

## Polystyrene moon Visualising the phases of the moon using a ball on a stick

Set up a powerful light, such as a projector or a desk lamp at one end of a darkened classroom to act as the 'Sun'. Then give polystyrene balls to each pupil or group of pupils and ask them to push a sharpened pencil into the ball, as shown in the photographs. They can then use the ball on a stick to simulate the moon.

Then ask them to:

EITHER

- use their model to find out for themselves how to simulate the phases of the moon;

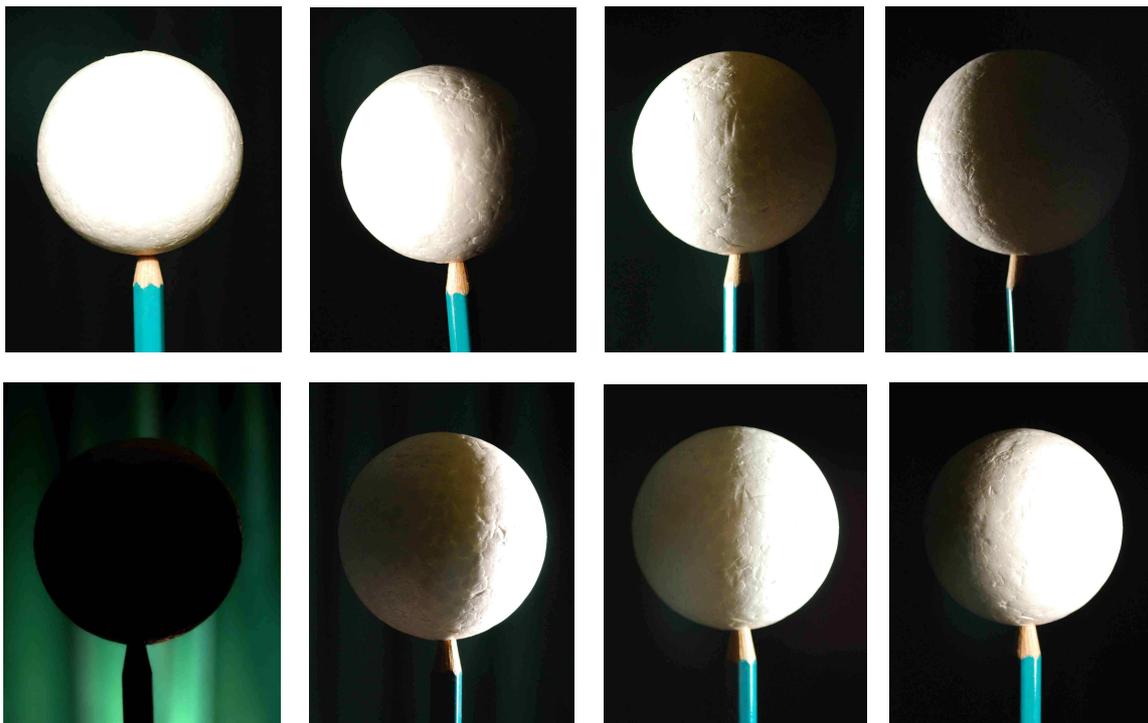
OR, take them through the phases step by step by:

- standing with their back to the light and holding the ball in the beam of light (without letting their head cast a shadow on the 'moon') – to see what the full moon looks like from the Earth;
- rotating their bodies by 45° to the left and holding the ball in the light again – to see a simulation of a waning gibbous moon (as the moon rotates anticlockwise around the Earth);

- rotating by another 45° – when the polystyrene 'moon' will be at right angles to the beam of light – to see a third (last) quarter 'moon';
- turning another 45° left – they will see a waning crescent 'moon';
- then turning another 45° to face the beam of light – and see the polystyrene 'moon' from the 'back' when it is in shadow – as just before a new moon is seen;
- through four more 45° turns, rotating back to where they began – seeing a waxing crescent 'moon', a first quarter 'moon' and a waxing gibbous 'moon', before seeing the full 'moon' again.

Check if they have seen the 'moon' images as in the photographs below. The bright part of the ball they see is equivalent to the bright part of the moon as it reflects light from the Sun.

Finally ask them to describe the activity they have just carried out to another pupil, as if the other pupil were a younger brother or sister – to reinforce their learning.



(All photographs by Peter Kennett)

### The back up

**Title:** Polystyrene moon.

**Subtitle:** Visualising the phases of the moon using a ball on a stick.

**Topic:** Using a ball and stick to simulate the moon and a light beam to simulate the Sun to see what the phases of the moon look like from the 'Earth'.

**Age range of pupils:** 10 – 16 years

**Time needed to complete activity:** 15 mins

**Pupil learning outcomes:** Pupils can:

- use the model to explain the phases of the moon, as seen from the Earth, as the bright section of the moon seen from different

perspectives changes as the moon rotates counter-clockwise around the Earth;

- explain that the bright part of the moon can be seen from the Earth because it reflects light from the Sun.

**Context:**

This activity can be used to follow the 'Jaffa moon' Earthlearningidea activity where pupils describe and learn the phases of the moon. This activity models these phases, as seen from the Earth.

The polystyrene ball represents the moon, the beam of light (from projector or desk lamp) the Sun and the person holding and looking at the ball is representing the Earth, and seeing what the 'moon' would look like, from the 'Earth' during the moon's different phases.

**Following up the activity:**

Carry out the Earthlearningidea 'Lollipop moon' activity to make a three dimensional model of the moon's phases. Then, carry out the 'Eclipse the lollipop' activity to see how the moon's regular phases are not related to eclipses.

**Underlying principles:**

- The changing shape of the bright part of the moon can be explained because only half the moon is illuminated by the Sun; we see the half-illuminated moon from different perspectives as the moon circles the Earth in a counter-clockwise direction, seeing different phases as the lunar month progresses.

**Thinking skill development:**

Explaining the pattern seen to another pupil involves understanding the pattern (construction) and explaining it (metacognition).

**Resource list:**

- polystyrene balls for individual or groups of pupils – balls of 5 cm diameter or larger are preferred, but marshmallows could be used instead
- sharpened pencils to mount each ball upon
- a strong light source, such as a projector or desk lamp
- a darkened room

**Useful links:**

Type 'lunar animation' into a search engine like Google™ to find animations of the phases of the moon, with explanations of the cause of the phases seen.

**Source:** Based on an activity in, Kastens K. A. and Manduca C.A. (2012). *Fostering knowledge integration in geoscience education*. In: Kastens K. A. and Manduca C.A. (eds.) *Earth and Mind II: a synthesis of research on thinking and learning in the geosciences*. Geological Society of America Special Paper 486. Boulder, Colorado: Geological Society of America, p 198.

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**The progression of thinking skills shown by the Earthlearningidea 'Moon' exercises**

Earthlearningidea	Strategies and skills developed
Jaffa moon: modelling the phases of the moon using Jaffa Cakes™	<ul style="list-style-type: none"> <li>• concrete observational, recording and modelling skills</li> <li>• predicting from a pattern – using construction skills</li> </ul>
Polystyrene moon: visualising the phases of the moon using a ball on a stick	<ul style="list-style-type: none"> <li>• 3D spatial skills, viewed from 'inside' the model</li> </ul>
Lollipop moon: modelling the phases of the moon with a ball, lollipops and a bright light	<ul style="list-style-type: none"> <li>• 3D spatial skills, viewed from 'outside' the model</li> </ul>
Eclipse the lollipop: modelling eclipses of the moon and the Sun with a ball, lollipops and a bright light	<ul style="list-style-type: none"> <li>• 3D spatial skills, viewed from 'outside' the model</li> </ul>
Why does the Sun disappear? Demonstrate what happens when the Moon hides the Sun	<ul style="list-style-type: none"> <li>• 3D spatial skills, viewed from 'inside' the model</li> </ul>