EXPERIENCE 4.5

Modeling Eclipses

Overall Concept

Now that students understand where the Moon has to be in its orbit to see each phase, modeling continues by exploring where the Moon, Earth, and Sun have to be to produce solar and lunar eclipses.

Objectives

Students will
1. distinguish between lunar and solar eclipses and
2. understand that solar eclipses only happen when the Moon is in its new phase and lunar eclipses only occur when it’s in its full phase.

Procedure

1. If you did Experience 4.2, “What Do We Think We Know?” ask students to review their response to prompt 3, “What are solar and lunar eclipses, and what causes them?” If you did not do Experience 4.2, ask students if they know what an eclipse is. What is the difference between a solar eclipse and a lunar eclipse? Ask them if they have ever seen an eclipse, and if so, whether it was solar or lunar. Have them write responses to the questions in their astronomy lab notebooks. Then explain that this activity will help them understand the difference between these two types of eclipses as well as why they occur.

2. Set up the equipment in the same way as it was used in Experience 4.4, “Modeling the Moon.” Have the students explore moving their model Moon in its orbit (always revolving counterclockwise) to determine when the Moon can block the Sun’s light from reaching the Earth (a

MATERIALS

For the class:
- Lightbulb on a stand or clamp (or lamp with the shade removed)
- Extension cord

One per student:
- Smoothfoam or Styrofoam ball or light-colored sphere (as a model Moon)
- Pencil
- Blank sheet of paper
- Astronomy lab notebook
solar eclipse) and when the Earth can block the Sun’s light from hitting the Moon (a lunar eclipse). If you recently did Experience 4.4, in which you told the students that the shadow of the Earth was not a factor, you may want to tell them that shadows are a factor for eclipses, and they can now feel free to play with shadows. As much as possible, have them use the model to come up with the correct answer. (Solar eclipses only occur when the Moon is in its new phase. Lunar eclipses only occur when the Moon is in its full phase.)

3. After the students have explored how to produce the two types of eclipses, reinforce what they observed by having them move the Moon ball in orbit until it completely blocks their view of the lamp. Explain that it is when the Moon is positioned exactly between the Earth and the Sun that it blocks the Sun and produces a solar eclipse. Ask them what phase the Moon must be in to line up and make a solar eclipse. (New Moon) This is a good time to show several photographs of different solar eclipses. These are easily found by searching the internet for solar eclipse images.

4. Now ask them to position their Moon balls so that the Sun’s light falling on the Moon is blocked by the Earth. Ask them what phase the Moon must be in to produce this lunar eclipse. (Full Moon) This is a good time to show several photographs of different lunar eclipses.

5. Have the students take notes in their astronomy lab notebooks and briefly write the reason that we have eclipses. They should explain what is necessary for us to experience a solar eclipse and a lunar eclipse. Ask them to explain what the two types of eclipses have in common. (The Sun, Earth, and Moon are all lined up.)

Teacher note: A question that typically arises at this point is why we don’t have solar and lunar eclipses every month since we have a new Moon and full Moon every month. The Moon’s orbit around the Earth is out of alignment by 5° from the plane of Earth’s orbit around the Sun (the ecliptic). This means the Moon is not lined up with the Earth and the Sun most months. This is the subject of elaborate Experience 4.6, “How Often Do Eclipses Occur?” which makes a great extension for this experience.