Cosmic Craters Lesson Plan

Overview: In this lesson, students learn about craters and conduct experiments to explore what might cause craters to vary in size and shape. The lesson concludes with students creating their own clay craters.

Grades: Preschool and K-2

Length of Lesson: Approximately 45 minutes

Related Video: "How a Crater is Formed" (Goddard Space Center) and "Cranberry Crater" episode

Learning Goals:

After completing this lesson, students will be able to:

- Describe what a crater is and how it is formed.
- Make predictions about what will happen in an experiment.
- Observe and discuss the findings of an experiment.
- Compare and contrast different results.
- Explain that larger objects create larger craters.

Related Goals from the Space Racers™ Curriculum:

Scientific Inquiry -

Exploration and Investigation: We obtain information and learn about the world through exploring objects and investigating how things work. Conducting scientific investigations, engaging in hands-on experiences, and asking open-ended questions can foster greater conceptual understanding of our world.

- Explore new things as a way to broaden one's understanding of the world.
- Use prior knowledge and experiences to develop specific questions that will lead to information, solutions, and answers.
- Form theories/hypotheses/predictions to explain how and why things happen.
- Design and carry out simple cooperative investigations that apply learning from past experiences and support new discoveries.
- Discuss the findings of investigations.

Observation: Looking carefully is one way to learn about things around us.

- Take note of a variety of properties and describe as accurately as possible (e.g., number, shape, size, length, color, texture, weight, motion, temperature, other physical characteristics, etc.).
- Scan/analyze an object or event from multiple positions in order to capture different perspectives.
- Make comparisons to identify similarities and/or differences.
- Inspect/investigate in detail in order to sort, group, classify, or sequence according to size or other characteristics.
- Develop questions and predictions based on observations.
- Communicate findings verbally or by using pictures, graphs, charts, and/or representations.

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Experimentation: Sometimes more can be learned by actually doing something to things and taking note of what happened. We use scientific testing and experimentation to seek reasons and evidence in an attempt to prove or disprove our ideas and hypotheses, to discover new information, and to draw conclusions.

- Form hypotheses/make predictions using prior knowledge and past experiences.
- Perform tests and observe any new findings.
- Collect data: e.g., ask questions, make observations, perform simple measurements using standard and/or non-standard units of measure, make estimations, etc.
- Analyze data: e.g., compare, contrast, sort, classify, etc.
- Describe things as accurately as possible in terms of their number, shape, texture, size, weight, color, motion, etc.
- Draw conclusions/discover new information; compare conclusions to original hypotheses.
- Communicate findings using pictures, graphs, charts, representations, and/or words.
- Model safe behaviors while experimenting.

Materials:

- "Crater Images" handout
- one pie tin, baking dish or other relatively shallow container for every 5-6 students
- one marble for every 5-6 students
- one super ball, ping pong ball or similarly-sized ball for every 5-6 students
- one tennis ball or similarly-sized ball for every 5-6 students
- flour and cocoa powder
- sprinkles (optional)
- tarp, plastic covering or other surface that can be used to catch flour, cocoa powder, etc.
- tape measure or ruler (optional)
- air-dry clay or playdough
- small paper plates (one per student)

Prep:

- Gather all the materials in the materials list.
- Print out one copy of the "Crater Images" handout.
- Place about an inch of flour in the baking dish. Place sprinkles on top of the flour (optional). Cover with a thin layer of cocoa powder. See the How to Make a Crater video from NASA's Jet Propulsion Laboratory at the California Institute of Technology for details about how to prepare for the crater experiment. (Note: In the video, sprinkles are used. This experiment can be done with or without sprinkles.)
- Refer to the "Clay Craters" photograph (in the Wrap-up section), as desired, when preparing the Wrap-up activity.

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Lesson Activities:

Activity 1: Introducing Craters

1. Explain that today you will be discussing craters. Ask if any students can describe what a crater is. Explain that a crater is a large bowl-shaped area in the ground, caused by the impact of something hitting the ground (like a meteorite or other object).
2. Ask students where they think craters are located. Explain that they are on the moon, Earth and other planets.
3. Show your students the images in the "Crater Images" handout. Point out each of the craters on the handout and name the planet each one is on.
4. Ask students to describe some things that the craters have in common. Ask them to discuss some differences between two or more of the craters.

Activity 2: Crater Experiments

1. Ask students to discuss why they think some of the craters are bigger than others.
2. Let students know that today they will be conducting an experiment to create their own craters and to see what might cause some craters to be bigger than others. (Note: This is the same experiment featured in the Space Racers™ "How a Crater is Formed" segment from the Goddard Space Center.)
3. Divide your students into groups of 5-6 students each. Give each student a baking dish with the flour and other ingredients. (See the prep section for more details.)
4. Give each group one marble. Ask the students in each group to predict what will happen when they drop the marble into the pan.
5. Ask one student from each group to drop the marble in the pan. Have the student remove the marble from the pan and have the group observe and discuss the pattern it made.
6. Ask students if the result is what they predicted or different from what they expected. Repeat this experiment until each person in each group has had a chance dropping a marble into his/her group's pan.
7. After everyone has dropped the marble once, encourage groups to try the following:
    - Vary the height at which the marble is dropped. Instruct students to stretch their arm straight in front of them (so that their arm is perpendicular to the pan) and drop the marble into the pan. Then ask them to remove the marble from the pan and raise their arm higher up and drop the marble into the pan again. How does the pattern change? Then ask each student to lower his/her arm and drop the marble into the pan from a low height. Ask each group to look closely at the three different holes formed and compare how the height at which the marble was thrown changed the size and pattern of the crater. Encourage students to repeat the height experiment. If desired, have students use a ruler or tape measure to compare the sizes of the craters.
    - Drop the marble at different angles and observe how that impacts the crater it makes.
8. Give each team a slightly larger object (a ping pong ball, super ball, etc.). Ask students to predict if the size of the crater will be the same, larger or smaller than that created by the marble. Have them drop the larger object and then drop the marble again (dropping them both from the same height). Lift each one out of the hole and then compare the size of each. Repeat and compare again. Use a ruler or tape measure to compare the size of the craters, if desired.
9. Give each group another ball (a tennis ball or something similar in size) and ask students to predict what type of pattern the tennis ball will make and how the size will compare with that made by the other objects. Ask students to drop the larger ball and then drop the two smaller objects again and, after removing each object, compare the patterns and sizes of each of the "craters."

10. Lead a discussion about what they discovered through their crater experiments. Explain that just like in their experiment, in real life when a meteorite or other object hits the surface of the moon or a planet, the larger the object the larger the crater will be.
11. *Optional*: Watch the Space Racers™ "How a Crater is Formed" segment from the Goddard Space Center. After viewing the segment, ask students to compare what they discovered in their crater experiments with what the students in the video discovered.

Activity 3: Cranberry Crater (Optional)

1. View the Space Racers™ "Cranberry Crater" episode.
2. After watching the episode, ask your students where the crater was located. *(The moon.)* Ask them to describe why the Space Racers travelled to that crater. (*They thought it was made of cranberry fuel.*)
3. Ask them to discuss what caused the crater. (*A meteorite many thousands of years ago.)*

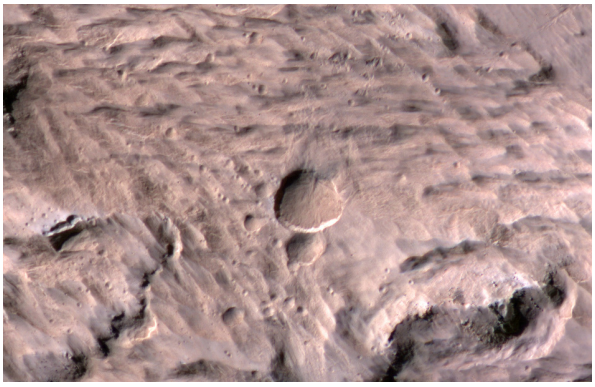
Wrap-up:

1. Lead a discussion about craters. Ask students to describe some facts they learned about craters. Ask students to discuss what they learned from their crater experiments.
2. Show your students the "Crater Images" handout again and let them know that they are now going to be able to create their own crater landscapes.
3. Give each one small paper plate. Turn each plate over and write each student's name on the plate. Turn each plate back over and place a ball of clay or playdough on top of each one.
4. Ask each student to flatten out the ball of clay, pressing it flat onto the plate. Then, ask them to use their fingers to create "craters" in the clay, by shaping the clay into little craters. (Refer to the "Clay Craters" photograph for an example.)
5. If using air dry clay, let the craters dry for a few days and, if desired, paint them.
6. Create an exhibit in your classroom, showcasing all of the clay craters that the students created. Ask each student to present and discuss his/her creation.

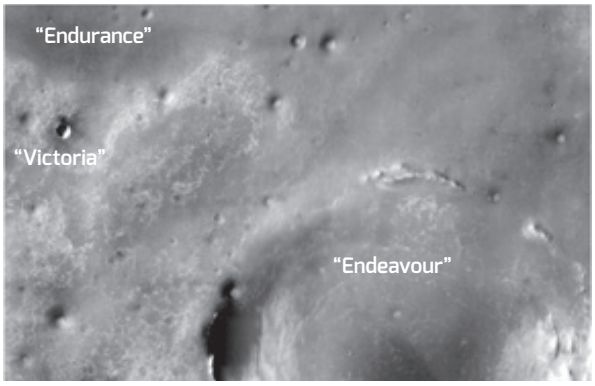
Clay Craters

Crater Images

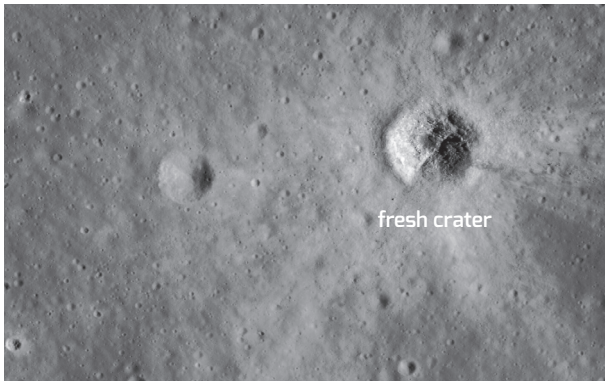
This handout is designed to be used in the Space Racers "Cosmic Craters" lesson.



A Meteor-Impact Crater, Mars

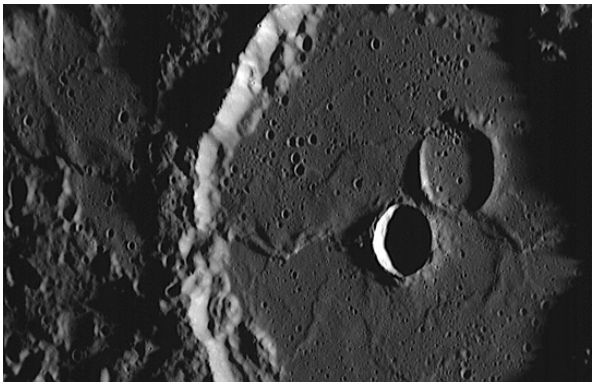


Craters on Mars

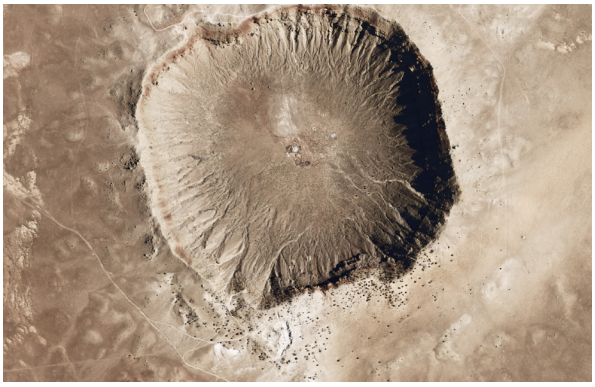


Impact Crater, The Moon

Highlands Terrain inside Dante Crater, The Moon



Machaut Crater, Mercury



Meteor Crater (Barringer Crater), Arizona

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Mars: http://www.nasa.gov/press/2014/may/nasa-mars-weather-camera-helps-find-new-crater-on-red-planet/index.html (Meteor-Impact Crater)
http://marsrovers.jpl.nasa.gov/gallery/press/opportunity/20080922a/Southeastern_Crater_THEMIS_label_br2.jpg (Craters)
The Moon: http://www.earthobservatory.nasa.gov/IOTD/view.php?id=39769 (Impact Crater)
http://www.nasa.gov/mission_pages/LRO/news/image_release042310.html (Highlands Terrain inside the Dante Crater)
Mercury: http://www.nasa.gov/mission_pages/messenger/multimedia/flyby2_20081007_5.html (Machaut Crater)
Earth: https://solarsystem.nasa.gov/multimedia/display.cfm?IM_ID=789 (Meteor Crater)