MODELING ECLIPSES

ACTIVITY A-4

GRADE LEVEL: 6-9+

What's This Activity About?

The Moon phase modeling activity can also be used to simulate both lunar and solar eclipses. Lunar eclipses occur when the Earth's shadow falls on the Moon during the "full" phase. The Moon will darken significantly (but not disappear). Solar eclipses occur when the Moon passes between the Earth and Sun, temporarily blocking sunlight over a small portion of our planet's surface.

With the Styrofoam balls and light of the preceding activity, students will see that their shadow occasionally covers the Moon ball, creating a lunar eclipse. They can also observe the Moon ball's shadow sometimes covering their face, blocking the light, creating a solar eclipse. The activity has background information and pictures to explain why both types of eclipses occur.

What Will Students Do?

Students will simulate solar and lunar eclipses using Styrofoam balls and a single light source. They will observe how both types of eclipses occur, predict when eclipses are likely to occur, and consider whether more people will be likely to see a lunar or solar eclipse.

Tips and Suggestions

- Note that the Moon is an average of 30 Earth diameters away from the Earth. This is much greater than textbook diagrams can show. Such diagrams can mislead students into thinking that eclipses should happen each month.
- The hula hoops are helpful in demonstrating the orbit of the Moon around the Earth, and the relative positions of the Moon and Sun, but may be confusing to some students because the Sun is so much farther away (about 400 times farther away than the Moon). The activity can be done quite successfully without the hoops.
- For older grades, discuss what happens when only a portion of the bulb is blocked by the Moon ball (a partial eclipse), or when the ball appears smaller than the light bulb (an annular solar eclipse). These events are usually illustrated in high school astronomy texts.
- Most astronomy software include eclipse demonstrations. Some programs (*Voyager* for the Mac, *The Sky* for DOS and Windows, among many others) can automatically predict the date, time, and locations of upcoming eclipses and simulate the exact views seen from Earth. These programs are especially helpful in comparing different views of eclipses seen from different locations on Earth.
- 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
- Solar Eclipses
- Lunar Eclipses
- Phases of the Moon
- Orbit of the Moon around the Earth

Inquiry Skills
- Experimenting
- Observing
- Reasoning
- Predicting

Big Ideas
- Patterns of Change
- Interactions
- Models

MODELING ECLIPSES

This activity explores why, when, and how often solar and lunar eclipses occur, using the earth, moon, and sun models of Activity Three.

CONCEPTS

Eclipses are caused by a predictable alignment of the earth, moon, and sun. Different alignments create lunar and solar eclipses.

OBJECTIVES

Students will:

- distinguish between lunar and solar eclipses.
- model how lunar and solar eclipses occur.
- predict when an eclipse is most likely to occur.
- determine whether more people can see a total lunar or total solar eclipse.

MATERIALS

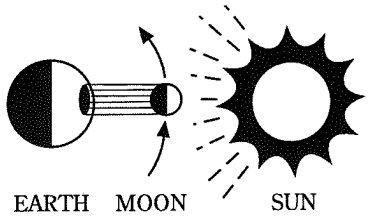
light bulb on a stand or clamp (or lamp with its shade removed)
extension cord
one Styrofoam ball or light colored sphere (as model moon)
pencil and paper
two hula hoops

PROCEDURE

Advanced Preparation:
Read the eclipse information at the end of this unit for a more thorough understanding of eclipses.

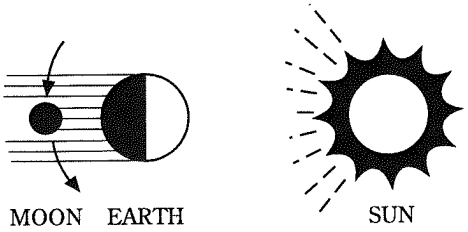
1. Ask students if they know the definition of an eclipse and the difference between a solar eclipse and a lunar eclipse? Explain that this activity will help them understand the difference between these two types of eclipses and why they occur.

2. Set up the equipment as it was used in Activity Three, with students in a semicircle facing the lamp. Have them move the moon ball in orbit until it completely blocks their view of the lamp. Explain that when the moon is positioned between the earth and the sun, and it blocks the sun, it produces a solar eclipse. Students can remember this by thinking of the view of the sun as being clipped off. Have students position themselves so that the view of the full moon is clipped off by the earth's shadow. Ask them to tell you what phase the moon must be in to produce each type of eclipse.



Total Solar Eclipse

Moon must be in new phase. Only people in a small region on earth where the moon's shadow falls can see the total solar eclipse.



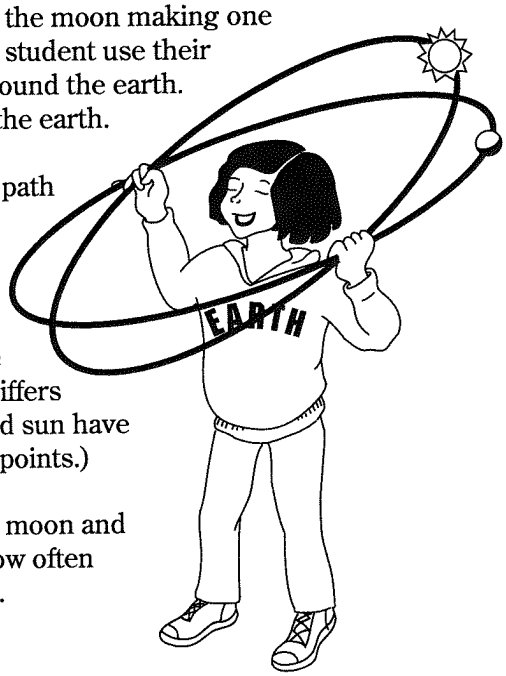
Total Lunar Eclipse

Moon must be in full phase. All people on the night side of the earth can see lunar eclipse.

3. Now that students know what causes eclipses, ask them to predict how often there should be solar and lunar eclipses, and whether more people get to see a total solar eclipse, or a total lunar eclipse. Give them time to work with the moon ball model before guiding them to the answers.

4. Although solar and lunar eclipses occur with equal frequency, a person is less likely to see a total solar eclipse than a total lunar eclipse. Ask students to take partners. Have one partner hold the moon ball to produce a solar eclipse. Have the other person look at the shadow of the moon falling on the face of his/her partner. Ask students to consider this question: if the student's head were the earth, from what part of the earth could people see the solar eclipse? Have the partner hold the ball to produce a lunar eclipse. Ask if more people will see a lunar eclipse or a solar eclipse. Generate a list of predictions for how often solar and lunar eclipses should occur, along with reasons for the answers.

5. Hold two hula hoops over your head, as shown in the illustration, to show the relationship of the path of the sun and the moon *as seen from earth* (your head). The inside hoop is the orbit of the moon, with the moon making one complete revolution each 29.5 days. Have one student use their moon model to follow the path of the moon around the earth. Discuss the route the moon takes as it orbits the earth.



6. The outer hoop represents the sun's apparent path as seen from earth, with the sun appearing to go around the earth once a year. (Although the earth actually goes around the sun, our view from earth makes the sun appear to go around the earth.) Have one student trace the path of the sun around the hoop. Ask how it differs from the moon's path. Where do the moon and sun have to be to produce an eclipse? (At the crossing points.)

7. Use the students' knowledge of how often the moon and sun are at the crossing points to determine how often eclipses occur (see Background Information).

Notes