Exploring Eclipses

How do lunar eclipses occur?

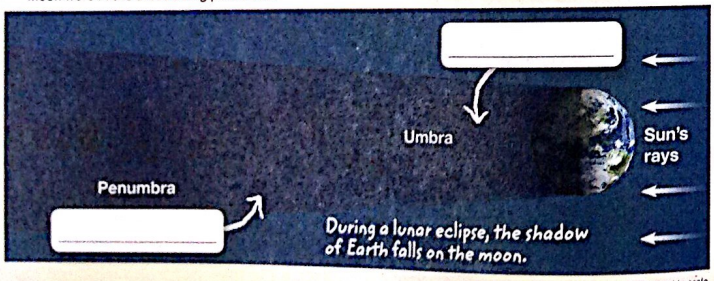
An **eclipse** (ih•KLIPS) is an event during which one object in space casts a shadow onto another. On Earth, a lunar eclipse occurs when the moon moves through Earth's shadow. There are two parts of Earth's shadow, as you can see in the diagram below. The **umbra** (UHM•bruh) is the darkest part of a shadow. Around it is a spreading cone of lighter shadow called the **penumbra** (pih•NUHM•bruh). Just before a lunar eclipse, sunlight streaming past Earth produces a full moon. Then the moon moves into Earth's penumbra and becomes slightly less bright. As the moon moves into the umbra, Earth's dark shadow seems to creep across and cover the moon. The entire moon can be in darkness because the moon is small enough to fit entirely within Earth's umbra. After an hour or more, the moon moves slowly back into the sunlight that is streaming past Earth. A total lunar eclipse occurs when the moon passes completely into Earth's umbra. If the moon misses part or all of the umbra, part of the moon stays light and the eclipse is called a partial lunar eclipse.

You may be wondering why you don't see solar and lunar eclipses every month. The reason is that the moon's orbit around Earth is tilted—by about 5°—relative to the orbit of Earth around the sun. This tilt is enough to place the moon out of Earth's shadow for most full moons and Earth out of the moon's shadow for most new moons.

This composite photo shows the partial and total phases of a lunar eclipse over several hours.

Visualize It!

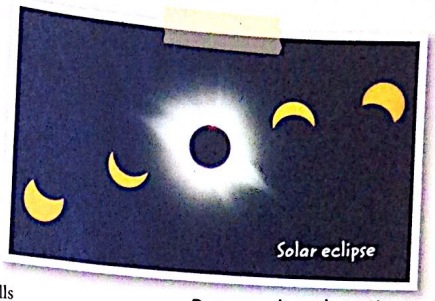
11 Identify Fill in the boxes with the type of eclipse that would occur if the moon were in the areas being pointed to.



How do solar eclipses occur?

When the moon is directly between the sun and Earth, the shadow of the moon falls on a part of Earth and causes a solar eclipse. During a total solar eclipse, the sun's light is completely blocked by the moon, as seen in this photo. The umbra falls on the area of Earth that lies directly in line with the moon and the sun. Outside the umbra, but within the penumbra, people see a partial solar eclipse. The penumbra falls on the area that immediately surrounds the umbra.

The umbra of the moon is too small to make a large shadow on Earth's surface. The part of the umbra that hits Earth during an eclipse, is never more than a few hundred kilometers across, as shown below. So, a total eclipse of the sun covers only a small part of Earth and is seen only by people in particular parts of Earth along a narrow path. A total solar eclipse usually lasts between one to two minutes at any one location. A total eclipse will not be visible in the United States until 2017, even though there is a total eclipse somewhere on Earth about every one to two years.



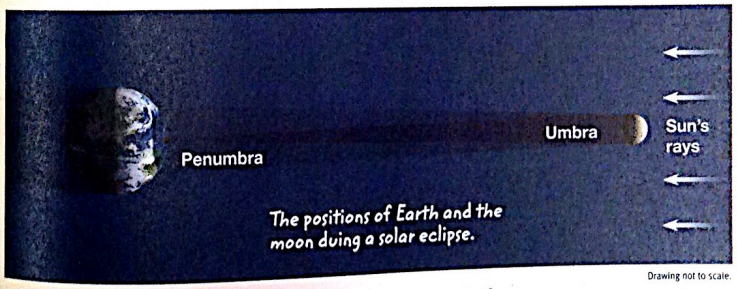
During a solar eclipse, the moon passes between the sun and Earth so that the sun is partially or totally obscured.

Active Reading

12 Explain Why is it relatively rare to observe a solar eclipse?

Visualize It!

13 Describe Explain what happens during a solar eclipse.



Drawing not to scale.