# TRY THIS — Ice at the Poles!

**Students explore why the lunar poles may contain concentrations of ice.**

## What's Needed

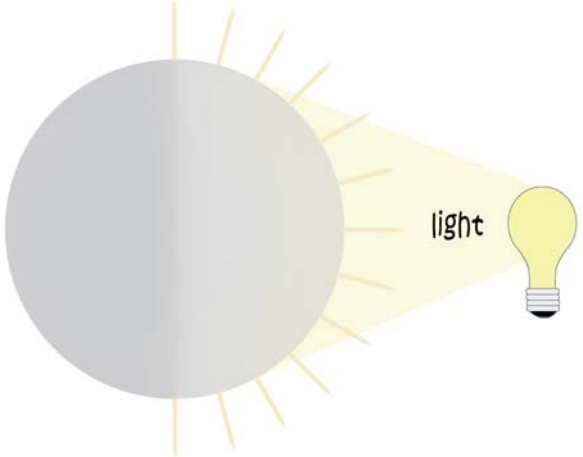
Image of the South Pole of the Moon
(example: http://www.lpi.usra.edu/publications/slidesets/clem2nd/slide_29.html)

For each group of 3 to 4 students

- Ball of light-colored clay (at least 6 inches in diameter)
- 13 toothpicks
- Work light or other lamp (75 watt or greater bulb)

## Getting Started

The students should have an understanding of what causes day and night. While focused on examining why deep polar craters on the Moon are in permanent shadow, the activity can be used to explore causes of day and night and seasons on Earth and other planetary bodies.




## What to Do

- Provide the students with the clay balls, toothpicks, and lamps. The clay ball represents the Moon and the lamp represents the Sun. Have the groups insert one toothpick halfway into the north pole and one toothpick halfway into the south pole of their clay Moon so that the toothpicks are perpendicular to the surface.
- Invite the students to experiment with creating day and night on the lunar surface using the lamp and ball. Explain that the Moon spins more slowly on its axis than Earth. The lunar day and the lunar night each are about the length of 14 Earth days. Because the Moon has no atmosphere to moderate surface temperatures, the Moon's surface that is in sunlight is very hot (average of 225°F/107°C), and the surface that is in darkness is very cold (average of –243°F/–153°C).

  Explain to the students that the Moon's axis is tilted only 1.5 degrees; this is much smaller than Earth's axial tilt of 23.5 degrees. Ask the students where the Sun's light most directly strikes the Moon's surface.
- Invite the students to add the rest of their toothpicks in a line stretching from the north to the south lunar pole. The toothpicks should be placed equal distances apart, perpendicular to the surface with one at the equator of their clay Moon. Have the students illuminate their Moon from two to three feet away so that the center of the beam of light is aimed at the Moon's equator.

  **What do the students observe about the shadows cast by the toothpicks?** The toothpick at the equator has no shadow. The toothpicks increasingly distant from the equator have increasingly longer shadows. The Sun's light — and energy — is striking most directly at the equator.

  **Are there any areas on the lunar surface that are shielded permanently from the Sun?** No. Even at the low levels of incident sunlight, the polar regions receive some light as the Moon rotates.

  Invite the students to examine images of the cratered lunar surface. Have them crater their clay moons by poking holes in the surface, including several half-inch-deep craters in the polar regions (the depth of cratering is greatly exaggerated in this model compared to actual crater depths on the Moon). **When they illuminate their clay Moon as they did earlier, what do they observe about the light in the cratered regions?** Craters across much of the surface are illuminated by the light, but the bottoms of craters at the poles stay dark all the time.

## Wrapping Up

**What do the student's observations suggest about temperatures in these permanently shaded craters?** Because the bottoms of these craters are permanently dark, the temperatures are below freezing all the time. **Comets are made, in part, of water ice; if comets delivered ice to the Moon, where might temperatures be permanently cold to preserve the ice?** The craters of the polar regions that are in permanent shadow are cold enough to preserve the ice.