Phases of the Moon

Overview

This activity leads students to simulate the phases of the moon 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

The moon does not generate its own light. Half of the moon is always lit by the sun, except during a lunar eclipse. Moonlight is the reflected sunlight. The phases of the moon are created by the amount of that lit surface that we see from Earth at a particular time. The most common misconception is that the phases are a result of the Earth's shadow on the moon. This only happens during a lunar eclipse, and will be simulated in the **Eclipses** exercise.

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

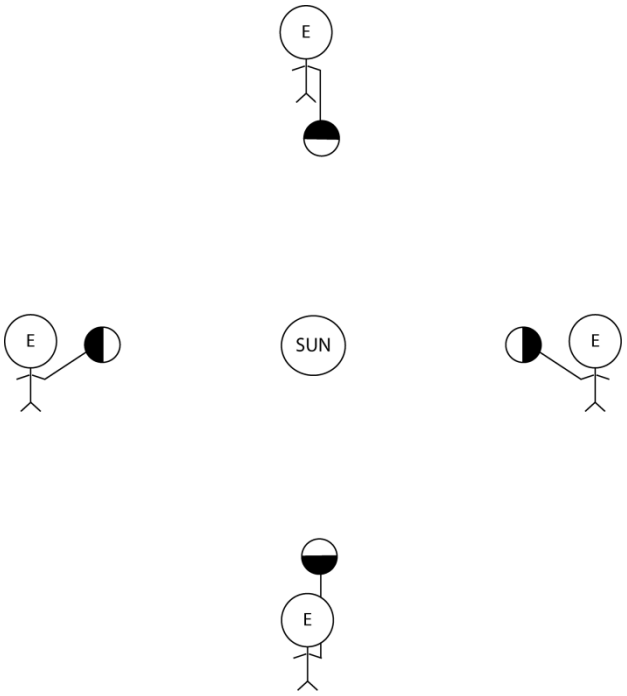
Set up the lamp in the center of the room. If you use the extension cord, tape it securely to the floor so that no one can trip over it.

Procedure

1. Start with a discussion of why we see phases of the moon. Get as many ideas from students about this as possible. It is not necessary to explain phases of the moon now. Wait until you have all of the students' ideas about it. Afterward, you can say that the sun always lights up half the moon, but some of the part that us lit often faces away from us, and we don't see that part. The only time we see the whole lit surface is on the night of the full moon. The Earth's shadow is not

involved in moon phases. Explain that we are going to simulate one full cycle of the moon's phases – 28 days. The moon takes 28 days to go around the Earth.

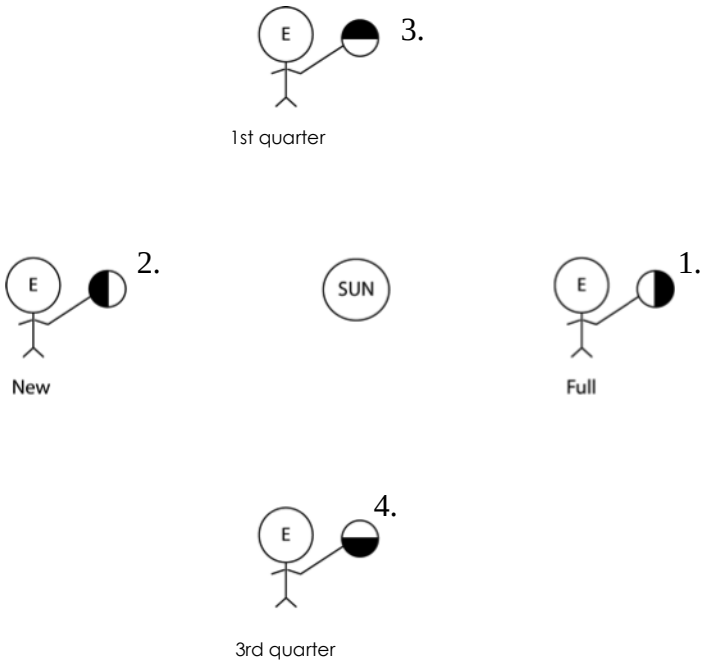
2. Make 'moon-sticks' using skewers and foam balls.
3. Again, the central bulb is the sun. Have students stand in a large circle around the bulb/sun. Explain that our heads represent the Earth, and the tops of our heads are North Poles.
4. Ask everyone to hold their moons directly toward the light (as in the diagram below). Ask what phase of the moon everyone sees. *[The moons are dark, fully in shadow]* Explain that this is called a "New Moon."



5. Ask everyone to rotate a quarter turn to the left and stand so that the light is directly to their right. Say that it would take one week for the moon to move this far. Ask what everyone sees. *[The moons are lit on their right hand sides]* Explain that this is called "First Quarter."
6. Ask everyone to rotate another quarter turn to the left so that their moons are directly away from the light (another week's time). Tell them to lift the moon high enough over their head so that their head does not block the light. Ask what everyone sees. *[The moons are fully lit]* Say that this is a full moon.
7. Ask everyone to rotate another quarter turn to the left so that the light is directly to their left. Again, it would take a week for the moon to move this far .Ask what everyone sees. *[The moons are lit on their left hand sides]* Explain that this is called "Third Quarter." In another week, the moon will be "new" again.

8. Ask whether the moon is closest to the sun when it is a new, full, or first or third quarter moon. When is it farthest from the sun?

9. Remind students that their head represents the Earth and their eyes represent someone on Earth looking up. Ask them to show you the following. Between each demonstration, ask them to always turn to the left – the way the moon would actually travel. Optional: Ask how much time would pass between these positions of the moon.
   - a new moon *[#2 in diagram below, moon directly toward the sun]*
   - a full moon *[#1 in diagram below, moon directly away from the sun]*
   - a first quarter moon *[#3 in diagram below, sun on the right]*
   - a third quarter moon *[#4 in diagram below, sun on the left]*



Reflection/Discussion

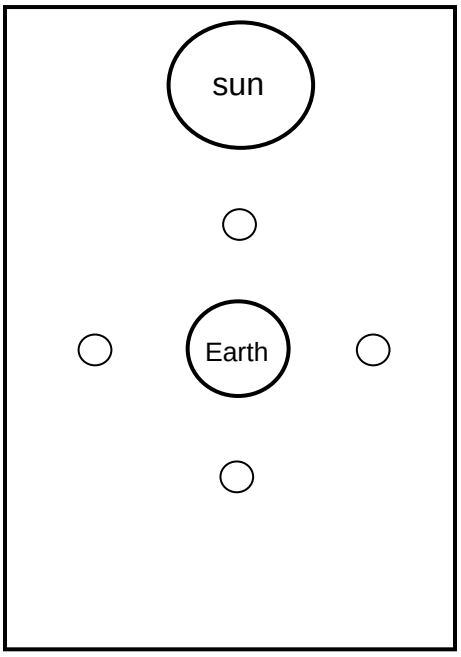
Ask students to refer back to their moon logs. The simulation that students completed relates to what they saw and recorded in the sky. It can work well to do this with students and their moons still in a circle around the bulb. Ask the "Reflection/Discussion" questions from the Moon Log exercise again to reinforce the following ideas.

- The lit side of the moon always faces the sun.
- The amount of that lit surface that we see depends on where the sun is in relation to the moon and to us on Earth.

- The moon's orbit around the Earth causes us to see the phases, NOT the Earth/Moon's orbit around the sun. In the 28 days it takes the moon to show all of its phases, the Earth travels only about 1/13 of its orbit around the sun.
- If you want, you can introduce the terms "waxing" for getting larger, and "waning" for getting smaller, and the term for in-between moons, "gibbous." The phases always follow the same sequence: new, waxing crescent, 1st quarter, waxing gibbous, full, waning gibbous, 3rd quarter, waning crescent, new.
- To figure out whether a crescent moon is waxing (getting bigger) or waning (getting smaller), notice its shape. If it is a 'D,' it is getting larger (waxing). If it is a 'C', it is getting smaller (waning)
- The moon is on the sun side of the Earth when it is new, and on the opposite side of the Earth from the sun when it is full. Refer back to the fist-length data from **The Sun's Path Across the Sky.** Ask how those data fit with what happened in the simulation. *[The moon appears to be closer to the sun in the sky when it is about to be new, or has just been new. The new moon sets in the West at sunset, with the sun (very near the sun). When the moon is closer to full, it appears farther from the sun in the sky. The full moon rises in the East at sunset, opposite the sun (as far from the sun as possible).]*

Assessment

1. Ask students to begin a sketch as follows: draw a small Earth in the center of a page, and a sun at the top of the page. Ask them to sketch 4 small moon circles equally spaced around the earth, with one of the moon circles directly between the sun and earth, and one on the direct opposite side of the sun. Ask them to color in the moon phases and label them at each position.



2. Based on observations they made during the seasons simulation, ask students:
    - How does the moon get its light?
    - Why can't we see the moon when it is new?
    - Why do we see different parts of the moon during the course of a month?