# MAKING A SPLASH

In ***Asteroid Hunters***, we see that the Moon is covered in surface craters from asteroid impacts. Earth has craters, too, but because our planet's surface has changed so much over millions of years, they're much harder to see. Find out how craters form with a simple experiment.

1. Your teacher will provide you with a deep container and several filler materials like flour or cocoa powder. Layer these materials, one at time, into your pan to create a model of Earth's surface.
2. Gather a series of small objects such as pebbles, marbles, and magnets. These will be your asteroids.
3. Working with your group, take turns dropping the objects from different heights into the pan, and measure the craters that form. Since asteroids can come from many different directions, drop your objects from a variety of angles. Watch how the layers of "dirt" spray out from the center in different patterns called *ejecta*. Be sure to wear safety goggles for the experiment.

**Hypothesis:** Before you begin, how do you think the size and speed of the falling object (or asteroid) will affect the size of the crater and the ejecta pattern?

**Data:** Record your findings in the chart below and use the back of this page to make notes and draw pictures. Follow the example listed.

| ASTEROID | DIRECTION OF IMPACT | CRATER DEPTH | CRATER WIDTH | EJECTA PATTERN |
|---|---|---|---|---|
| Small Pebble | Straight down | | | |
| Small Pebble | 45° angle | | | |
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**Conclusion:** Once you've conducted your experiment several times using a variety of objects, discuss the results with the class. Write a statement summarizing how the size of the object and the distance from which it fell affected the dimensions of the crater. Explain what the size of the crater and the ejecta pattern tell us about the amount of kinetic energy that was transferred.

**Evaluate:** On the back of this sheet or a separate paper, answer each of the questions below.

1. Newton's first law tells us that an object will continue moving at the same speed unless force is exerted on it. What force(s) caused the asteroids in your experiment to fall? What force(s) caused them to stop?
2. Newton's second law tells us that force is equal to the mass of an object times its acceleration (F=ma). How would the force of impact be different if the asteroid was shot from a machine instead of dropped?
3. Newton's third law tells us that whenever there is an interaction between two objects, equal force is exerted on both objects. If equal force is exerted onto the Earth during a collision, why doesn't Earth itself change its orbit? On the back of this page, draw a diagram depicting the forces on the asteroid and Earth at the point of impact.

**Bonus Question:** In the film's footage from a 2013 meteorite crash in Chelyabinsk, Russia, we see windows breaking. How does the transfer of energy that causes an impact crater also cause windows to break? Draw a diagram to illustrate this.