even snow on Mars; NASA's Phoenix lander spotted what appeared to be a high-altitude snow storm in 2008. NASA's Mars Reconnaissance Orbiter observed dry-ice snow falling over the southern pole of Mars.

**Note: The following images are all from the Space Stage App.**

Mars is much colder than Earth because it is farther away from the Sun. Temperatures average a frigid -81 degrees Fahrenheit! Is your spacesuit well equipped to keep you warm?

**URL:** <https://goo.gl/63fy97>

Mars goes through extreme temperature changes from day to night due to a thin atmosphere and lack of water vapor. Average temperatures hover around -80 degrees Fahrenheit. Of course, temperatures vary based on seasons and distance from the equator.



NASA mission: Viking 2, 1979. Credit: NASA / JPL / Ted Stryk is licensed under CC BY-NC-SA 3.0



# Destination Mars

Sunsets on Mars look very different than on Earth! Dust in the Martian atmosphere allows blue light to pass through while other wavelengths get blocked. Twilight, the time when you can still see a soft light from the sun even though it's below the horizon, is much longer on Mars – it lasts for close to two hours! This is caused by sunlight reflecting off of dust high in the atmosphere.

Mars boasts some of the biggest features in the entire Solar System! It has the largest volcano, Olympus Mons, three times taller than Mt. Everest, and the deepest and widest canyon, Valles Marineris, which is about as long as the United States is across, making it four times longer and, in places, four times deeper than the Grand Canyon!

URL: <https://goo.gl/r4cH4Z>

Valles Marineris is the largest canyon in the Solar System. Valles Marineris is sometimes called “The Grand Canyon of Mars,” but this Martian canyon is much deeper, longer, and wider than its terrestrial counterpart. It could stretch across the entire United States! It is approximately 2500 miles long, 400 miles across, and 4 miles deep!

Scientists believe that the canyon formed billions of years ago as the Martian crust cooled and cracked.

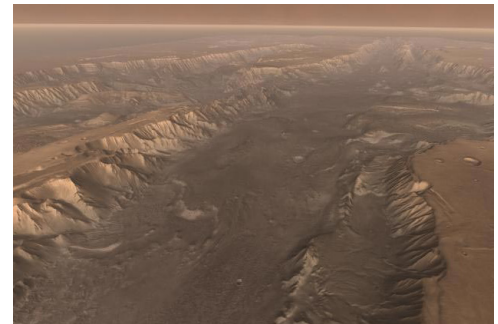
URL: <https://goo.gl/tVNQaF>

Rising approximately 18,000 feet above the surrounding Martian landscape, Mount Sharp is taller than any peak in the continental United States. Still, it's not even a quarter of the height of Olympus Mons, the tallest peak on Mars. Scientists study the mountain's layers to better understand early Martian environments.

URL: <https://goo.gl/w2pWvY>



NASA Mission: Curiosity Rover, 2015



NASA/JPL/Arizona State University, “Flight Into Mariner Valley”, 2006



NASA mission: Curiosity Rover, 2015

# Destination Mars

Studying the rocks, minerals, and landscapes on Mars's surface helps scientists better understand past Martian environmental conditions. This region on Mars likely had environmental conditions in its past that were suitable for supporting life.

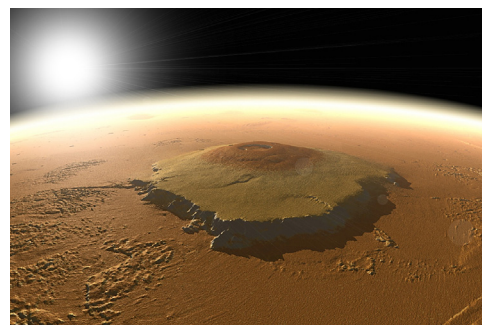
URL: <https://goo.gl/os9Ac3>



NASA Mission: Curiosity Rover, 2015

At over 90,000 feet tall, Olympus Mons is the largest known volcano in the entire Solar System. For perspective, Olympus Mons is three times as tall as Mt. Everest and as wide as the state of Arizona. Since the gravity on Mars is 62% lower than on Earth, climbing it should be a breeze!

URL: <https://goo.gl/dnh2Zk>



NASA/Mola Science Team/ O. de Goursac, A. Lark,  
9 May 2012

Imagine what it would be like to go for a visit! Scientists and engineers are considering what it would take for humans to explore Mars. It's important to consider what a human would need to take with them just to step out onto the surface and take a quick glance around. If we want to visit the planet Mars and stay for any period of time, we have to consider the complexities involved in engineering an interplanetary journey and what a human needs to survive and thrive in a completely different environment. Along with our basic requirements of food, water, clothing, shelter, and oxygen, what else do we use and do every day that makes us not only able to survive, but keeps us happy and healthy, both mentally and physically, on Earth? These are questions scientists and engineers have when trying to design a space mission involving humans, whether they are simply going into orbit around Earth, staying for awhile in the International Space Station, or traveling farther out into space.

Humans require a lot to keep them alive, and that makes sending humans into space both risky and expensive. A long mission to Mars would not only be dangerous, but very physically and mentally taxing on the participants. Huge amounts of equipment are required to provide radiation protection, oxygen, waste removal, food, and exercise equipment. In space, muscles degrade, bones deteriorate, and the heart shrinks. Just to get to Mars would be an amazing feat for a human.

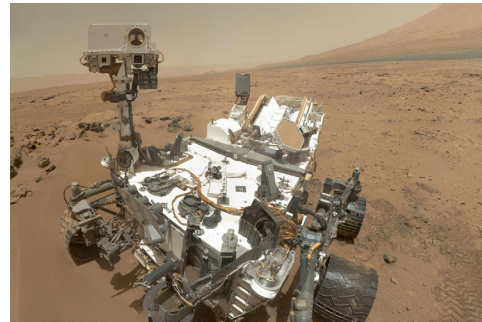
Once there, the shelter would have to be shielded from harmful radiation (e.g. from the Sun). Water and energy would have to be generated, and food would have to be grown. A trip to Mars would be for scientific research and that would include bringing transportation, digging equipment, and scientific instruments. To top it all off, some of the equipment would arrive needing assembly!

# Destination Mars

Does the risk outweigh the benefit? Many would argue, “yes,” yet there are many reasons to push the limits of our capabilities by exploring *farther* and *farther*, both on Earth and off.

NASA’s Curiosity rover has many different tools to help it complete its mission, including a scoop that helps it collect rock samples.

URL: <https://goo.gl/SeZ6kA>



NASA mission: Curiosity Rover, 2012

## Supporting Media

Videos, images, and websites can be incorporated before, during, or after Mars-related activities.

### Green Screen Filming Tips

- “How Does a Green-Screen Work?”  
<https://goo.gl/wbZu2e>

### Mars Background Information

- Mars in Minute: Is Mars Red Hot? (NASA JPL)  
<https://goo.gl/wJmr2j>
- Mars in a Minute: Is Mars Really Red? (NASA JPL)  
<https://goo.gl/KXnyWe>
- Mars 101 (National Geographic)  
<https://goo.gl/mSrcHL>
- Learn about Mars Facts with Pictures!  
<https://goo.gl/woVuca>
- The Mysteries of Life with Tim and Moby: Is there Life on Mars (Brain Pop)  
<https://goo.gl/6RW6FV>
- Mars Lithograph, NASA Educational Product LG-2013-07-569-HQ:  
<https://goo.gl/aXmKSb>
- Check out Rover POV: Five Years of Curiosity Driving on Mars to find out what driving NASA’s Curiosity rover on Mars is like!  
<https://goo.gl/4tYqsN>

# Destination Mars

## Near-real-time Weather Data

- Access to Mars weather updates from the Curiosity rover on Mars (cut and paste into browser)  
<https://goo.gl/ChPXJo>
- Access to weather website such as National Weather Service:  
<https://goo.gl/YV8UGF>

## What's the Weather Like on Mars?

- Wispy Blue Clouds Over Mars:  
<https://goo.gl/EYVaSv>
- Clouds over the Eastern Martian Horizon:  
<https://goo.gl/LzmLhx>
- Clouds Sailing Overhead on Mars:  
<https://goo.gl/f9Co3J>
- Clouds Sailing Above Martian Horizon:  
<https://goo.gl/JeGqii>
- Frost at the Viking 2 landing site:  
<https://goo.gl/8cfh3r>
- The Serpent Dust Devil of Mars:  
<https://goo.gl/HtMr2F>
- NASA's Curiosity Sees Blue Sunset On Mars:  
<https://goo.gl/QsWVs1>
- Seasonal Cycles at Gale Crater (as measured by NASA's Mars rover Curiosity):  
<https://goo.gl/5qYn3W>

## Mars Scenery

- Take a tour of Valles Marineris in NASA's Flight Into Mariner Valley video.  
<https://goo.gl/8n959c>
- Use NASA's Mars Trek website to get a firsthand view of the Martian surface!  
<https://goo.gl/iB1VGH>

## Human Exploration of Mars

- Mars: Enduring the Journey (National Geographic)  
<https://goo.gl/MRud3v>
- Mars: How to get to Mars (National Geographic)  
<https://goo.gl/z6taHs>
- Today I learned how to transform Mars into our second home (National Geographic)  
<https://goo.gl/CiZ25x>