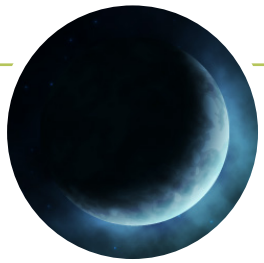
Modeling Lunar Phases

A Carolina Essentials™ Activity

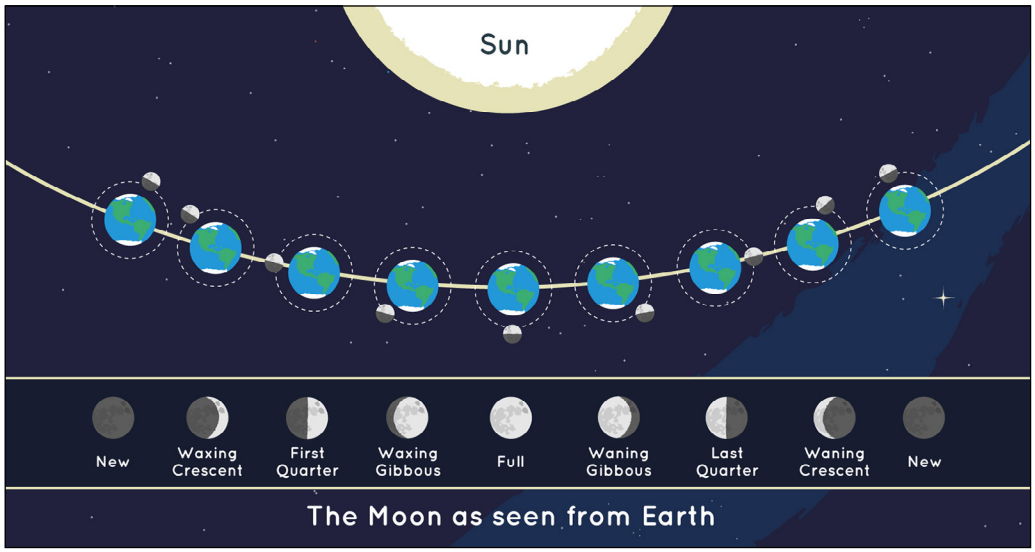
Student Worksheet



Overview

When you look up at the night sky, the largest object you see is the moon. If you observe the moon for a month, you probably notice that the moon appears to change shape. The moon really doesn't change shape, but the area that is illuminated by the sun does change. The moon is between Earth and the sun for several phases, behind Earth for several, and in line with Earth for the remaining phases. The location of the moon relative to Earth determines the amount of the moon's surface that is illuminated by the sun.

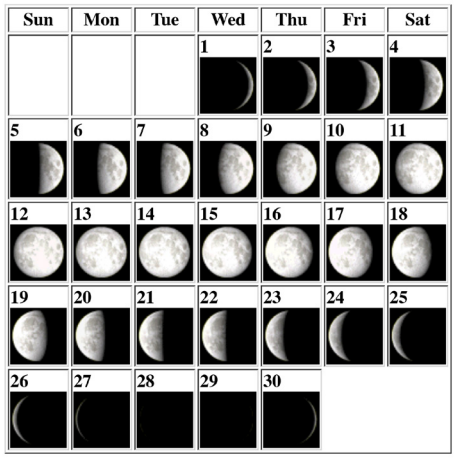
The NASA diagram below illustrates the position of the moon relative to the sun and Earth and how the moon's surface illumination changes.



NASA/JPL-Caltech "This graphic shows the position of the Moon and the Sun during each of the Moon's phases and the Moon as it appears from Earth during each phase."

Phenomenon

The following is a lunar cycle calendar. What patterns do you observe?



The University of Texas McDonald Observatory

The moon's phases repeat in a cycle. The phases are cyclical because the moon orbits Earth while Earth is orbiting the sun. The moon takes about 27.3 days to orbit Earth, but if you look at the lunar phase cycle calendar to the left, from new moon to new moon, the length is 29.5 days. Earth travels about 45 million miles around the sun on its orbit during the time the moon completes one orbit around Earth. Therefore, the moon must travel an extra 2.2 days to catch up.

To model lunar phases, you'll construct a simple Earth-sun-moon model consisting of a flashlight or lamp representing the sun, a foam ball on a pencil representing the moon, and a person standing at the center of a circle of paper (divided into eighths) representing the rotating Earth.

SAFETY REQUIREMENTS

No PPE is required for the activity.

MATERIALS

Bulletin board paper, 48 × 48 in (any color)

Scissors

Pencil or wood dowel, 1/2 × 10 in

Foam ball, 3 in

Flashlight or lamp

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The student, holding the moon in constant position, rotates 45 degrees until returning to the starting position, resulting in a model of the moon's phases. The lunar cycle model and background information will be used to predict lunar phase dates for the next 3 lunar cycles.

It's time to be an astronomer!

Essential Question

What causes the cyclical pattern of lunar phases?

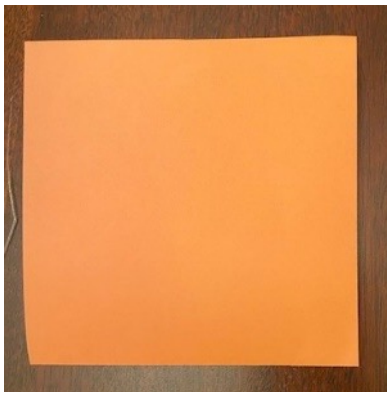
Activity Objectives

1. Develop a model of the lunar cycle.
2. Draw or use photos to describe the pattern of lunar phases.
3. Use the pattern to predict the dates of the next three lunar phase cycles.

Procedure

1. Take the piece of bulletin board paper and fold it in half, making a sharp crease.

2. Fold the paper a second time to make it into a square again, making a sharp crease.



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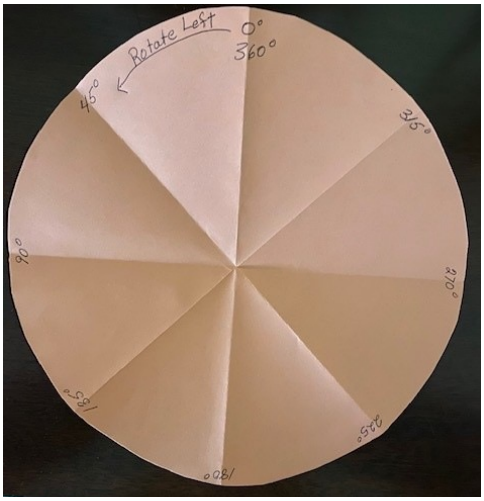
3. Fold the paper a third time on the diagonal, making a cone shape. The cut edges of the paper should all be at the large opening of the cone. Make a sharp crease through all layers of the paper.

4. Using the scissors, trim the wide end of the cone into a curve so it looks like a piece of pie or pizza.

5. Completely unfold the paper. It should be a circle divided into 8 sections, as shown in the following image.



6. Label one crease as 0°. Move to the left and label the next crease 45°. Continue labeling the creases, moving to the left each time—90°, 135°, 180°, 225°, 270°, 315°, and 360° (0° and 360° are the same crease).

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7. Position the lamp (the sun) on a table or desk 3 to 4 feet from the center of the circle. If using a flashlight, the person holding the flashlight needs to stand 3 to 4 feet from the center of the paper circle.
8. Place the labeled circle on the floor with the 0° crease pointing to the lamp.
9. Carefully push the pencil into the middle of the foam ball (this represents the moon).
10. Stand on the center of the circle (Earth) with the 0° crease in line with the light.
11. Turn on the lamp or flashlight (the sun) and turn off the room lights.
12. Hold the pencil with the ball out at arm's length, slightly higher than shoulder height, and in line with the 0° crease.
13. Observe and sketch or photograph what the ball looks like from the center of the circle.
14. Turn your whole body slowly to the left until you are in line with the 45° crease, and sketch or photograph the ball again.
15. Repeat the process until you are back to the 0°/360° crease.
16. If using photos, upload the photos to the data table.

Data and Observations

Observations and Positions in Degrees

0º	45º	90º	135º	180º
225º	**270º**	**315º**	**360º**	

Analysis and Discussion

Analysis

1. Use your data table to explain the pattern of light and dark produced by the Earth-sun-moon model.

2. Explain the differences between the lunar phase pattern you observed and the one presented in the phenomenon.

3. Using your lunar phase model, explain why lunar phases happen.

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Discussion

1. Use the lunar phase model to predict the date and phase of the next 3 lunar cycles. Your teacher may ask you to confirm your predictions by using an online calendar or checking the moon phase nightly.

Lunar Phase Calendar						
Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**

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