Smithsonian Latino Center

¡DESCUBRA!

Meet the Science Expert

¡*DESCUBRA!* CREATE-IT POCKET SCIENCE HANDOUTS

LET'S LAND A ROVER ON MARS!

1. Overview:

This activity allows children to understand the essential steps needed to land a "payload," such as a Rover, safely on Mars. Initially, they will learn how rockets work and the principle of "action" and "reaction." Then, they can begin to figure out how to safely land a Rover on Mars. Finally, the children can work with their parents or teachers to explore what is needed to sustain human life in another planet—such as Mars—or on the Moon. The two key steps necessary for the task are:

- "Let's Build a Rocket!" – This simple activity demonstrates how rockets work and the principle of action and reaction. Launching a rocket is a first step in the process of taking a payload safely to Mars.
- "Let's Land a Rover!" – Through this exploratory activity, students will investigate how to safely land a Rover on Mars by pretending that the Rover is a boiled egg, and experimenting with different coatings and wrappings to keep the egg from cracking.
- "Let's Build a Space Settlement!" is an extension activity where students can work with their families to explore what is needed to sustain human life on another planet, such as Mars, or on the Moon. Even if we can land on other planets, humans will need to figure out a way to sustain ourselves safely in alien environments.

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- Age level: 7–12 years
- Time frame:
  - Preparation: 30 minutes
  - Activity itself: 30 minutes for “Let’s Build a Rocket!” and “Let’s Land a Rover!” and another 30–40 minutes for “Let’s Build a Space Settlement!

2. Background:

For the past thirty years, the National Aeronautics and Space Administration (NASA) has made it its mission to learn more about Mars—its climate and atmosphere, its composition, and other geological factors—in the hopes of determining whether or not there is life on Mars. Various characteristics of the planet, such as climate, weather patterns, and evidence of possible water sources indicate that this might be a possibility. Currently, NASA continues to explore this question with its Mars Science Laboratory missions and its Curiosity Rover. Many images, as well as soil and rock samples, are being studied to learn more about this fascinating planet. Orlando Figueroa, a Mechanical Engineer and former Deputy Director of the Goddard Space Flight Center in Maryland, led NASA’s Mars Exploration Rover Project that successfully landed two rovers (Spirit and Opportunity) in 2004. Opportunity is still operational and beaming back photos after 11 years of service.

3. Preparation:

Materials

- For “Let’s Build a Rocket!”
  - One box of plastic soda straws (enough for one straw per student)
  - Balloons (one per student)
  - One roll of masking tape
  - One pair of scissors and
  - One ball of string at least 60 feet (18 meters) long, cut into roughly 20-foot (6 meter) lengths.
- For “Let’s Land a Rover!”
  - One hard-boiled egg per student
  - Plastic sandwich bags
  - Aluminum foil
  - A glue stick
  - A bag of popcorn
  - A bag of cotton balls
  - Paper napkins

- Metal washers and
- A stairwell, or chairs for students to stand on so they can drop the "Rover" from a high distance.

- For "Let's Build a Space Settlement!"
  - One piece of poster-board, about 1–1.5-foot square (30 x 50 centimeters) per group of children.
  - Various building supplies, such as scrap wood, cardboard, poster-board, construction paper, straws, cardboard tubes, pins, nails, corks, tape, glue, plastic cups, paper cups, Styrofoam cups, plastic wrap, plastic bags, wire, Styrofoam balls, Styrofoam packing blocks, and anything else you can think of.
  - Scissors.
  - Glue sticks.
  - Tape.

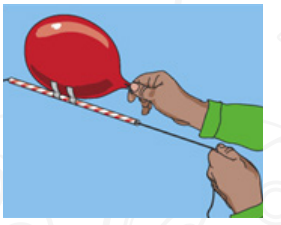
Adult Preparation

- Gather all materials.
- Boil the eggs for 10 minutes in slow simmering water to make sure they don't develop any cracks, and let them cool by rinsing gently in cold water.
- Lay out the materials for the lunar or Martian settlement. The poster-board or plywood represents the lunar or Martian surface. The remaining building materials will be used to construct the model settlement.

4. Making and Doing

Let's Build a Rocket!

1. Thread one end of the string through the drinking straw.
2. Attach one of the ends to a stable item, such as a curtain rod or a heavy piece of furniture. Take care that no one trips over the string.
3. Have someone inflate a balloon and hold the air inside by pinching it (see the illustration).
4. While someone else holds the other end of the string taut, attach the balloon to the straw with masking tape.
5. Release the air from the balloon.
6. How far does the straw travel



Let's Land a Rover!

1. Give each student an egg and a selection of different materials from the list. Ask the student to figure out how to use these materials so that the egg will not crack when dropped from up high.
2. Students can experiment with two or three different coverings to protect the egg from cracking as it "lands" on Mars (a hard surface such as cement or tile). Have the students drop the egg from a stairwell or by standing on a chair and holding the egg above shoulder height.

Let's Build a Space Settlement!

1. To begin building a settlement, have the groups of children pretend that they will live on the Moon or on Mars for at least a year. Encourage them to discuss what they might need in a model settlement to survive and provide a good life for the duration. Discuss each structure in the lunar or Martian base, such as "oxygen tanks" or the "recreation area." Review the information in the "Comparison Chart for Making a Lunar/Martial Settlement" to make sure that the settlement takes into account all aspects of the alien environment.

Lessons learned

"Let's Build a Rocket!: This activity demonstrates how rockets work. Rockets carry containers filled with substances that, when ignited, produce gases. These gases escape through vents in the rear of the rocket. The gases escaping backward drive the rocket forward. This force demonstrates the principle of action and reaction—Newton's third law of motion on "action" and "reaction."

Let's Land a Rover!: Students will find that energy is dissipated, providing greater protection, if the material surrounding the egg yields, or compresses, on impact. Popcorn and cotton balls work very well, while washers and foil do not work as well. Have the students peel and eat the eggs when they are done!

Let's Building a Settlement!: Discuss with the students what humans need to survive, and what the Earth gives us that is so special in the Solar System (water, an atmosphere that allows us to breathe, moderate temperature ranges, land masses, food, materials to make shelters, clothes, etc.).

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Comparison Chart for Making a Lunar or Martial Settlement

	Earth facts	Moon facts	Mars Facts
Water	70% of Earth's surface is covered with water	Tiny amount, in the form of ice (found by NASA's Prospector mission in 1998)	Mainly as permafrost under polar surfaces, with intermittent flowing water on the planet's surface; recent research points to the possibility of flowing water in some areas, at least in the warm season
Diameter	7,926 miles (12,753 kilometers)	2,159 miles (3,476 kilometers)	4,217 miles (6,785 kilometers)
Atmosphere	78% Nitrogen, 21% Oxygen	None	Thin, with surface pressure averaging 1/100th that of the Earth. Mainly composed of carbon dioxide. There is less than 1% Oxygen
Surface Temperature	Mean surface temperature: -128° to 136° Fahrenheit (-89° to 57.7° Celsius)	Mean surface temperature in the day: 224° Fahrenheit (107° Celsius) Mean surface temperature at night: -243° Fahrenheit (-153° Celsius)	Surface temperature range: From -174° Fahrenheit (-113 ° Celsius) at the winter pole, to 32° Fahrenheit (0° Celsius) on the dayside during Summer
Gravity	Earth's gravity	15% of that on Earth. A person who weighs 110 pounds (50 kilograms) on Earth would weigh 16.5 pounds (7.5 kilograms) on the Moon.	37% of that on Earth. A person on Mars could leap three times higher than on the Earth. **Rotational period or Martian day:** **Martian Year:** 1.88 Earth years
Rotational period (day)	24 hours	27.3 Earth days	24.6 hours
Rotational period (year)	365 days	27 days	687 days

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My Notes and Observations

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