

Modeling Eclipses with a Scale Model of the Earth and Moon

Have you or a family member ever wondered why eclipses (often confused with a New Moon) don't happen every month? Making a simple scale model of the Earth–Moon system can help you answer this question! This activity is suitable for families, or for students in 4th grade and above. Younger children may need extra assistance.

What you'll need:

- Half of a standard 5-ounce container of play dough
- One or two rulers
- A measuring tape (optional)
- Two toothpicks (optional)
- A lamp without a shade for casting shadows (optional)

Instructions

Part 1:

- 1) Take half of the container of play dough and divide into 50 approximately equal pieces. Before beginning this step, it may be useful to consider what different methods can be used to divide the play dough. As a tip, a standard plastic ruler can make a great dough-cutting tool.
- 2) Set aside one average-sized piece.
- 3) Put the remaining 49 pieces back together. (Parents and teachers may not want to share this part of the activity before the 50 pieces are made.) The Earth has 49 times the volume of the Moon.
- 4) Roll the small piece (model Moon) and large piece (Model Earth) of play dough into spheres.

You have now made a scale model, in size, of the Earth-Moon system! You can double check to see how close you are to the actual size difference by measuring the Earth-ball and Moon-ball. The Earth-ball should have ~4 times the diameter of the Moon-ball.

Part 2:

- 1) *Make a prediction:* If we could shrink the real Earth-Moon system down to the size of our play dough model, how far apart would the Earth and Moon be? It may

be useful to ask students or family members to share with one another before moving to the next step.

- 2) *Compare your prediction with data:* The real Moon is about 30 Earth diameters away from the Earth.
- 3) *Create a scale model in distance:* Measure the size of your Earth-ball, multiply by 30, and place the Moon-ball at that distance from your Earth-ball. For most people, you will be able to hold the model in your hands with your arms stretched out to either side.

Extension: Where is the International Space Station?

- 1) *Make a prediction:* Where would the International Space Station (ISS) be on this scale model?
- 2) *Compare your prediction with data:* The Moon is about 384,000 km (or 239,000 miles) from the Earth. The ISS ranges from about 330 km to 425 km (or 205 to 270 miles) above the surface of the Earth. This means the ISS is only about 1/1000th of the way to the Moon!
- 3) *Measure it out:* How far from the Earth would the ISS be on your scale model?

Simulating Eclipses by Casting Shadows:

- 1) Push one toothpick each into the ends of the Earth-ball and Moon-ball. The toothpicks will make handles for your models of the Earth and Moon.
- 2) Put the lamp without a lampshade on a table in a dark room.
- 3) Try to simulate lunar eclipses by casting the shadow of the Earth-ball on the Moon-ball while keeping them at the proper scale model distance.
- 4) Try to simulate solar eclipses by casting the shadow of the Moon-ball on the Earth-ball.

Which type of eclipse is easier to make? Would eclipses be more common if the Earth and Moon were only a few Earth diameters apart as many people think?

This activity is from the NASA CINDI Mission Education and Public Outreach program. See more on our website and download our cool (free!) CINDI comic books at cindispace.utdallas.edu/education/. The Earth and Moon scale model was originally adapted from Astronomical Society of the Pacific's *The Universe at Your Fingertips* (1995) by Mary Urquhart for the CINDI mission.

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