DIY SUN SCIENCE

Shadows on the Moon

Does sunlight reach the entire surface of the Moon?

Description

Use playdough and a flashlight to explore shadows on an accurate model of Moon craters hiding water ice.

Age Level: 6 and up

Materials

- 1 cup flour
- ¼ cup fine grain salt
- 1 teaspoon cream of tartar
- ½ tablespoon canola or another vegetable oil
- ⅓ cup very hot water (from the tap)
- Red and blue food coloring to make gray color
- Large bowl
- Large spoon
- Measuring cups and spoons
- Cutting board or flat dish to hold playdough
- Flashlight

Start with Step 4 if you are using premade playdough.

Time

Preparation: 30 minutes
Activity: 15 minutes
Cleanup: 10 minutes

Safety

Have an adult help you make the playdough. Even tap water can burn your skin if it comes out too hot. Playdough is not edible.

Step 1

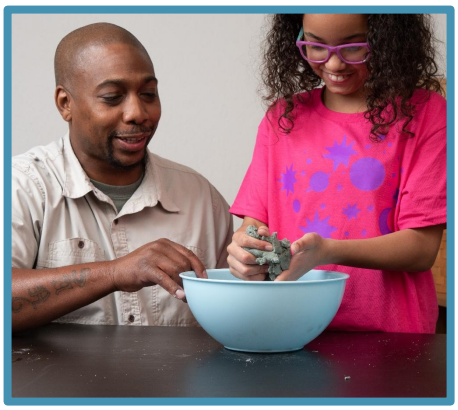
Place the flour, cream of tartar, salt, and oil into your bowl, followed by the warm water and food coloring. Add equal amounts of red and blue food coloring to get a Moon-like gray color. You will need about 20 drops total.

Step 2

Mix everything with a spoon until it's well blended and then let the bowl sit until the mixture cools down.

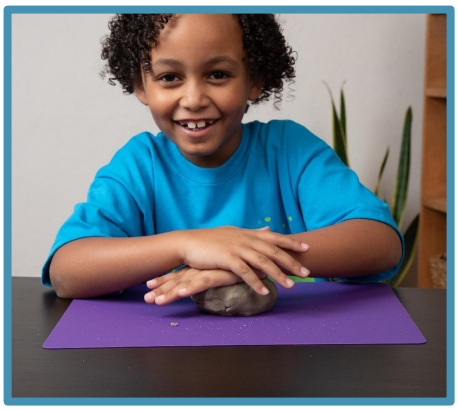
Step 3

Once cooled, knead the playdough and add a sprinkle of flour if it feels sticky.



Step 4

Plop your playdough on a cutting board or flat dish. Spread out the playdough so you have a flat and smooth blob at least ½ inch thick. This will be the surface of your Moon model.

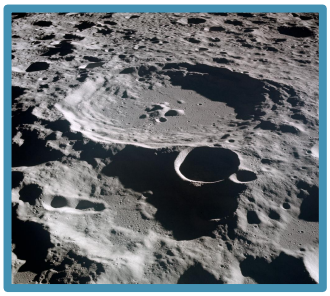


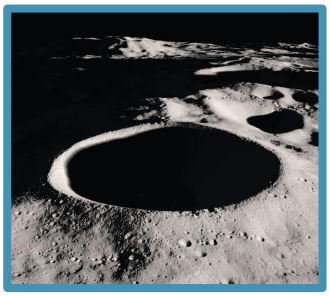
Step 5

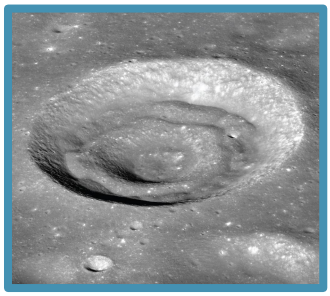
Get creative with your craters! Asteroids and comets crashing into the Moon make real craters, but in this activity you can just use your fingers. Poke your fingers into the playdough to make craters, and pinch the playdough to make hills. Some craters can be very deep, while others may be more shallow.

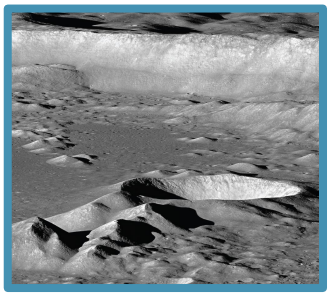
Step 6

Compare your crater creations to NASA images of craters on the Moon. How are they similar and how do they differ? What changes do you want to make to your model to make it more accurate?









Step 7

Turn down the lights or take your model into a dark room. Try shining a flashlight over your craters. Be sure to change the position and angle of your flashlight as you experiment. What shadows do you see?

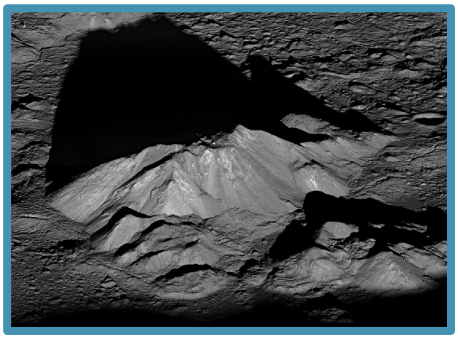
Step 8

Shadows get strange at the top and bottom of the Moon—places known as the poles. To see for yourself, hold the flashlight low and parallel to your playdough, like in the photo here. Now rotate the cutting board or flat dish while continuing to hold the flashlight. How long are the shadows? Are there spots in your craters the light cannot reach? If light reaches the bottom of some of your craters, try making deeper ones.

Step 9

Now that you have your playdough, try the experiment again with more crater shapes, or design a shelter for astronauts! NASA may use the dust and rocks from the Moon's surface to build a lunar outpost. This new home for astronauts living and working on the Moon will protect them from the dangers of our active Sun.

What's going on?

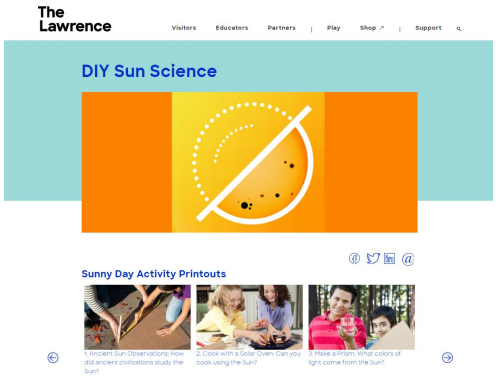


Think about the long shadows you see early and late in the day. They occur because the Sun is very low in the sky, which is how the Sun always appears at the Moon's poles. Long shadows often cover much of the craters in these areas of the Moon. Sometimes sunlight doesn't even make it to the bottom of a crater—just like how the light from the flashlight didn't reach the bottom of the deepest craters you made in your playdough. Being in permanent darkness keeps the craters very cold, as low as -233 ^{o}C, or -388^{o}F, and prevents the water ice inside them from melting and evaporating into space. The Moon is a very dry place compared to Earth. There are no oceans, lakes, or rivers. If astronauts are going to stay on the moon for long periods of time, they will rely on the water ice in the craters at the Moon's poles.

Is the Sun dangerous to astronauts on the Moon?

Extreme temperature swings between sunlit and shadowed regions aren't the only danger facing astronauts on the Moon. The Sun sometimes emits massive bursts of electromagnetic radiation and charged particles. These events, known as solar flares and coronal mass ejections, can affect life on Earth and equipment orbiting the planet. Luckily, the Earth's magnetic field and atmosphere provide significant protection from these events, but the surface of the Moon is often defenseless. Astronauts on the Moon will have to seek shelter underground or within protective habitats during these solar outbursts. Fortunately, a whole fleet of NASA satellites and solar observatories keep track of activity on the Sun's surface to predict these events and provide early warning.

Learn More



For more info and other activities, visit:

LawrenceHallofScience.org/do_science_now/diy_sun_science

Credits

The Lawrence Hall of Science
UNIVERSITY OF CALIFORNIA, BERKELEY

The DIY Sun Science app allows families and educators to investigate and learn about the Sun at home, at school, or anywhere you go! The app provides 15 hands-on investigations, images, and videos.

Slide 8, 12, NASA/GSFC/LROC. Slide 13, 14, NASA.

NASA Partner

This work was supported by NASA under award number NNX10AE05G and 80NSSC21M0082. Any opinions, findings, conclusions, or recommendations expressed in these programs are those of the author and do not reflect the views of NASA.