

water. He called these lowland regions **maria** (MAH ree uh), Latin for “sea.” The lighter regions, he found, were covered with mountains and **craters**.

The Moon’s maria are large, relatively flat plains that scientists believe were formed by lava flows that cooled and hardened. They were given romantic-sounding names by people who did not yet realize that there was no water on the Moon: Ocean of Storms, Sea of Showers, Sea of Rain, Bay of Rainbows.

The Moon’s highlands contain numerous mountain ranges, many named for mountains in Europe: the lunar Alps, the Apennines, and the Taurus Mountains. The highest mountain on the Moon is believed to be about 5 miles high, relatively small compared to the mountains on Earth.

By far the most numerous—and most interesting—of the lunar landforms are the craters. Data collected by Ranger, Orbiter, Surveyor, and Apollo spacecraft indicate that roughly 3 trillion (3,000,000,000,000) craters with diameters greater than 1 meter (3 ft) exist on the Moon’s surface. Craters range in size from several inches to nearly 700 miles in diameter.

Scientists believe that some of the Moon’s craters are volcanic in origin, hollowed-out regions formed by volcanic explosions. Most craters, however, are impact craters formed from the bombardment of meteorites—particles of matter in space that strike the surface of a planet or moon. Impact craters tend to be larger than volcanic craters, and the larger the meteorite and the more forceful the impact, the larger the crater.

Scientists have found that every solid body in the solar system—both planets and moons—shows signs of cratering. Earth contains both volcanic and impact craters. The Meteor Crater near Winslow, Arizona, is an example of an impact crater. No doubt there were many more that have long-since disappeared from the changing face of Earth.

In this activity, students create their own lunar landscape by reenacting the bombardment of the Moon’s surface by meteorites.

▼ Activity Sheet 7

Lunar Landforms

Draw a picture of your Moon model.

Name the craters and “seas.”

Answers will vary.

Guiding the Activity

- 1 Ask students to recall what they learned in the last activity about the Moon’s environment. Ask, **What is it like on the Moon? How is the Moon different from Earth?**

Write the word *lunar* on the board. Tell students that **lunar** means having to do with the moon.

- 2 Display the posters and the photographs of the Moon for all students to see. Begin a class discussion by asking, **What does the Moon look like up close? Is it smooth?**

Point to several of the maria on the posters. Ask, **What do you think these dark patches are?**

Explain that these dark areas are called “seas” or “oceans.” Read the names of several of the seas and oceans as you point them out on the poster.

Ask, **What is a sea or an ocean?**

Ask, **Why do you think the words *sea* and *ocean* and *rain* are funny names for places on the Moon?**

Tell students that these areas were named a long time ago, before people knew that there was no water on the Moon. From Earth, these dark spots looked like giant bodies of water. Today we know that these “seas” are actually large, flat, smooth areas of the Moon.

- 3 Next, point to several of the large craters on the map and ask, **What are these?**

Write the word *crater* on the board and read the word to students. Tell students that these round pits on the surface of the Moon are

Additional Information

Earth is covered with water, plants, and animals and is surrounded by a layer of air. Unlike Earth, the Moon contains no air and water and therefore cannot support life. The temperatures on the Moon get very hot in the day, then very cold at night. The Moon is covered with dust and rocks. Nothing lives on the Moon.

No. In the posters, students can see that the Moon has light and dark spots and that it is covered by what appear to be different-size holes. In the photos taken from the surface of the Moon, students can see that the surface has hills and rocks and boulders, and that it looks very dry and dusty, like a desert.

Accept all answers.

for example, Sea of Clouds, Sea of Rain, Ocean of Storms

a large body of water

because there is no water on the Moon

Accept all reasonable answers.

Guiding the Activity

called **craters**. Explain that some craters are very small—less than a foot wide—and some are very big—larger than a state. Ask, **How many craters do you see on this map?**

Tell students that the Moon is covered with trillions of craters. Some of the biggest ones are named after famous people. Smaller ones are named after the scientists who first saw them.

Ask, **What do you think made these craters?**

Tell students that they are going to make a model of the Moon's surface and learn how these craters were formed.

4 Divide the class into teams of two. Distribute an aluminum pan, a magnetic marble, and a bar magnet to each team.

Have students place their pans on the newspaper. Fill each pan about halfway with sand, and ask students to gently smooth out the surface. Then fill each pan almost to the top with flour. Again, ask students to carefully smooth the surface. Finally, completely cover the top of each pan with a thin layer of powdered cocoa. (Students should not touch this layer.) Explain that the powdery material in the pans represents the dusty surface of the Moon.

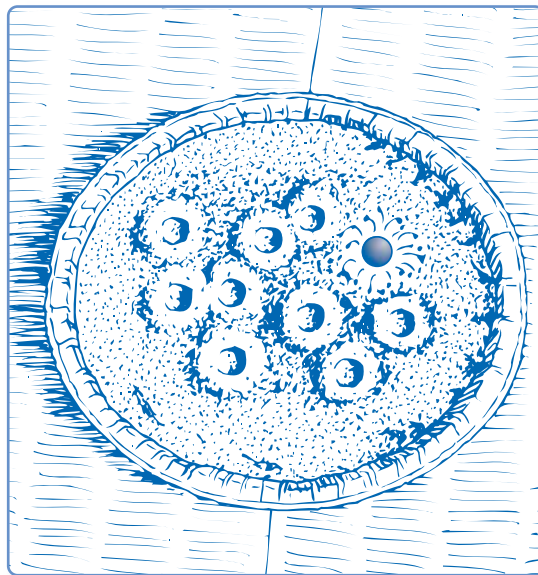
Additional Information

Give students a minute or two to try to count them.

Accept all answers.

This can be easily done by gently shaking the pan from side to side.

Remind students not to taste any of the materials in the Moon model.



▲ **Figure 7-1.** *The formation of craters in the model of the Moon.*

Guiding the Activity

Next, direct students in each team to take turns dropping the marble into the pan from a height of about 30 cm (1 ft). Tell them to remove the marble with the magnet, being careful not to disturb the powder in the pan. Have each team member do this until the surface is heavily cratered (see Figure 7-1).

5 When students have finished, ask, **What does your pan of powder look like?**

Have teams compare their Moon models to the photos and the posters of the Moon. Ask, **What things can you see in your models that are also in the photos?**

Ask, **What made the craters in your model?**

Ask, **What do you think made the craters on the Moon?**

Tell students that there are rocks flying around in space. Every once in a while, one of these rocks will hit the Moon, just as the marble hit the powder. When this happens, the rock leaves a large pit, or crater, on the surface of the Moon (see Figure 7-2).

Tell students that some of the rocks that hit the Moon are big—about the size of a house—and some are very small. Some are traveling fast when they hit the Moon, and some are traveling slower. Explain that large rocks that hit the Moon very hard make larger craters. Small or slower-moving rocks make smaller craters.

Additional Information

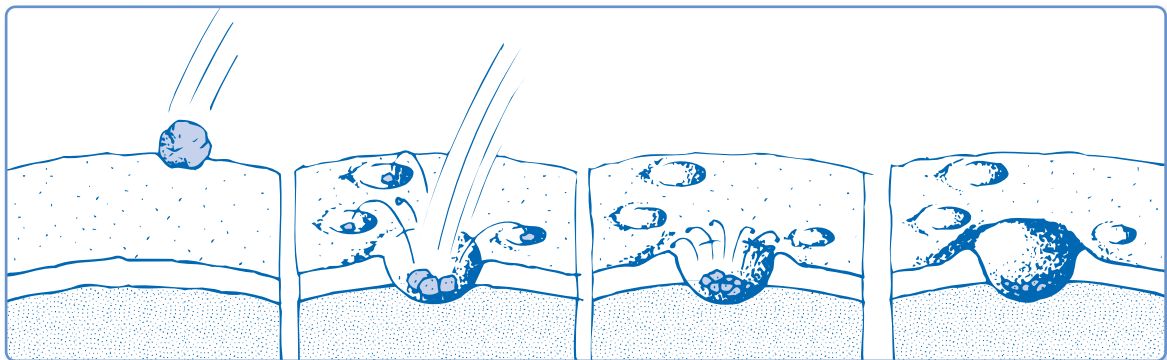
You may wish to demonstrate for students how to remove the marble from the pan using the magnet. If students have trouble removing the marble, tell them to try using the other end of the magnet.

Students should report that their pans of powder look like the surface of the Moon.

craters

dropping marbles into the powder

Accept all reasonable answers, but encourage students to recognize that the Moon was hit repeatedly by objects from space.



▲ *Figure 7-2. Most of the Moon's craters were formed by the impact of rocks.*

Guiding the Activity

Distribute a copy of **Activity Sheet 7** to each student and a box of crayons to each team of two. Have students draw what their Moon models look like and name the craters and seas on their model.

Additional Information

Students will probably guess correctly that, unlike the marbles in their models, the rocks broke apart on impact.

6 Finally, ask, **What do you think happened to the rocks when they hit the Moon?**

Explain that when the rocks hit, they broke up into many tiny pieces, including those the size of sand and dust. This layer of sand, dust, and rocks covers the Moon today.

Tell students that in the next activity they will get to see what the soil and rocks on the Moon look and feel like.

REINFORCEMENT

Have students smooth out the surface of their Moon models. Sprinkle another thin layer of cocoa over the surface. Then have students drop actual stones in the pan for a more realistic model.

SCIENCE JOURNALS

Have students place their completed activity sheets in their journal envelopes. Collect the envelopes and return them to their storage place.

CLEANUP

Tell students to wrap their pans of powder in newspaper and carry them to the trash bin. Have them carefully dump the newspaper and the contents of the pans into the bin. (Line the bin with a plastic bag first.) Have students wash their hands. Rinse the powder off the pans, bar magnets, and magnetic marbles and dry them. Reseal the containers of flour, cocoa, and sand and return them, along with the magnets, marbles, and pans, to the kit. Leave the posters and photos of the Moon where students can see them.

Connections

Science Challenge

Ask students whether they think there is any sound on the Moon. Accept all responses, then explain that without air, there can be no sound. Because the Moon has no air around it, there is no sound on the Moon. Then do the following demonstration with small groups:

Stretch plastic wrap over the top of a bowl and secure it with a rubber band. Sprinkle grains of sugar, salt, or uncooked rice on the plastic. Tell students to watch the grains as you hold a pan next to the bowl with its open side facing the bowl and rap the bottom of the pan several times with a spoon. (Each time the pan is struck, the grains will bounce up. If students cannot see this clearly, tell them to look at the grains from the side.) Explain that the sound created by hitting the pan traveled through the air to the bowl and made the plastic move, which made the grains bounce. Students also might like to try making loud vocal sounds directed at the bowl to see if they can make the grains bounce. Tell students not to make sounds that produce puffs of air.

Science Extension

Ask students whether they have ever seen a “shooting star” in the night sky—perhaps when they were making their Moon observations for this module. Explain that “shooting stars” are rocks from outer space falling through the air around Earth. When the rocks rub against the air, they heat up and glow, so we can see them from Earth. To allay any fears that students may have about rocks falling from space, tell them that these space rocks usually burn up before they ever reach the ground. Sometimes, though, they do hit Earth—just as rocks hit the Moon to make its craters. Explain that some “shooting stars” occur in groups (called meteor showers) at certain times of the year. Obtain a list of the major meteor showers that occur each year.

Make a copy of the list to send home with each student, and encourage them to ask an adult or older sibling to help them look for these meteor showers when they are next scheduled to occur.

Science and Social Studies

Students may not know that there are a number of craters on Earth that were formed by meteorites. One famous example is Meteor Crater near Winslow, Arizona. This huge pit—0.8 km (0.5 mi) wide and over 180 m (600 ft) deep—is believed to have been made by a meteorite that crashed to Earth some 25,000 years ago. Another example is Chubb Crater in Canada. Obtain books with photographs of craters on Earth for students to examine. Use a world map or a globe to show students each crater’s approximate location. If any students have visited Arizona’s Meteor Crater, let them tell the rest of the class about their experience.