

Activity 01 - Simulate an Eclipse Using Balls

Year Level: Grades 1–7 (typically from 6 to 12 years of age)

Background: Eclipses occur when the shadow of one solar system object falls on another. To help younger students understand the basic process it is useful to physically model what happens using everyday objects such as balls.

Aim: Students will observe what happens during a solar eclipse using balls to represent the Earth and the Moon.

References:

- Section 2 “What are Eclipses” of the AAQ/STAQ teacher booklet.
- PowerPoint presentation PP02 “How Eclipses Occur”

Safe Observing Message

When discussing a solar eclipse, students should be reminded that it is not safe to look directly at the Sun at any time and that safe viewing methods must be used to observe a solar eclipse.

Shape of the Australian Curriculum: Science strands on focus areas.

Content descriptors: Years 1, 3, 5 and 7

Science Understanding	Science as a Human Endeavour	Science Inquiry Skills
<p>Yr 1</p> <p>Observable changes occur in the sky and landscape (ACSSU019)</p>	<p>Yr 1</p> <p>Science involves asking questions about, and describing changes in, objects and events (ACSHE021)</p>	<p>Yr 1</p> <p>Respond to and pose questions, and make predictions about familiar objects and events (AC SIS024)</p> <p>Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas, and accessing information sources (AC SIS025)</p> <p>Through discussion, compare observations with predictions (AC SIS212)</p> <p>Compare observations with those of others (AC SIS213)</p>

<p>Yr 3</p> <p>Earth's rotation on its axis causes regular changes, including night and day (ACSSU048)</p>	<p>Yr 3</p> <p>Science involves making predictions and describing patterns and relationships (ACSHE050)</p>	<p>Yr 3</p> <p>With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (AC SIS053)</p> <p>Compare results with predictions, suggesting possible reasons for findings (AC SIS215)</p>
<p>Yr 5</p> <p>The Earth is part of a system of planets orbiting around a star (the Sun) (ACSSU078)</p>		
<p>Yr 7</p> <p>Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the Sun, Earth and the Moon (ACSSU115)</p>		

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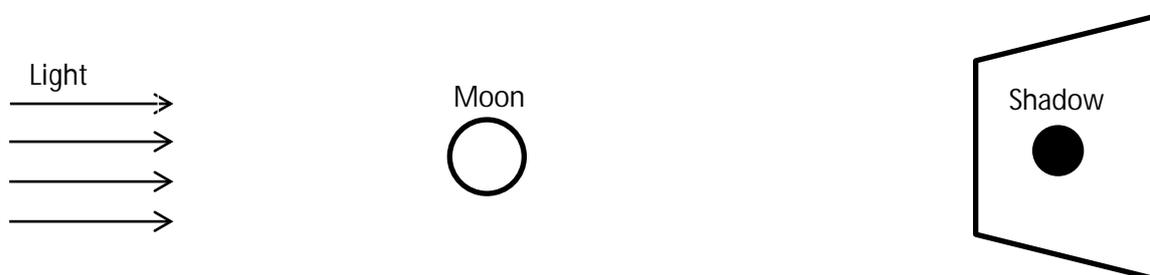
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Simulate An Eclipse Using Balls – Grades 1 - 7

Using some balls of different sizes and either a data projector or an overhead projector the basics of a solar eclipse can be demonstrated and explored.

To approximate the size of the Earth and the Moon an Earth Globe or a basketball and a tennis ball or something similar can be used. The distances between the Earth and the Moon are too hard to simulate at this scale because the tennis ball would need to be 7.4 metres away from the basketball. The data projector (Sun) would need to be 2.9 km away and be 27 metres across.

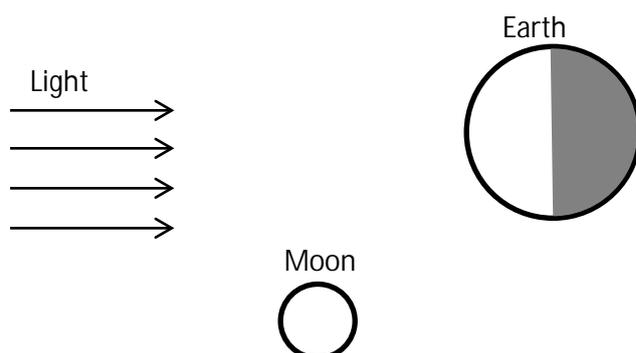
The teacher should start off by getting a student to hold the “Moon” so that the “Sun” creates a shadow on the whiteboard or wall. This can be used to create discussion about how a shadow is formed and where it is in relation to the light source.



Replace the “Moon” with the “Earth” being held by another student. At this point the students will see the “Earth” is lit up by the “Sun”. Get the students to sit side-on to the “Earth” and ask if there is anywhere on the “Earth” that is in a shadow. It may be useful to turn the room lights off. Use this time to discuss what causes day and night.



Now you can bring the “Moon” back in. The Moon orbits the Earth in a circle that is roughly horizontal in this case. Start by having the “Moon” orbit at about 2 metres from the “Earth” but try not to make a shadow of the “Moon” on the “Earth” just yet.



You could discuss the fact that the Moon is seen by the night side of the Earth for only some of the time and that the Moon is in the sky during the day for the some of the time.

Place the Moon on the opposite side of the Earth from the Sun but not in the shadow. Discuss what the Moon will look like. This is the position for a full moon. You might want to tell the students that the Moon takes 29 days from one full moon to the next.

An extended discussion could be about the phases that can be seen of the Moon. See also Activity 19.

Have the students look from where the Sun is and now have the Moon orbit in front of the Earth but get a Moon shadow to go across the Earth to create a Solar Eclipse where the Sun is hidden (eclipsed). Ask the students what the Sun would look like if you lived where the shadow was. This is where you would see the Sun completely hidden by the Moon and it would go dark. What would the Sun look like if you lived near the shadow? The Sun would only be partly covered by the Moon which is known as a Partial Eclipse.

If the lesson is conducted at roughly a week either side of a new moon the class can go outside and see the Moon during the day but explain to the students that they should never look directly at the Sun.

Lunar Eclipses

The same demonstration can be used to show how a Lunar Eclipse occurs. When the Moon goes behind the Earth it can sometimes pass into the Earth's shadow. Put the Moon in the Earth's shadow to show a Lunar Eclipse and discuss how the full moon can get a shadow on it. The Moon can either be fully in the Earth's shadow for a total lunar eclipse or partially in the Earth's shadow for a partial lunar eclipse.

Why Solar Eclipses do not occur every new moon and lunar eclipses do not occur every full moon.

As the Moon's orbit is at a slight angle to the plane of the Earth's orbit around the Sun (about 5 degrees), the Moon, Earth and Sun do not always exactly line up. You can use a hula hoop to show the tilted orbit of the Moon (tilted up towards the "Sun"). You can show that at new moon the Moon can pass above or below the Sun in the sky and there will be no solar eclipse. Also at full moon the Moon can pass above or below the Earth's shadow and there will be no lunar eclipse.

You can then hold the hula hoop at the same angle but move it out at right angles from the Sun to the previous line of the Sun and Earth (to simulate the Earth has moved three months in its orbit). This will show that even with the tilted orbit of the Moon, the Sun, Earth and Moon can still line up. There can be either a solar eclipse or a lunar eclipse (or both). This happens about every six months when the Sun is close the nodes of the Moon's orbit.

There are some very good computer simulations that can show what is actually seen (see activities 04, 05, 07 and 21).

Safety Message

When discussing a solar eclipse remind the students that it is not safe to look directly at the Sun at any time and that safe viewing methods must be used to observe a solar eclipse.

Some useful websites:

http://www.lpi.usra.edu/education/other_programs/lunar_eclipse/fruit_loops.shtml

<http://solar-center.stanford.edu/eclipse/model.html>