Ages:
3-8th grades

Duration:
20 minutes

Materials:
- Water balloons
- Nozzle to help inflate balloons
- Water hose
- Concrete patio or parking lot area
- Rulers
- Paper and pencils

Balloon Impacts

Overview —

The students measure the diameter of their water balloons, model an impact, measure the diameter of the "crater" area, and determine the ratio of impactor to crater.

Objective —

The students will:
- Measure the width of a water balloon and of an impact.
- Determine the ratio of the impactor to the "crater."
- Discuss the successes and limitations of this model of impact cratering.

Before You Start: Prepare the water balloons in advance and keep them floating in a tub with water, to reduce the number that break early, or prepare a space (possibly outside) where the students can fill their own balloons.

Determine a safe space outside to conduct the experiment, where there is plenty of concrete surface and little chance of hitting someone's car.

Activity —

1. Begin with a class discussion on the nature of craters.
   - *Where do we find craters?* [On planets and moons throughout our solar system]
   - *How are craters formed?* [Asteroids and comets impact the planet or moon]

2. Let your students know that they will be experimenting with a model of the impact process, using water balloons.
   - *What will the water balloon represent?* [The impactor—an asteroid or comet]
   - *What will represent the crater?* [The splash marks]

3. Go outside with your class and hand out the filled water balloons and rulers. (For less disciplined classes or smaller students, you may want to hand out one balloons, and have the rest of the class watch the experimental impact before handing out the second balloon.)

4. Have your students measure and record the balloon's width or length.

5. Have them break a balloon by throwing it onto an outdoor concrete patio or sidewalk, taking care to avoid each other.

6. The students should measure the width of the impact (splash of water) that has been created.
   - *What happened to the asteroid or "impactor"?* [It exploded.]
   - *What happens to comets or asteroids that impact a planet or the Moon?* [They explode.]

7. Ask the students to calculate the ratio of the size of the balloon to the size of the impact, and compare their results.

8. Hold a class discussion:
    - *In what ways does this model work for an asteroid or comet impact on the Moon? What ways does the model fail?*
    - *What was the range of ratios that the students calculated?* [The impact area should be about 10-20 times bigger.]
    - *Is a crater on the Moon bigger or smaller than the asteroid that made the crater?* [Craters are bigger than the asteroids.]
    - Invite the students to predict what would if they threw the balloons faster. *What might happen when an asteroid or comet is moving faster?* [The crater might be larger.]

EXTENSION —

Conduct Impact Craters with a cratering box, such as at http://ares.jsc.nasa.gov/Education/activities/ExpMoon/ImpactCraters.pdf and invite the students to compare the impact box model to the water balloon model. In which was does each model succeed at demonstrating an impact? What are the limitations of each model?

BACKGROUND —

The size of an impact crater depends on the speed and size of the asteroid or comet before the collision. A faster impact will create a larger crater. Typically, asteroids hit Earth at about 20 kilometers (slightly more than 12 miles) per second. Such a fast impact produces a crater that is approximately 20 times larger in diameter than the asteroid. Most impacts will be 10 to 20 times the size of the asteroid. Smaller planets have less gravitational "pull" than large planets; asteroids and comets will strike at lower speeds.

TIES TO STANDARDS —

Texas TEKS

Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;

(E) demonstrate that repeated investigations may increase the reliability of results; and

(F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

Scientific investigation and reasoning. The student knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(C) represent the natural world using models such as volcanoes or Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials

3rd grade Science Concept Standards (TEKS)

(8) Earth and space. The student knows there are recognizable patterns in the natural world and among objects in the sky. The student is expected to: (C) construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions…