Glossopedia™

Learning Activity Guide

Moon

www.globio.org/glossopedia/moon

GLOBIO-created Learning Activity Guides are designed to simplify integration of Glossopedia based learning into classroom and extra-curricular activities and curriculum. Each activity is designed around the use of Glossopedia articles and subjects, incorporating technology into interdisciplinary instruction. Learning Activities are intended to be fun, inquiry-driven, and interesting; exciting for students and helpful to teachers.

Activity

Shoebox Moonscape Pages 2-7

Extensions

Crater Simulator Page 8

Concepts

- Moons are natural satellites held in an orbit around a planet by gravity.
- Earth has one moon that is about one-third its diameter.
- Only one face of the moon is visible from Earth due to synchronous rotation.
- The moon is the only other place in the solar system visited by humans.

Related Topics

- Earth
- Solar System
- Sun

Vocabulary

- Asteroid
- Atmosphere
- Atoms
- Comets
- Crater
- Diameter
- Elements
- Erosion
- Gravity
- Lava
- Maria
- Meteor
- Meteoroid
- Meteors
- Myths
- Profile
- Relief elevation
- Satellites
- Soviet Union
- Telescope
- Topography
- Volcanoes

Standards

LA A ES SI

ST G T M

Standards Key available at www.globio.org/standards

Recommended Outside Links

- **Lunar and Planetary Institute:** http://www.lpi.usra.edu/expmoon/
- **Amazing Space:** http://amazing-space.stsci.edu/
- **Fourmilab moon viewer:** http://www.fourmilab.ch/earthview/vplanet.html

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Activity: Shoebox Moonscape

Background:

Someday scientists think that people will be able to live on the moon. This will take a lot of planning. It will be very important to know the highs and lows, or topography, of the surface terrain to determine the best location for a moon base or colony.

How can scientists discover this without ever setting foot on the moon? By using light and sound as tools for remote measuring! Light waves from Laser and Radar Altimeters, or sound waves from Sonar Altimeters can be bounced off the surfaces of objects in space from orbiting spacecraft. Measurements of these wavelengths can be graphed to create topographic relief maps or profiles.

For instance, the Mars Global Surveyor orbiter used light waves (Mars Orbiter Laser Altimeter, or MOLA) to create surface profiles of Mars, and the Magellan spacecraft that orbited Venus from 1990 to 1994 used sound waves from a Radar Altimeter to explore beneath thick clouds. The TOPEX/Poseidon satellite measures Earth's sea surface detail with microwave pulses, while sonar "pings" bounced off the sea floor from ships help map its bottom.

Bats use the very same principle to create mental "bug maps" of prey by striking them with sound waves that rebound to their sensitive ears.

Preparation:

- Copy the ***Shoebox Moonscape worksheet*** and graph for students.
- Put the cardboard, scissors, glue, modeling clay, rocks, pebbles, containers of sand, wood and other small items where students can share them.
- Students may be divided into pairs or teams for the activity. You may choose to do only parts of the activity or all of it, depending on the learning level of students or available time.
- Direct students to read the Glossopedia article on the ***moon***.

Time:

- 30 to 60 minutes (1 or 2 class periods)

Materials:

- Printable worksheet
- Printable graph
- Shoe or other comparable box with a lid, one per student or team
- Pencils
- Colored pens
- Metric rulers
- Chopsticks or other small stick, one per student
- Variety of rocks and pebbles
- Sand
- Modeling clay
- Small pieces of wood, blocks, other small items
- larger wood blocks, one per student or team
- Large nails
- Light cardboard
- Scissors
- Glue

Glossopedia:

- www.globio.org/glossopedia/moon
- www.globio.org/glossopedia/bats

Pre-Activity Discussion:

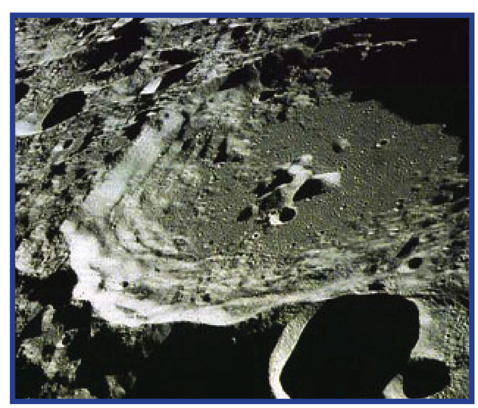
- Discuss what students think the moon might look like if they were there.
- Discuss scientist's interest in creating bases and colonies on the moon in the near future. Ask students to think about what kind of location would be best for a base or colony. How important do they think location will be? Why/why not?
- Discuss how scientists might go about determining what the surface of the moon and other space objects might be like without actually seeing them, for instance if they are too far away or hidden under thick atmospheric or other types of clouds. Use and explain the words ***topography***, ***relief***, ***elevation***, and ***profile***.
- Ask students to go back to the Glossopedia ***Moon*** article to examine photos of the moon's surface.

Directions:

- Give each student or team a box, worksheet, graphs, nail, block of wood, ruler, chopstick, and pencil.
- Explain that they are going to create an imaginary moonscape in a shoebox and then make topographic profiles of it without being able to see the surface.

Part 1

- Have students cut out the grid from the worksheet and glue it to the outside of their box lid. The number of squares is based on an average shoebox size and can be trimmed to fit smaller boxes.
- Help students poke a hole at the center of each square with the nail, using the wood block for backing.
- Have them run their chopstick through each hole several times.
- Using clay, sand, rocks, pebbles, bits of wood, etc., instruct students to create a moonscape that includes hills, valleys, and other features that they observed in the Glossopedia ***Moon*** photos. They may return to the photos for reference, if needed.
- When they have completed their moonscape, have students replace the lid on their box.



Part 2

- Aligning the tip of the chopstick with 0 on the ruler, have students mark every 1/2 centimeter with their pencil or colored pens and number the centimeters on the chopstick. This is their measuring tool.
- Beginning with square A1 on the lid, students will insert the stick into the hole and guide it until it touches the surface inside the box. They should not poke it into the surface, but allow the stick to gently rest as perpendicular to the lid as possible.
- Have students mark the line closest to where the stick protrudes from the top of the lid and count and record the measurement to the nearest 1/2 centimeter in square A1
- They will continue doing this for all of row A. If students are divided into teams, they may divide the rows between members.

Part 3

- Show students how to use their graph paper to record their measurements.
- Beginning with Row A, Box 1, they will mark the moonscape height with a dot.
- They will continue this for all the boxes in Row A, then Row B, etc.
- Show students how to connect the dots on the graph to show the topographic profile of each section of their moonscape.

Part 4

- When the dots have been connected, students may glue the graph to a piece of light cardboard and cut out the elevation profile.
- Each profile may be attached with cardboard tabs to the top of the box along its corresponding row.
- When all the profiles are attached to the top of the box, students may lift the lid to see if they have accurately re-created the topography inside.

Questions

- Ask students if they could create a more 3-dimensional depiction of their moonscapes, i.e. by making profiles that go in both directions, or using points that are closer together.
- Ask if they think the earth would look similar to the moon if all the vegetation were removed.
- Do students think that they created a good place for a colony or base in their moonscape? Why/why not?

Alternate for younger students:

Rather than measuring the topographic height at each point, give students enough chopsticks of the same length for each hole in their box lid. When they have inserted a stick in every hole, they will have a stick profile of their moonscape topography. They may use it to make a sketch of their moonscape.

Alternate for older students:

Create a permanent moonscape using paper mache' or plaster with rocks, sand, etc. Label its important features, such as craters, maria, volcanoes and mountains. Try different techniques for measuring and mapping its surface.

Worksheet: Shoebox Moonscape

A1 .	A2 .	A3 .	A4 .	A5 .	A6 .	A7 .
B1 .	B2 .	B3 .	B4 .	B5 .	B6 .	B7 .
C1 .	C2 .	C3 .	C4 .	C5 .	C6 .	C7 .
D1 .	D2 .	D3 .	D4 .	D5 .	D6 .	D7 .
E1 .	E2 .	E3 .	E4 .	E5 .	E6 .	E7 .
F1 .	F2 .	F3 .	F4 .	F5 .	F6 .	F7 .
G1 .	G2 .	G3 .	G4 .	G5 .	G6 .	G7 .
H1 .	H2 .	H3 .	H4 .	H5 .	H6 .	H7 .

Shoebox Moonscape Graph

14 cm							
13 cm							
12 cm							
11 cm							
10 cm							
9 cm							
8 cm							
7 cm							
6 cm							
5 cm							
4 cm							
3 cm							
2 cm							
1 cm							
Row ___	Box 1	2	3	4	5	6	7

Extension:

Crater Simulator

Create impact craters that simulate the lunar landscape. See how different sizes of "meteors" and different surface materials influence cratering.

Directions:

- Cover an area of floor or ground with a plastic sheet or tarp.
- Use fine materials that vary in color and texture, such as flour, sugar or salt, cornmeal, oatmeal, sawdust, sand, and small beans to form a layered surface in the center of the covered area.
- Choose round objects of different sizes to represent meteors, such as marbles, stones, and small balls.
- Drop a "meteor" from 1 meter into the layers. Observe the way the ejected material is distributed around the crater rim and measure the distance it traveled from the impact point.
- Repeat from 2 meters; 3 meters.
- Change to a larger object and repeat. Try an even larger one!
- Try different angles and velocities of impact.

Observation Questions:

- How mixed are the layers of ground material? Can you clearly see features like basins, rims, rays, central peaks and ejecta? Are craters forming within other craters? Do they overlap? How did the size, angle and speed of meteor impact determine the appearance of craters?
- Cover the resulting moonscape with dried or artificial plants and a few pieces of wood for buildings. Does your moon now look more like the earth? Can you still tell where the craters are?