Meteor, Moon, Splat!

Make your own water balloon impact craters and use math to understand how scientists use crater clues to study our solar system.

Time

- 10 min prep time
- 30 minutes of class time

Grades

- 2-6

Next Generation Science Standards

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
- ESS1.C: The History of Planet Earth ▪ Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.
- MS-ESSI-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Utah Core Standards

- 3.1.1 Describe the appearance of Earth and the moon.
- 5.2 Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.
- 6.3 Students will understand the relationship and attributes of objects in the solar system.
- 7.2.2 Construct an explanation based on evidence for how processes have changed Earth's surface at varying time and spatial scales.

Materials

- 5 water balloons for each group
- Rulers for measuring in centimeters
- Lab Sheet- edit beforehand for your grade level
- Optional: calculators
- Optional: clip boards
- Optional: bucket for each group to carry water balloons

This lesson plan is adapted from:

Explore Marvel Moon, Lunar and Planetary Institute, 2018

https://www.lpi.usra.edu/education/explore/marvelMoon/activities/familyNight/splat/

Do Ahead

- You will need an outdoor area with a safe balcony (or high area) to drop balloons from.
- You may want to tell your students to wear something that they don't mind getting wet.
- Prepare enough water balloons for each team to have 5 balloons.
- Provide the balloons in the drop off locations in buckets. Also have clipboards and measuring tapes waiting for them. Place the students into five groups to complete the activity.
- Enlist volunteer helpers to assist activity for younger grades.

Background for Teachers

Scientists study the Moon's rocks and surface features to learn how it formed and changed over its long "lifetime." Impact craters and basins are caused when an impactor, such as an asteroid or comet, collides with a planet or moon. The Moon's largest impact basins — those we can see only with our eyes —were formed by very large asteroids or comets striking the surface early in the Moon's history.

The Moon endured a violent period in solar system formation when large impacts were much more common than they are today; based on the ages of the Apollo samples, scientists theorize that this period ended by 3.8 billion years ago. Lunar researchers are trying to determine how long this period of intense bombardment occurred, and what caused it.

The size of an impact crater or basin depends on the speed and size of the asteroid or comet before the collision and the material it impacts. Most impact craters will be 10 to 20 times the size of the impacting asteroid.

In this activity students model ancient lunar impacts using water balloons. By measuring the diameter of the crater area, students discover that the Moon's largest impact basins were created by huge asteroids. Like these huge asteroids, the water balloons are destroyed on impact and leave a splash (i.e. a "crater") that is 10 to 20 times wider than the impactor.

Impactors are like water balloons because they are destroyed upon impact, and very little of the asteroid or comet remains. Remnants of asteroids found on a planetary surface are called meteorites.

Scientists have observed small asteroids and comets hitting the Moon and Earth, and these formed small craters. NASA's Lunar CRater Observation and Sensing Satellite (LCROSS) mission intentionally impacted the Moon's south pole with a used rocket and the spacecraft itself on October 9, 2009. The crater left by the LCROSS impacts were about a third of a football field across and less than 10 feet (about 3 meters) deep.

Directions

- Introduce the subject through the videos and /or PowerPoint.
- Have students fill out page 1 of the Lab sheet before leaving the classroom.
- Remind students to measure and record the width of the water balloon (demonstrate to class) before dropping it to form a splash (crater). See example on following page.
- Give students parameters for how to drop balloons. Have them go outside to drop their 5 water balloons, taking turns in their group and measuring and recording their results as they go.
- After cleaning up balloon debris come inside to finish the Lab sheet questions and discuss what students learned.

How to measure your balloon and splash width

- Let students know that exactly where they measure it not that important
- They can choose the widest section of the balloon and splash
- Younger students can use calculators

After completing your water balloon impacts do the math!

Example:
Crater width (splash width) divided by impactor (balloon) size

54 inches divided by 3 inches = 18 times larger
137.2 cm divided by 7.6 cm = 18 times larger

Most impacts are 10 to 20 times the size of the asteroid.

Balloon Size: 3 inches (7.6 cm)

Splash Width: 54 inches (137.2 cm)