LESSON 3: MAKING CRATERS

OBJECTIVE

Looking at the Moon and planets, we can see surfaces pitted with craters of all different sizes and shapes. Almost every solid object in the Solar System shows evidence of craters. Most craters result from impacts from rocky objects like meteors or asteroids. The size and speed of the impactor determines how a crater looks.

To simulate crater formation, fill a shallow pan with flour, top with chocolate drink mix, then drop (don't throw!) rocks into the pan. If rocks are not an option, substitute marbles or balls of various sizes. You can experiment with different sizes, speeds, and impact angles—comparing the craters' diameters, depths, and rays [streaks radiating outward from the crater].

LESSON LENGTH

50 minutes

MATERIALS

- ☐ Safety glasses
- ☐ 1 five-pound bag of flour
- ☐ 1 can of chocolate drink mix powder (not cocoa powder, which clumps and darkens flour)
- ☐ Shallow basin (foil roasting pan, dishpan, or cardboard box)
- ☐ Sifter
- ☐ 3 rocks of different sizes: about the size of a pea, a marble, and a small lemon.
- ☐ Metric ruler or meter stick
- ☐ Plastic spoon to retrieve rocks
- ☐ Pencil
- ☐ Data Collection Table (p. 6)
- ☐ Newspaper to protect floor
- ☐ Broom

***Teachers**: If a class rather than an individual, is doing this activity, you will only need one broom and can of chocolate powder for the whole class, but you'll need the rest of the items on the list for each team. The chocolate powder can be subdivided among the teams, in small containers.*

Try the procedure yourself beforehand so you know what will happen. If in a classroom setting, prepare the class by talking about craters, showing photos of the Moon and other cratered bodies, and asking how they think craters form and what affects the size of the craters. Prior to setting up team "crater stations," demonstrate the procedure.

PREPARATION

❶ **Put on your safety glasses.**

❷ **Cover the floor with newspaper.**

❸ **Prepare your "Crater Station"** by filling basin about 10 cm deep with flour. With the sifter, make a light layer of chocolate drink powder on top of the flour. The flour represents the Moon surface; rocks will represent meteoroids.

START

❹ **Drop (do not throw)** each rock into the flour-filled basin and observe the impact. *(Actual meteoroids travel 6,000 times faster than the rocks you drop!)*

❺ **Experiment** to find out how the size of the meteoroid affects the size of the crater:

a. Make 3 craters with each of your rocks, all dropped from the same height (9 drops total). You can use a meter stick or your height as the constant. Why is it important to use the same drop height? [Any changes in crater size will be due to different rock size.]

b. With the metric ruler, carefully measure the crater diameter in centimeters after each drop. Include crater depth and measurements of rays, if appropriate.

c. Carefully remove the rock with the spoon after each measurement. (Doing so ahead of time may deform the crater; you will need to remove the rock for depth measurement).

❻ If you need more surface area, smooth the surface by gently shaking the basin a few times to level the flour. If necessary, sift more chocolate powder on top.

❼ Use the Data Collection Table (p. 6) to record your results.

❽ Try the optional cratering experiments and explore more cratering activities on the next page.

TEAM: _____

Data Collection Table (All values in centimeters)

First Drop	Crater Diameter			
	Crater Depth			
	Ray Length			
Second Drop	Crater Diameter			
	Crater Depth			
	Ray Length			
Third Drop	Crater Diameter			
	Crater Depth			
	Ray Length			

OPTIONAL CRATERING EXPERIMENTS

Here are a few more cratering experiments you can try – no data sheet needed:

- Drop your meteoroid from different heights. How do the craters differ?
- Carefully toss your meteoroid at an angle onto your moon surface. What shape crater do you expect to see? What shape crater occurs? [Round craters always occur, whatever the impact angle or shape of the impactor!]
- Simulate a "crater chain" on your flour moon surface by dropping a handful of small gravel. [A crater chain occurs when a meteoroid breaks up, due to gravitational forces, before impact. Crater chains are visible on moons and even on Earth, as seen from space, as a line of circular lakes or holes.]

DISCUSSION

❶ What do you observe in the data on your Data Collection Table above? Does the size of the meteoroid change the size of the crater? [Data will vary, but generally larger rocks make larger craters.] Also, if measured, how does meteoroid size affect crater depth and length of rays?

❷ Discuss the difference between meteoroids [rocks in space], meteors [meteoroids glowing from atmospheric friction as they fall toward a moon or planet with an atmosphere], and meteorites [meteoroids that reach the surface without burning up in the atmosphere].

❸ Does Earth have craters? Yes! Earth has many craters, some of which are impact craters (not volcanic). We don't see them all because Earth's weather erodes surface features over time. Craters on the Moon stay sharp because it has no atmosphere.

More advanced students may also perform the experiment at this site:
www.ucmp.berkeley.edu/education/dynamic/session2/sess2_act4.html

Additional information about cratering activities can be found at:
http://simulator.down2earth.eu/planet.html?lang=en-US OR www.nasa.gov/pdf/180572main_ETM.Impact.Craters.pdf