



Drexel-SDP GK-12 ACTIVITY

Subject areas: physical science (Astronomy)

Unit title: Holt *Astronomy* activities

Activity title: Reflection and refraction (Holt Chapter 4, Section 1)

Grade level: 6

Time required: 60 minutes

Keywords: craters, ratio, diameter, momentum

Educational standards:

3.4.7D

Concept/Vocabulary

In this activity, students investigate the formation of craters on the moon. They will explore how changes in meteoroid size, mass and speed effect the properties of craters. Students will become familiar with differences between meteors, meteoroids and meteorites. They will also use the Holt text and other resources to review the terms satellite, phase, eclipse and craters. Students will exercise concepts of dimensions, fractions, decimals, forces and momentum. They will practice measurement skills using a mass scale, Vernier calipers, and rulers/tape measures.

Objectives

- Students will understand how craters are formed, and how size, mass and speed of a meteorite's impact affects the properties of craters.

- Students will understand how craters can be used to determine the age of planets and moons.

INSTRUCTIONAL STRATEGIES

Group size: This activity can be performed in groups of 4-6 students.

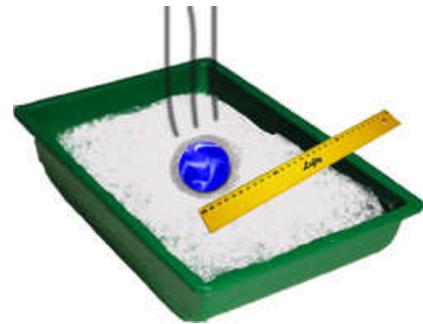
Duration: It can be performed in one class period.

Before

Students will discuss in groups the differences between a lunar eclipse (shadow of the Earth falls on the moon) and solar eclipse (shadow of the moon falls on the earth). Students will draw a picture to support their answer.

During

- In cooperative groups, students are instructed to select three pebbles, balls, or other objects of different sizes and masses. These will be the “meteoroids.”
- Each group will find the mass and diameter of their meteoroids, using a scale and Vernier calipers. This information will be recorded on their data sheets, and will be shared with the rest of the class.
- Students will drop each of their three meteorites into a FOSS stream table containing a layer of flour or corn starch 3-4 cm (1 1/4 to 1/12 in) deep. If a deeper crater is desired, a bucket can be used in place of the stream table and the depth of flour or corn starch can be increased.
- Meteorites will be dropped from three different heights, measured using tape measures. Ask the class to help choose three reasonable heights (i.e. 100 cm, 200 cm, and 300 cm). These three height distances will be used for all measurements. Newspaper should be spread on the floor to aid cleanup.
- Students will record the diameter and depth of each crater formed, and record the information on their data sheets. This information will be shared with the rest of the class.
- Student groups will construct scatter plot graphs to represent their data. Graphs should have proper titles and axes labels.
 - Groups 1 and 2 will plot *falling distance vs. crater diameter* for all data, using a different symbol for different meteorites.
 - Groups 3 and 4 will plot *meteorite mass vs. crater depth* for all data, using different symbols for different falling distances.
- Students will discuss their findings with the instructor and each other. They should be able to verbally answer questions like “*How does falling distance (and speed) effect the size of the crater, and why?*” and “*Do heavier meteorites make deeper craters? Why or why not?*” It should be explained that objects of the same volume will fall at the same rate of **acceleration**, but that a heavier object will have more **momentum**. Therefore, it should be predicted that a heavier object will impact at the same speed as a lighter object of the same size; however, the heavier object will probably make a larger crater because its momentum makes it harder to stop.



After (mathematics skills)

- What is the ratio of the moon's diameter (3,476 km) to the sun's diameter (1,392,000 km)?
- What is the ratio of their distances from Earth if the moon is about 384,000 km from Earth and the sun is about 150,000,000 km from Earth?

Reading/Writing

Students will write a concise summary of the experiment in their science notebooks, focusing on a simple hypothesis, method of testing, and results. They should be encouraged to briefly explore any of their ideas that may have changed during and after the experiment. They will answer the "Journal Questions" listed on their handouts. They should also be encouraged to write down their thoughts about any of the suggested web links relating to the lesson.

Inquiry (Cultural Connection)

Students will research the many names for the Full Moon (i.e. harvest moon, hunter's moon, etc.). Students will report on the origins of these names.

TerraNova

The moon has no atmosphere and a force of gravity that is about $1/6$ that of Earth. What would happen if a hammer and feather were released together from the same height on the moon?

- a.) The hammer would land first.
- b.) The feather would land first.
- c.) Both would land at the same time.*
- d.) Both would float in space.

Attachments: A data collection sheet, 4_CratersHandout.pdf, is included

Owner: Drexel University GK-12 program, *Engineering as a Contextual Vehicle for Science and Mathematics Education*, supported in part by National Science Foundation Award No. DGE-0538476

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Astronomy on the Move

How do craters form on the moon?

EXPERIMENT DATA:

	meteorite mass (g)	meteorite diameter (mm)	falling distance (cm)	crater diameter (mm)	crater depth (mm)
team 1					
team 2					
team 3					
team 4					

JOURNAL QUESTIONS

experiment

What trends do you observe in your graphed data?
If two objects, dropped the same height, have different masses but the same volume, will the crater be the same diameter/depth?

textbook

What is the current explanation for the formation of the moon?
Using information about the age of our own moon and the number of its craters, how could you determine the age of one of Jupiter's moons?

- For more fun with craters, visit go.hrw.com, keyword **HZ5FAMF**, and read about the work of **Adriana Ocampo**.
- To find your weight on the moon (and other spots in the solar system), visit exploratorium.edu/ronh/weight.

