

# Learning about the Mars Exploration Rovers

## Purpose

The purpose of these activities is to gain exposure to the equipment being used to explore Mars. Moreover, the purpose is to improve/reinforce language and math skills.

Students will be able to

1. Expand their vocabulary set (diagram labels), while reviewing definitions of some parts of the Mars Exploration Rovers (MERs).
2. Read and comprehend text (diagram, story problems) regarding the MERs.
3. Perform basic math skills (i.e. multiplication, basic algebra).

## Important Vocabulary/Key Terms (essential terms in bold)

geology	exploration	Mars
topography	sol	<b>planet</b>
<b>Mars Exploration Rover</b>	<b>arm</b>	<b>cameras</b>
<b>antenna</b>	<b>solar array</b>	<b>wheels</b>

## Label the Diagram (Vocabulary exercise)

How does a Mars Exploration Rover (MER) work? Scientists on Earth control the MERs by sending commands to them from Jet Propulsion Laboratories in Pasadena, California. The scientists send commands that allow the many parts of each MER work together to study the geology and topography of Mars. Label the parts of the rover below, by filling in the boxes. (A more technical diagram of the rover can be viewed online at [http://marsrovers.jpl.nasa.gov/mission/spacecraft\\_surface\\_rover.html](http://marsrovers.jpl.nasa.gov/mission/spacecraft_surface_rover.html). And a hint: the clues below were adapted from explanations linked to the diagram at this URL!)

1. The rover \_\_\_\_\_, also called the instrument deployment device (IDD), holds and maneuvers the instruments that help scientists view the Martian terrain/topography very closely, and to find out more about the geology of Mars.
2. Each rover has nine separate “eyes.” Six engineering \_\_\_\_\_ aid in rover navigation, while three others perform science investigations.
3. The rover has two \_\_\_\_\_; one serves as its “voice,” while the other serves as its “ears.” They allow the rover to send and receive information between themselves on Mars and scientists on Earth at the Jet Propulsion Laboratory in Pasadena, California.
4. A Mars Exploration Rover has six \_\_\_\_\_, each with its own individual motor; they function as the “legs” of the MER.
5. The main source of power for each rover comes from a multi-panel \_\_\_\_\_ that look a lot like large “wings.” They are there to provide energy harnessed from the sun’s light.

**Problem Solving** (Math skills review)

How much work can one rover do? What happens if other rovers join the efforts? Scientists have to consider questions like these all the time; and some are easier to answer than others...

*Solve.*

1. If 1 Martian day, or sol, is equal to nearly 25 hours, then about how many hours are in a Martian week? (Hint: 1 Martian week = 7 sols)? (*about 175 hours*)
2. If 1 Mars rover can capture 9 images in a sol, then how many images can 2 rovers capture in a single sol? What if each rover can capture 12 images per sol? (*18 images; 24 images*)
3. If a Mars rover can capture 5 images per sol, how many images will the rover have after 3 days have passed? (*15 images*)
4. How many images can 3 rovers capture in 5 days, if each rover is capable of capturing 15 images each day? (*225 images*)
5. Rover Spirit has to travel 150 meters from Adirondack to explore a nearby crater on the surface of Mars. If Rover Opportunity is twice as far from the crater, how many meters will Rover Opportunity have to travel to meet Spirit at the there? (*300 meters*)
6. How far will Rover Spirit have to travel to get back to Adirondack, if it has traveled to another interesting rock 60 meters away, followed by a trip to a large rock outcropping three times as far as that? (*240 meters*)
7. Mars Exploration Rovers can travel up to 40 meters per day. If Rover Spirit travels the full 40 meters each day for 3 days, and Rover Opportunity does the same and catches up to Spirit 7 days later, how many meters will they have traveled altogether? (*400 meters*)
8. If Rover Spirit captures 10 images on the morning of its tenth sol on Mars, and Rover Opportunity captures 8 times as Spirit, what is the total number of images captured? (*80 images*)
9. After landing on Mars, it takes 16 hours for Rover Opportunity to contact scientists at California's Jet Propulsion Laboratory on Earth. If Rover Spirit lands on Mars 21 Earth days before Rover Opportunity, how many hours pass before Rover Spirit contacts JPL? (*520 hours*)
10. Best friends Dewey A. Lien and Carmichael Satellite stow away on a trip to the first habitat on Mars. Dewey brings 9 packs of space ice cream in his jacket pockets, and 17 packs in his backpack. Carmichael brings 3 times as many packs as Dewey, plus the 1 he's eating. So, how many packs of space ice cream do Carmichael and Dewey have altogether? (*79 packs*)