Eclipses

Overview

Students will simulate the eclipses of the moon and the sun using a central light source as the sun, their own heads as the Earth, and a foam ball as the moon. Throughout this guide, all information in italics is a "teacher tip."

North Carolina Essential Science Standards

6.E.1.1 Explain how the relative motion and relative position of the sun, earth and moon affect the seasons, tides, phases of the moon, and eclipses.

Background

After doing the "Phases of the Moon**"** exercise, most students will see that the Earth's shadow plays no part in phases of the moon. However, shadows of both the Earth and moon are responsible for lunar and solar eclipses.

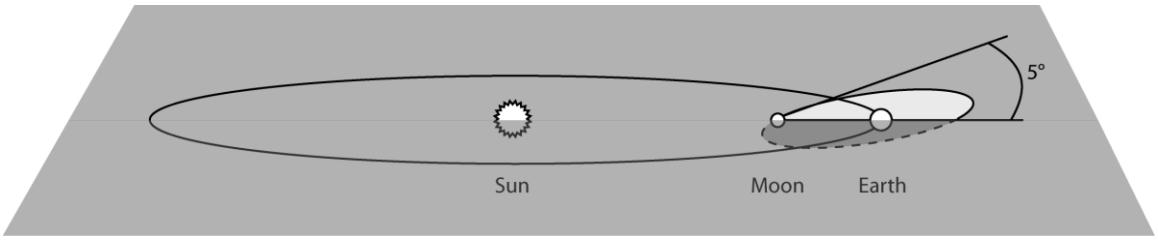

Figure 1. Solar eclipse.

In its orbit around the sun, the Earth travels in a plane called the *ecliptic*, the gray plane in Figure 1. The moon orbits the Earth in a different plane that is at an angle to the ecliptic. Traveling in this plane, sometimes the moon is above the ecliptic (solid arc in Figure 1), sometimes it is below (dotted arc), and it crosses through the ecliptic twice each orbit. Figure 1 shows the moon passing through the ecliptic when it is also directly between the Earth and the sun. When this happens, the moon's shadow falls on the Earth, blocking the sun. This happens during a new moon, and it is a solar eclipse.

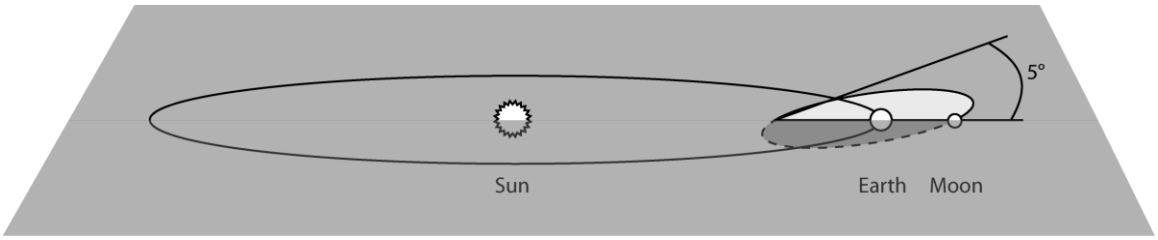

Figure 2. Lunar eclipse.

Figure 2 shows the moon passing through the ecliptic when it is on the far side of the Earth. When this happens, the Earth's shadow falls on the moon, blocking sunlight to the moon. This happens during a full moon, and it is a lunar eclipse.

If the moon orbited in the ecliptic, a solar eclipse would visible from somewhere on Earth at every new moon. Likewise, there would be a lunar eclipse at every full moon. However, since the two orbits are *not* in the same plane, new and full moons are usually above or below the ecliptic, and eclipses occur only rarely, when the moon's orbit crosses the ecliptic when it is new or full.

Materials

Materials for the whole class

- 1 lamp with a bare bulb
- 1 extension cord
- Duct tape

Materials for individual students

- 1 foam ball (3-inch diameter)
- 1 skewer
- *Science notebook

* *supplied by the teacher*

Preparation

- Set up the lamp in the center of the room. If you use the extension cord, tape it securely to the floor so that no one can trip over it.

Procedure

1. Use a similar procedure as for "Phases of the Moon." However, this time, ask students to hold their moons in line (in the same plane) with the bulb (sun) and their heads (Earth).
2. When students position themselves for a full moon, their head shadows will create a lunar eclipse.
3. When students position themselves for a new moon, the moon will block the light from the sun from shining in their eyes, thus simulating a solar eclipse.

Reflection/Discussion

While conducting the lunar eclipse simulation, ask students:

1. Why is it not possible to have a lunar eclipse during a quarter or crescent moon?

   [Lunar eclipses occur when the Earth's shadow falls on the moon. The Earth's shadow cannot fall on the moon during the quarter and crescent phases. Students might not have noticed this during "Phases of the Moon."If they seem to have difficulty understanding, have them try it with the bulb and their foam moons.]

2. Why isn't there a lunar eclipse every month during the new moon? A solar eclipse every full moon? See Background.

   [NOTE: Simulating a lunar eclipse reasonably demonstrates what actually happens in space, but the solar eclipse simulation is not exact. Real total solar eclipses are so beautiful because of the way the sun and moon appear to match in size, and it is difficult to achieve this effect with a foam ball and a bulb. Although the sun is much larger than the moon, it is much farther from the Earth than the moon. Because of this, the sun and moon appear to be about the same size in the sky. As a result, when the moon is exactly in front of the sun, only the very outermost rim of the sun is visible.]

3. *Optional:*
   - Challenge students to find out what a *partial* solar eclipse is and why it occurs.
   - Point out that when a solar eclipse occurs, it can be seen from some areas of the Earth, but not all. Challenge students to find out why this is so.

Assessment

Ask students to write an explanation of what causes eclipses to occur.

Recommended Resources

The LearnNC web site has excellent lessons about shadows, the sun, moon, and earth, provided by the Kenan Fellows program and written by a scientist and a teacher from Durham, NC. Although these lessons are aligned to grade 3 standards, you are likely to find many useful ideas for grade 6 in them.

These lessons are at http://www.learnnc.org/lp/editions/earth-sun/6564

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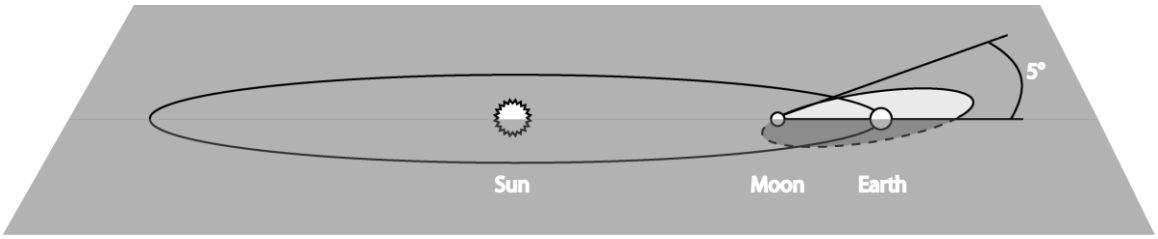
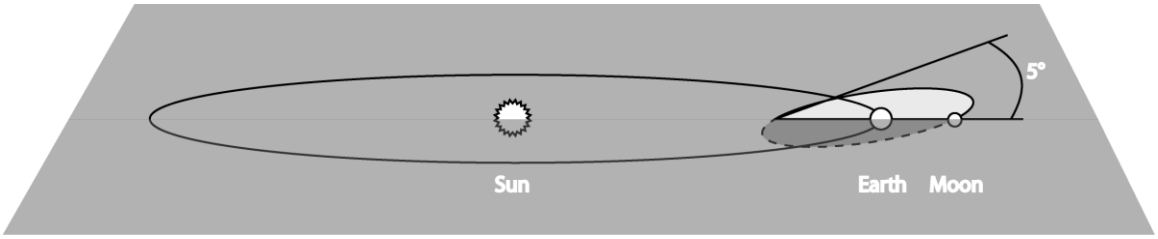


Solar eclipse



Lunar eclipse