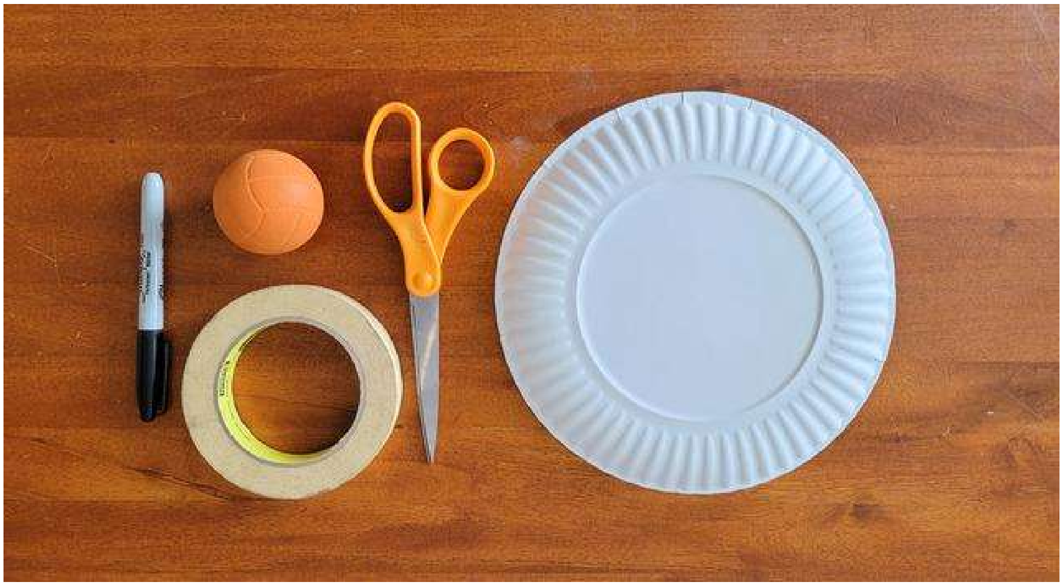
When Do Lunar Eclipses Happen?

Find out what causes a lunar eclipse. Then, use a paper plate to make a model that shows why they don't happen as often as you might expect.



Materials

- Paper plate, take-out container, or another flat surface with raised edges (thick material recommended)
- Pencil, pen, or marking pen
- Scissors
- Small ball, approximately 1-2 inches in diameter, or another object to represent the Sun
- (Optional) Jar, lid, or another round object that can be used to trace out a circle.

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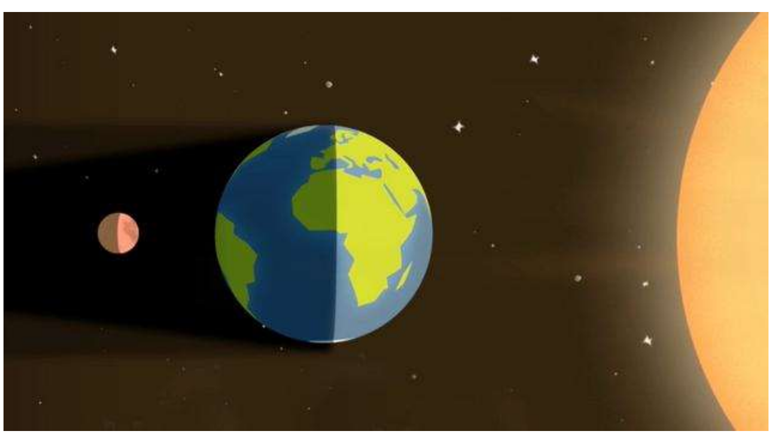


1. Learn about lunar eclipses

Solar and lunar eclipses can happen when the Sun, Moon, and Earth line up in certain ways. Lunar eclipses can only happen during a full moon – in other words when the Moon and Sun are on opposite sides of Earth. When sunlight reaches Earth, a shadow is cast on the side of Earth opposite from the Sun. If the Moon passes through this shadow, it results in a lunar eclipse.

But just because a lunar eclipse can happen during a full moon doesn't mean it will. This is because the Moon's orbit is slightly tilted. So usually, the Moon passes above or below Earth's shadow rather than through it.

The time period when the Moon, Earth, and Sun are lined up and on the same plane – allowing for the Moon to pass through Earth's shadow – is called an eclipse season. When a full moon occurs during an eclipse season, the Moon travels through Earth's shadow, creating a lunar eclipse.

Unlike solar eclipses, which require special glasses to view and can be seen only for a few short minutes in a very limited area, a total lunar eclipse can be seen for up to an hour by anyone on the nighttime side of Earth – as long as skies are clear.

2. Build an eclipse model

1. Draw or trace a circle 3-5 inches (8-13 centimeters) in diameter in the middle of the plate.

Step 1. Image credit: NASA/JPL-Caltech | + Expand image

2. In the center of that circle, draw a small circle and label it "Earth."

Step 2. Image credit: NASA/JPL-Caltech | [+ Expand image]()

3. At the edge of the paper plate, make a small arrow pointing outward that you will use as a reference in the next step and later in the project.

Step 3. Image credit: NASA/JPL-Caltech | [+ Expand image]()

4. On the inside edge of the larger circle, mark four evenly spaced points at 0, 90, 180, and 270 degrees (3, 12, 9, and 6 o'clock). You should align the 90 degree (12 o'clock) point with the reference mark you made in the previous step.
5. Label each point as follows:
    - Point 1 (at 90 degrees, or 12 o'clock)
    - Point 2 (at 180 degrees, or 9 o'clock)
    - Point 3 (at 270 degrees, or 6 o'clock)
    - Point 4 (at 0 degrees, or 3 o'clock)

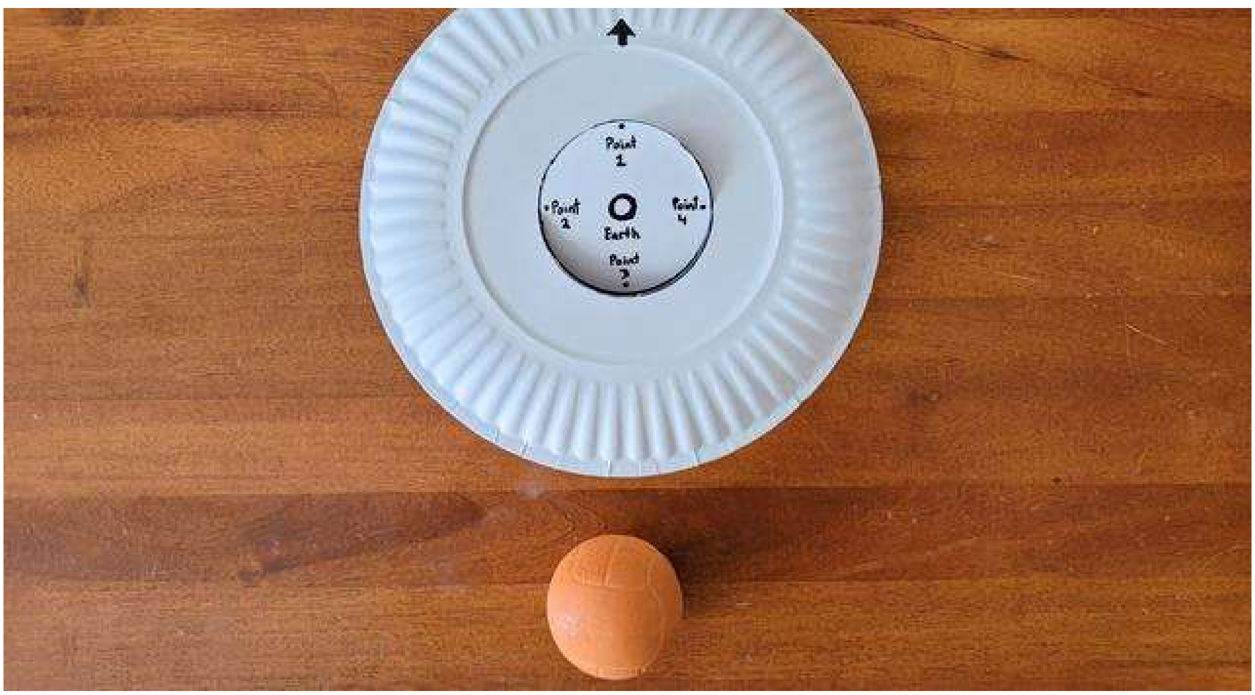
Steps 4 and 5. Image credit: NASA/JPL-Caltech | + Expand image

6. Carefully cut along the larger circle you drew, starting at the 90 or 270 degree marks (12 or 6 o'clock). You may want to poke a starter hole to make an easy spot to start cutting. Stop cutting at the 180 and 0 degree marks (9 and 3 o'clock), leaving a few millimeters of uncut space before continuing to cut around the circle. You should be left with a circle still connected to the plate at 180 and 0 degrees (9 and 3 o'clock).

Step 6. Image credit: NASA/JPL-Caltech | + Expand image

7. With both cuts made, gently twist the cut circle in the center of the plate so the 90 degree (12 o'clock) point rises up slightly and the 270 degree (6 o'clock) point dips down slightly. Be careful not to tear the paper between the two cuts.

Step 7. Image credit: NASA/JPL-Caltech | + Expand image



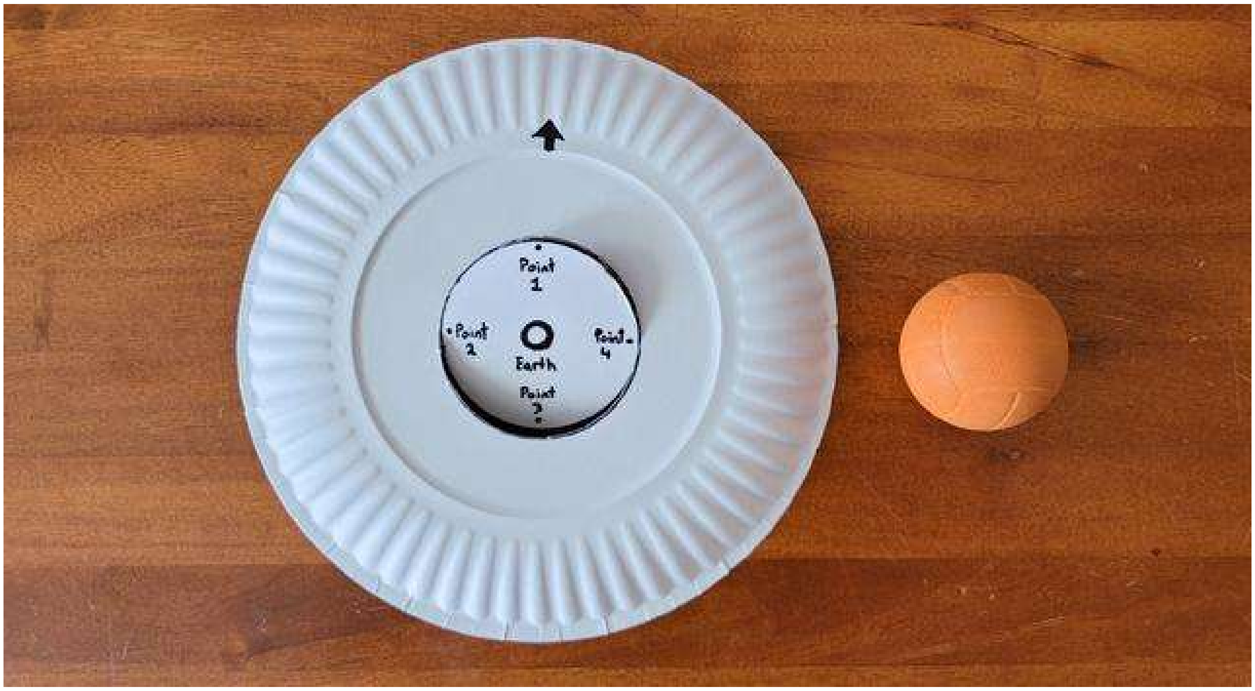
3. Check for an eclipse

The edge of the tilted circle represents the tilted orbit of the Moon around Earth. The outer part of the plate represents the plane in which Earth's shadow falls.

Place your plate on a flat surface and point the reference arrow away from you. Then, place an object representing the Sun on the opposite side of the plate from the arrow.

Use your model to answer these questions:

1. Where would the full moon be located? (**Hint:** remember a full moon is on the opposite side of Earth from the Sun.)
2. Is that point in the same plane as Earth's shadow?
3. Would there be a lunar eclipse during this full moon?



4. Travel around the Sun

Pick up the plate and move it counter-clockwise to the 180 degree (9 o'clock) position around the Sun. As Earth orbits the Sun, the orientation of the Moon's tilt stays the same, so make sure to keep your reference arrow pointed in the same direction it was pointed when you started.

Use your model to answer these questions:

1. Where would the full moon be located now?
2. Is that point in the same plane as Earth's shadow?
3. Would there be a lunar eclipse during this full moon?

5. Go all the way around!

Repeat these steps by moving the plate to the 270 degree (6 o'clock) and 0 degree (3 o'clock) positions around the Sun. Answer the same questions as in Step 4 for each position.

6. Make a prediction from your model

Moving the model all the way around the Sun represents one year. The time of year when an eclipse occurs is called an eclipse season. Based on what you've seen with your model, how often would you expect that an eclipse season occurs?