

Driving on Mars

References:

Some information on the Mars Rover was adopted from the How Stuff Works website. This information can be found on <http://science.howstuffworks.com/mars-rover6.htm>.

Grade: 8

Time: 30 minutes

Lesson Plan – Understanding how the Mars Rover Works

Materials Needed:

- pencils
- index cards
- instruction sheets (see attached)
- Construction Paper
- Markers
- Tape
- notes (see attached)
- chalkboard or smartboard
- stopwatches

Goals/ Objectives:

- Learn about the Mars Rover missions
- Learn about why Mars is being explored
- Gain understanding of how the Mars Rover Works
- Learn about how the Mars Rover is operated
- Learn about communication between Mars and Earth
- Have students understand the difference between a vehicle that operates autonomously and one that operates remotely

NJCCCS Addressed

- Standard 5.4 A,B,C and 5.9B in Science

Activities and Procedures:

Part 1. Pass out worksheets and generate class discussion about Mars and the Mars Exploration Rover Mission.

Part 2. Break students into two groups, and give each team a different set of directions. Each member of the team will also be assigned a different task to complete,

depending on his or her team. These tasks will include, NASA Scientists, Rover Signals, NASA Signals, and a Rover. The students will follow the instructions given to them as they send messages from Earth to the Mars Rover and vice versa. The students in Team 1 will use a “remotely” operated Mars Rover and the students in Team 2 will use an “autonomously” operated Mars Rover. The students acting as Mars Rovers will be instructed to walk to square of construction paper taped to the floor and collect data (index cards) from each square.

Part 3. After each Mars Rover reaches their destination, square 5, the class will discuss the outcomes of this exercise and gain and understanding of how the real Mars Rovers are operated. Students will discuss implications that would arise from remotely operated Mars Rovers.

Accommodations:

SLD

- Assign groups
- Assign tasks within a group
- Check up on students as they work
- Offer help to students as they work

ELL

- Allow students to be grouped with bilingual students
- Offer translations if possible
- Use words and ideas that are easier to understand in place of more complicated vocabulary

Assessment:

- Monitor students as they work to make sure everyone is completing their tasks
- Have students discuss what they observed and learned from the exercise

Follow-up:

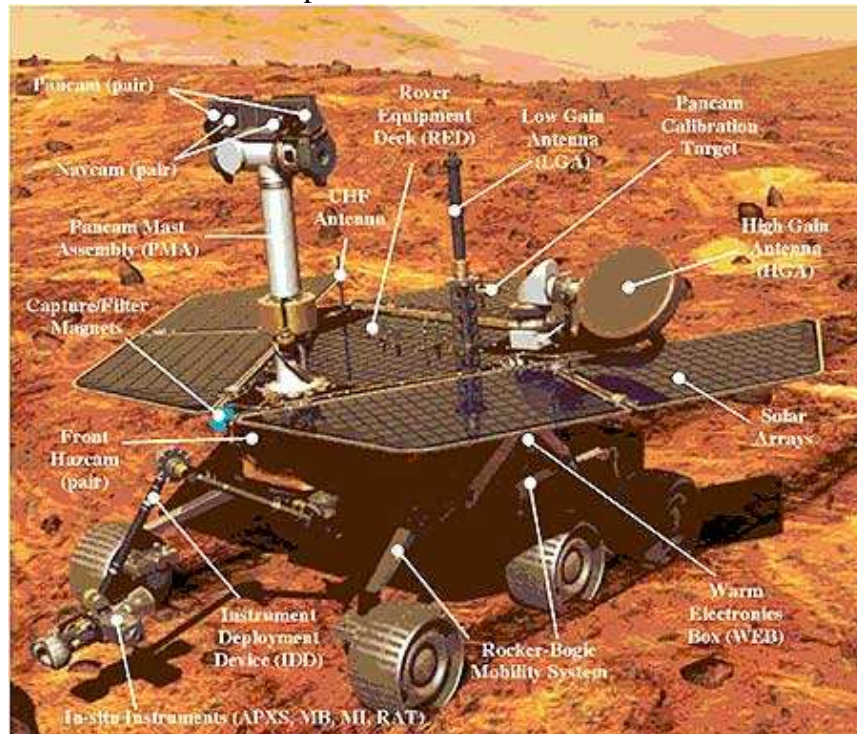
Students will be reminded of this activity before their trip to the Newark Museum.

Name: _____

Date ___/___/___

Driving on Mars

Pretend you are part of a team of engineers that has been asked by NASA to test out two types of Mars Rovers. One rover is operated **autonomously** and the other is operated **remotely**. In this exercise, you will be able to determine which rover NASA should use to explore the surface of Mars.



Picture courtesy of NASA

Procedure:

1. Students will be grouped into two teams: Team Auto and Team Remo.
2. There will be several tasks for each member in both teams. Make sure to read instructions carefully so that you know what to do. **DO NOT SHARE INSTRUCTIONS WITH MEMBERS OF THE OTHER TEAM!**
3. Each member of each team will pick a task out of a bag.
4. Each team will work together to complete the tasks given to them.
5. Once both teams have completed all tasks on their instruction sheet, both teams will share their experiences to determine the type of rover NASA should use when exploring Mars.

TEAM AUTO INSTRUCTION SHEET

Welcome to Team Auto! Please break yourselves up into the following tasks. If there are more people in the group, these extra people will be NASA Scientists.

1 Rover

3 NASA Signals

3 Rover Signals

5 NASA Scientists

1 Time Keeper

Instructions:

1. The Rover and the Rover Signals will start on the square labeled “Landing Site” and will wait for NASA Signals to give them instructions from NASA.
2. The time keeper will keep track of how long the entire mission takes.
3. NASA Scientists will write the following instructions on an index card:
“Move to square 2 and then Square 3. Collect data from both squares. Go to square 5 and collect data from this square. Square 5 is the end of your mission, use Rover Signals to send Data back to NASA.”
4. Once message has been copied to an index card, NASA signals will send the card to Rover.
5. Once Rover reaches square 5, the mission is over. Have Rover signals collect all data from Rover and send it all back to NASA Scientists.
6. Time Keeper will record how long the entire mission took.
7. When both Mars Rover teams are finished, discuss your observations with the rest of the class.

TEAM REMO INSTRUCTION SHEET

Welcome to Team Remo! Please break yourselves up into the following tasks. If there are more people in the group, these extra people will be NASA Scientists.

1 Rover

3 NASA Signals

3 Rover Signals

5 NASA Scientists

1 Time Keeper

Instructions:

1. The Rover and the Rover Signals will start on the square labeled “Landing Site” and will wait for NASA Signals to give them instructions from NASA.
2. The Time Keeper will keep track of the time it will take the Rover to complete its mission.
3. NASA Scientists will write the following instructions on an index card: **“Move to square 1 and collect data.”**
4. Once message has been copied to an index card, NASA signals give the card to Rover.
5. Once Rover reaches square 1 and collects an envelope of data, the Rover will give the data envelope to Rover Signals.
6. The Rover Signals will send the data envelope to the NASA Scientists.
7. The NASA Scientists will follow any instructions found in the data envelope as well as write the following instructions on an index card: **“Move to square 2 and collect data.”**
8. Once message has been copied to an index card, NASA signals give the card to Rover.
9. Team Remo will repeat instructions 1-6 until the Rover has explored all of the squares remaining.
10. The Time Keeper will record how long the entire mission took.
11. When both Mars Rover teams are finished, discuss your observations with the rest of the class.

Data Found on Each Square:

Square 1: The Rover has fallen off a small cliff on the Martian terrain. Though no equipment was damaged, transmissions to and from the Rover were disrupted. The Rover must wait 30 seconds for communication to resume before continuing with the mission.

Square 2: After digging into the surface of Mars, the Rover finds small crystals of ice that later evaporate. If you are on Team Remo, you must message NASA scientists and await further instructions. Team Auto's NASA Scientists must wait 30 seconds before they giving the Rover its next set of instructions. If you are on Team Auto, you are already programmed to keep digging so continue onto Square 3.

Square 3: The Rover tests the salinity of some soil that it has dug up. The test results indicate the soil is too salty to allow for the survival of microbes on the Martian surface. If you are on Team Remo, you have to wait until NASA reviews your results before you continue. Team Remo must pause for 20 seconds before resuming its mission.

Square 4: The Rover sends back several shots of the Martian landscape.

Square 5: The Rover finds patterns on the Martian surface that resemble dried up riverbeds. This may indicate that there once was running water on Mars. Team Auto's rover notes that the terrain near these patterns may be too steep and rocky for travel, so it inspects these patterns from a safe distance for now. Team Remo's Rover sends out data and continues to move as it waits for a response from NASA.

Square 6: The Rover is severely damaged by sharp rocks when it falls down a steep incline. NASA sent signals to the Rover, telling it to stop before it got to these rocks. However, these signals reached the Rover several minutes too late. It sustained a lot of damage in the fall and lost power as a result.

Name: _____

Date ___/___/___

Discussion:

Team Auto had a Mars Rover that operated **autonomously**. **Autonomously operated rovers can think for themselves** and avoid problems like cliffs. It can also analyze Martian terrain on its own. NASA uses autonomously operated rovers to explore Mars due to a time lag that can last up to 20 minutes. These rovers are programmed with preset instructions on how to use their power, compute findings, study terrain, and do other things on their own. They need very little help from NASA to explore Martian terrain. Team Remo, on the other hand, had a **remotely operated** Mars Rover. **Remotely operated rovers would need step-by-step instructions to perform every one of its functions**. This means that they would have to wait for NASA to send instructions every time they moved, or risk the chance of getting damaged if they kept moving on their own without directions.

Imagine if NASA had to send step-by-step instructions to the Rover. Based on your observations, do you think this could cause any problems? Use a few sentences to explain your conclusion.