Eclipses

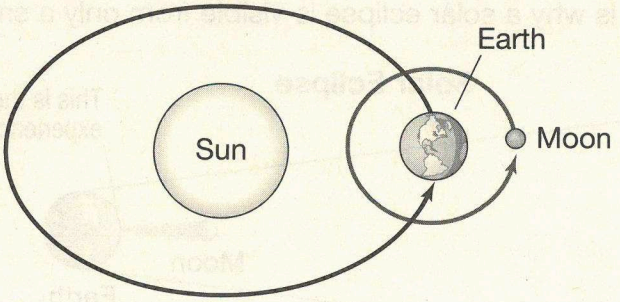
Key Words • eclipse • solar eclipse • lunar eclipse

Getting the Idea

Have you ever stepped into the shade on a hot, sunny day? That shade is a shadow that is caused by an object that blocks sunlight. Objects in space, such as Earth and the moon, also cast shadows by blocking light. Sometimes these shadows affect what you see in the sky. In this lesson, you will learn about the effects shadows can have on your view of the sun and the moon.

The Earth-Moon-Sun System

Earth, the moon, and the sun form a *system*—a group of parts that interact, or relate to one another. The moon revolves around Earth. At the same time, Earth revolves around the sun. Earth and the moon travel around the sun together.



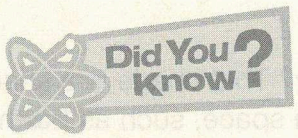
NOTE: Not to scale

Earth and the moon are always moving and always casting shadows. As their positions change, the positions of their shadows also change. At certain times, Earth and the moon align with the sun to block light and cast shadows on each other. An **eclipse** occurs when one object in space casts a shadow on another object in space.

The changing positions of the moon, the sun, and Earth cause eclipses. Eclipses only occur when all three bodies line up in a particular way. There are two different types of eclipses: solar eclipses and lunar eclipses.

Solar Eclipse

Sometimes the moon passes directly between Earth and the sun. When the moon comes between Earth and the sun in this way, a **solar eclipse** occurs. At this time, the moon blocks the sun's light from reaching parts of Earth. The moon gets in the way of the sunlight and casts a shadow on Earth. As Earth turns on its axis, the moon's shadow traces a path across part of the land below. If you are located on the part of Earth that is in the moon's shadow, you can see the moon pass in front of the sun and block it out. This is a solar eclipse.

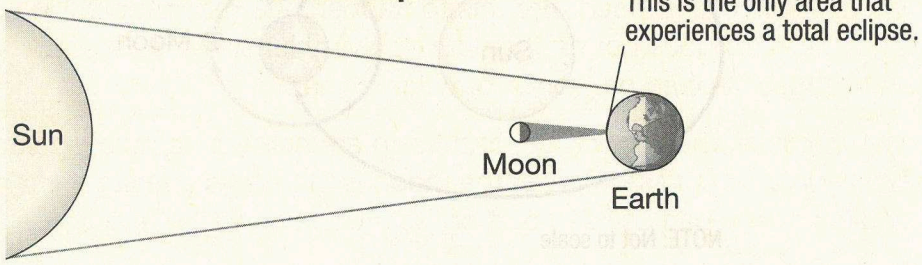


You should never look directly at the sun during a solar eclipse. The light that enters your eyes can cause permanent damage if you stare at it. There are special viewers that people use when there is a solar eclipse in their area.

In a *total solar eclipse*, the moon blocks the entire face of the sun from viewers on Earth. It takes about an hour from the time the moon begins to move in front of the sun until the time the eclipse is total. During this time, it looks as if a dark circle is slowly sliding across the sun. When the eclipse is total, only the outer layer of the sun's atmosphere can be seen as a glowing ring around the blacked-out sun. During a total solar eclipse, the sky becomes dark enough for stars to be visible.

In a *partial solar eclipse*, the moon blocks only part of the face of the sun. The diagram below shows the conditions for a solar eclipse. Notice that the moon's shadow on Earth is relatively small. This is why a solar eclipse is visible from only a small part of Earth.

Solar Eclipse



Notice that the lit side of the moon faces away from Earth during a solar eclipse. Recall that this is the *new moon* phase. A solar eclipse can happen only during a new moon.

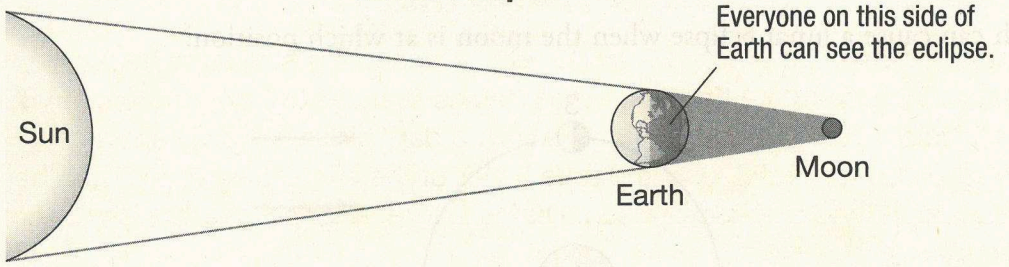
Since the moon goes around Earth about once a month, you might expect a solar eclipse that often. Actually, solar eclipses happen many years apart. Why do total eclipses not happen more often? The moon's orbit around Earth is slightly tilted compared to Earth's orbit around the sun. This means that the moon usually travels a little bit above or below the plane of Earth's orbit around the sun. As a result, the moon's shadow does not usually fall on Earth. The next time the moon's shadow will fall on the United States will be in 2017.

Lunar Eclipse

A **lunar eclipse** occurs when Earth comes between the sun and the moon, and Earth casts a shadow on the moon. As in a solar eclipse, a lunar eclipse can occur only when the moon, Earth, and sun are lined up in a row. In this case, Earth is lined up in between the moon and the sun.

Under these conditions, Earth blocks the sun's light from reaching the moon. As you can see in the diagram below, Earth gets in the way of the sunlight and blocks it from reaching the moon. From Earth, a lunar eclipse looks like all or part of the moon disappears and then appears once again.

Lunar Eclipse



A lunar eclipse can only happen during a full moon. A *total lunar eclipse* takes place when the entire lit side of a full moon moves into Earth's shadow. At the beginning of a total lunar eclipse, you can see a curved shadow on the moon. That is the edge of Earth's shadow. The moon continues to move in its orbit until it is completely inside Earth's shadow. At this point, the moon is completely eclipsed. For this to happen, the moon must line up *directly* with Earth and the sun. This does not happen during every lunar cycle. In a given part of the world, total lunar eclipses happen only once or twice a year.

During some lunar eclipses, the sun, moon, and Earth are not in a completely straight line. This results in a *partial lunar eclipse*. Part of the moon is in Earth's shadow, and part is out. Under those conditions, you can still see part of the moon during the eclipse.

Discussion Question

The moon is about one-fourth the size of Earth. If the moon were twice as big (one-half the size of Earth), how would that affect the way a solar eclipse looks?

Eclipses

1. What happens during a solar eclipse?

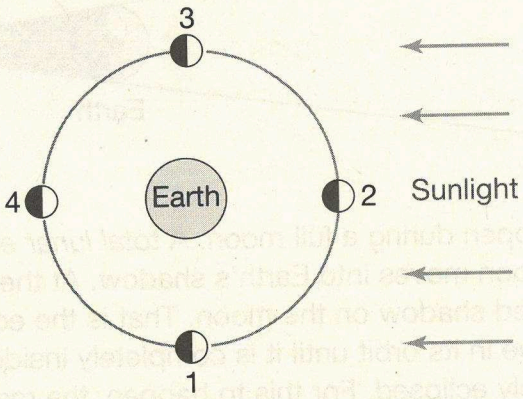
   A. The sun comes between Earth and the moon.

   B. The moon comes between the sun and Earth.

   C. Earth comes between the sun and the moon.

   D. The moon is hidden behind Earth.

2. Earth can cause a lunar eclipse when the moon is at which position?



   A. position 1

   B. position 2

   C. position 3

   D. position 4

3. What part of the sun can be seen during a total solar eclipse?

   A. the sun's outer atmosphere

   B. one-half of the sun

   C. the sun's shadow

   D. no part of the sun

4. During which phase of the moon can a solar eclipse take place?

   A. first quarter

   B. full moon

   C. last quarter

   D. new moon