

Shadows, Moon phases and eclipses explained

Grade 6 science (Year 7 · Class 6) · Lab

Name: _____ Date: _____ Class: _____

How does the size of a shadow depend on the distance between an object and the lamp? In this lab you measure the shadow of a card at five distances, analyse the pattern, and then use a ball and a lamp to model the phases of the Moon.

Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-ESS1-1

Aim

To find how the height of a shadow changes when an object is moved away from a lamp, and to model the Moon's phases with a ball and a lamp.

Equipment

- Small bright lamp or torch
- Card 10 cm tall, fixed upright with sticky tack
- White screen (paper on a book)
- Metre ruler
- Polystyrene ball on a pencil

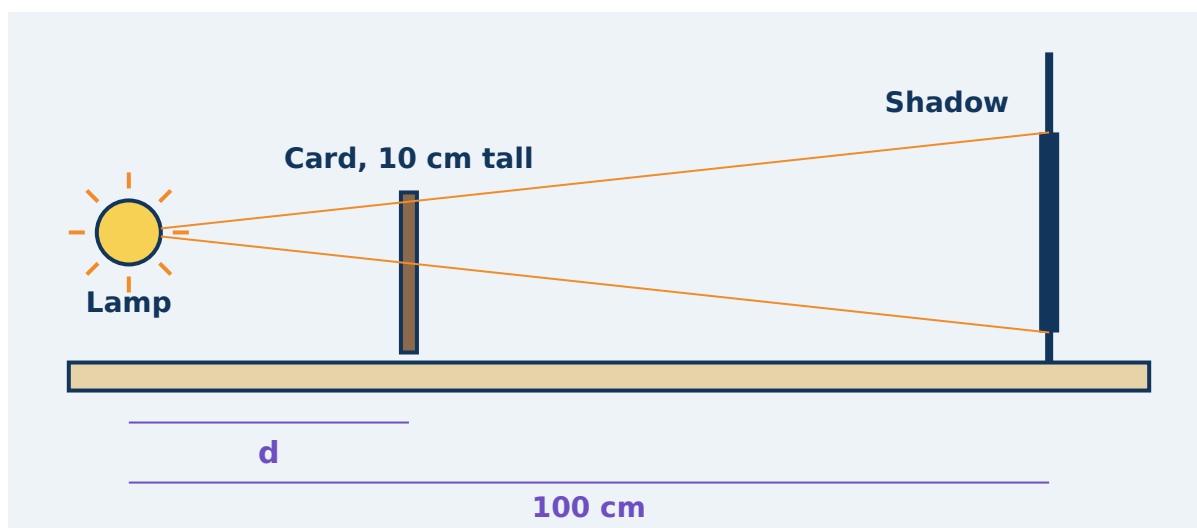
Safety

Safety

A lamp can get hot, so do not touch the bulb and keep leads away from water. Never look straight into the lamp or at the Sun during the Moon-phase model.

Method

1. Place the lamp at one end of the ruler and the screen at the 100 cm mark in a dim room.
2. Stand the card so that its distance d from the lamp is 20 cm. Measure the height of the shadow on the screen.
3. Repeat for $d = 30, 40, 50$ and 60 cm.
4. For the Moon model, hold the ball at arm's length and turn slowly on the spot with the lamp on one side. Note how much of the lit side you see in four positions: ball between you and the lamp, lamp at your side, lamp behind you, lamp at your other side.



The shadow height is measured on the screen for different values of d .

Results

Distance d (cm)	Shadow height (cm)	Shadow $\div$ card height	Shadow $\times d$
20	50.5	to calculate	to calculate
30	33.8	to calculate	to calculate
40	25.2	to calculate	to calculate
50	19.8	to calculate	to calculate
60	16.9	to calculate	to calculate

Analysis questions

Question 1 Predict the shadow

Use shadow height = card height $\times 100 \div d$ to predict the shadow for $d = 40$ cm and compare with the measurement.

Question 2 Trend

Describe how the shadow height changes as d increases.

Question 3 Magnification

Calculate shadow $\div$ card height for $d = 20$ cm and $d = 60$ cm.

Question 4 A constant product

Calculate shadow height $\times d$ for each row and explain what you notice.

Question 5 Moon model

For the four positions of the ball, state which phase each represents.

Question 6 Sources of error

Suggest two reasons why the measurements are not perfect.

Question 7 Improvement

Suggest one way to make the shadow edges sharper.