

# Eclipses and Transits

**Overview:** It just so happens that the Sun's diameter is about 400 times larger than the Moon, but the Moon is 400 times closer than the Sun. This makes the Sun and Moon appear to be about the same size in the sky as viewed from Earth. This is also why the eclipse thing is such a big deal for our planet. You're about to make your own eclipses as you learn about *syzygy*.

**What to Learn:** A total eclipse happens about once every year when the Moon blocks the Sun's light. Lunar eclipses occur when the Sun, Moon, and Earth are lined up in a straight line with the Earth in the. Lunar eclipses last hours, whereas solar eclipses last only minutes.

## Materials

- 2 index cards
- Flashlight or Sunlight
- Tack or needle
- Black paper
- Scissors

## Experiment

1. Trace the circle of your flashlight on the black paper and cut out the circle with paper. This is your Moon. If you are using the Sun instead, cut out a circle about the size of your fist.
2. Make a tiny hole in one of the index cards by pushing a tack through the middle of the card.
3. Hold the punched index card a couple inches above the plain one and shine your light through the hole so that a small disk appears on the lower card. Move the cards closer or further until it comes into focus. The disk of light is the Sun.
4. Ask your lab partner to slowly move the black paper disk in front of your light as you watch what happens to the Sun on the bottom index card.
5. Continue moving the black paper until you can see the Sun again.
6. Where does your circle need to be in order to create an annular eclipse? A partial eclipse?
7. How would you simulate Mercury transiting the Sun? What would you use?
8. Fill out the table.

# Eclipses and Transits Data Table

*For the second column, describe where your object was compared to the flashlight/Sun, and how large it was.  
For the third column, draw the change you saw in the Sun.*

Type of Eclipse	Where was the Moon located?	What did it look like?
<i>Total</i>		
<i>Partial</i>		
<i>Annular</i>		
<i>Transit</i>		

## Reading

An eclipse is when one object completely blocks another. If you're big on vocabulary words, then let the students know that eclipses are one type of *syzygy* (a straight line of three objects in a gravitational system, like the Earth, Moon, and Sun).

A lunar eclipse is when the Moon moves into the Earth's shadow, making the Moon appear copper-red.

A solar eclipse is when the Moon's shadow crawls over the Earth, blocking out the Sun partially or completely. There are three kinds of solar eclipses. A total eclipse blocks the entire Sun, whereas in a partial eclipse the Moon appears to block part, but not all of the Sun's disk. An annular eclipse is when the Moon is too far from Earth to completely cover the Sun, so there's a bright ring around the Moon when it moves in front of the Sun.

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Transits are where the disk of a planet (like Venus) passes like a small shadow across the Sun. Io transits the surface of Jupiter. In rare cases, one planet will transit another. These are rare because all three objects must align in a straight line.

Astronomers use this method to detect large planets around distant bright stars. If a large planet passes in front of its star, the star will appear to dim slightly.

Note: A transit is not an occultation, which completely hides the smaller object behind a larger one.

## **Exercises**

1. What other planets can have eclipses?
2. Which planets transit the Sun?
3. How is a solar eclipse different from a lunar eclipse?
4. What phase can a lunar eclipse occur?
5. Can a solar eclipse occur at night?

## **Answers to Exercises: Eclipses and Transits**

1. What other planets can have eclipses? (Mercury and Venus don't have moons, and the moons of Mars are too small. Jupiter, Saturn, Uranus and Neptune can have eclipses as their moons are large enough and the Sun appears smaller. Pluto and Charon are in a weird orbit so that only one side of either one will ever experience eclipses, and even when they do, it's every 120 years or so.)
2. Which planets transit the Sun? (Venus and Mercury)
3. How is a solar eclipse different from a lunar eclipse? (A lunar eclipse is when the Earth comes between the Sun and Moon. A solar eclipse is when the Moon comes between the Earth and Sun.)
4. What phase can a lunar eclipse occur? (Only on a night of a full Moon.)
5. Can a solar eclipse occur at night? (No, because the Sun isn't visible at night.)