



MODELING MOON PHASES

ACTIVITY A-3

GRADE LEVEL: 4-9+

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What's This Activity About?

With simple materials, students explore how the Moon's phases arise, why they change, and why a particular phase is visible at a certain time of night or day. Research has shown that students will cling to previous misconceptions about the reasons for lunar phases, even after hearing the correct explanation. This hands-on activity is perhaps the best way for students to confront their personal theories and discover the truth.

This popular activity not only demonstrates the reason for lunar phases, but also starts to develop students' sense of spatial perception as they create a mental image of the Sun, Moon, and Earth in space.

What Will Students Do?

Students use Styrofoam balls to simulate the Moon, which will be lit by a single light source in the classroom. They observe how different portions of their ball are illuminated as they hold it in various positions. They will create a complete series of phases matching the Moon's appearance. They will relate lunar phases to the positions of the Earth and Sun.

Tips and Suggestions

- This activity works best in a very dark room with a very bright light. Leave time to prepare if your classroom is not easily darkened, or a bright light is not easy to find. Dark colored plastic garbage bags work well to cover windows. An overhead projector can work as the light source.

- Because the visualization in this activity can be difficult for some students, it is helpful to do this activity with a smaller group while the rest of the class works on their moon phase chart or another project, or to do the activity more than once.
- Students will usually observe that their own shadows will cover the Moon ball when it is opposite the light source, simulating a lunar eclipse during the "full Moon" phase. Ask them to hold the Moon ball above or below the shadow of their head, and ignore the eclipse for the time being. Eclipses will be addressed in the next activity.
- To address students' misconceptions, before doing the activity ask the class to list possible explanations for the phenomena of lunar phases. Do not comment on the validity of the theories offered. Ask each student to write down their own explanation, based on what they have heard. After the activity, rewrite their explanation for phases and discuss any changes from earlier ideas. Have students do this activity at home with their families, or demonstrate to younger students and then write about their results.
- You may purchase Styrofoam balls from: Molecular Model Enterprises, 116 Swift St., P.O. Box 250, Edgerton, WI 53334, (608) 884-9877.

What Will Students Learn?

Concepts

Phases of the Moon

Inquiry Skills

Explaining
Observing
Reasoning
Recognizing Bias

Big Ideas

Patterns of Change

MODELING MOON PHASES

This activity allows students to use models of the sun, earth, and moon to discover why the moon phases occur.

CONCEPT

The observed phase of the moon is determined by its position relative to the earth and sun.

OBJECTIVES

Students will:

- be able to state the order of the moon's phases from one full moon to the next.
- demonstrate how the moon's position relative to the earth creates the phases.

MATERIALS

light bulb on a stand or clamp (or lamp with its shade removed)
extension cord
one Styrofoam ball or light colored sphere for each student (as model moon)
pencil and paper
darkened room

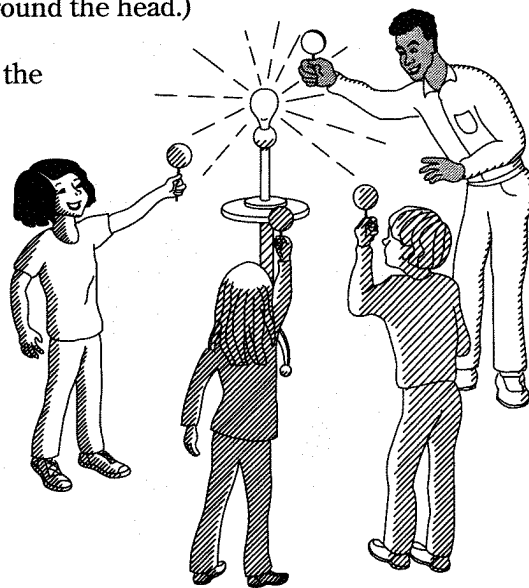
PROCEDURE

Advanced Preparation:

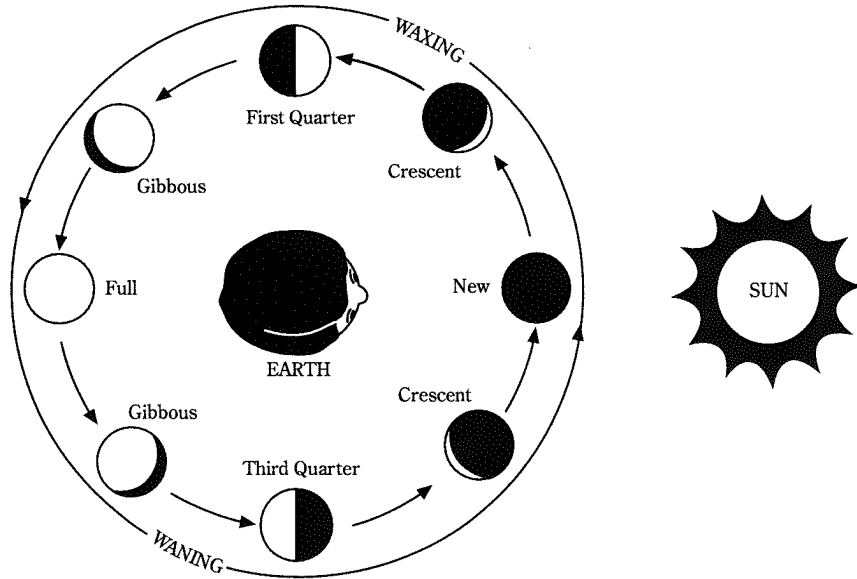
Collect enough Styrofoam balls to have one for each student. Be sure that there is plenty of space for students to stand and move about as they work through this activity. Check that the lamp or light bulb for the model sun works properly and that it can be placed in the front of the room where everyone can see it. The room will need to be completely dark for this activity.

1. Review the results of Activity Two, which showed that the moon goes through a sequence of phases. Work with the students to review the order of the phases from one full moon to the next.
2. Explain that to understand why the phases of the moon occur, students need to look at models of the moon, earth, and sun. Place the lamp in front of the room. Remind students of safety near the hot light bulb and electrical cord. Have students stand in a semicircle facing the lamp. Explain that the lamp represents the sun and that their head represents the earth, with their nose being their hometown.

3. Ask students to stand so it is noon in their hometown. If disagreement occurs, have them discuss this until it is agreed that noon is when their nose is pointed toward the "sun." Ask them to stand so it is midnight. They should turn so they face away from the "sun." Ask them to stand so it is sunrise and sunset. In order to stand properly, they will need to know their "earth" head rotates from right to left, with their right shoulders moving forward. Practice the ideas of sunrise, noon, midnight, and sunset until you feel that the students have a good understanding of these relative positions.
4. Distribute one Styrofoam ball moon model to each student. Have students stick a pencil into the ball to make it easier to hold and not interfere with their ability to observe the phases of the moon model. Have students hold the moon model at arm's length. Allow time for them to explore how the sun's light reflects off the model as they place their moons in different positions around their "earth" head.
5. Choose one of the lunar phases and ask students to find the position in the "moon's" orbit where that phase is visible. (First quarter is a good phase to start with.) Encourage students to compare their results and discuss differences. Ask one student who has the correct position to state why it is right. As the teacher, you can check for understanding by seeing if all of the students are standing in the same position.
6. Have students model the other phases; for example, full moon, third quarter, and new moon. As they learn where to hold the Styrofoam model for each phase of the moon, challenge them to determine the direction the real moon travels around the earth to create the phases in the correct order. (This can be demonstrated by moving the ball from right to left in orbit around the head.)
7. Allow time for students to experiment with the movement of the moon. Have them work together to draw a diagram of the moon's position in order to create each of the phases. Ask students to state what causes the phases of the moon. (The spinning earth—your head—makes the moon rise and set each day, but this does not affect the phase of the moon. The phases are caused by movement of the moon around the earth.)
8. Have students check their positions for the moon against those in the moon phases diagram that follows.



THE MOON AS SEEN FROM EARTH



THE MOON'S POSITION RELATIVE TO THE EARTH AND SUN AS VIEWED FROM OUTER SPACE, ABOVE OUR SOLAR SYSTEM

