

# Earth, day, seasons and orbits

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

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

Why is sunlight stronger in summer? In this lab you shine a torch on paper at different angles and measure how far the light spreads, then use your results to explain the seasons.

**Level:** Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-ESS1-2

## Aim

To find out how the angle of sunlight changes how much a surface is lit, which explains why summer is warmer than winter.

## Equipment

- Torch with a narrow beam
- Squared paper (1 cm squares) taped flat on a table
- Protractor
- Ruler
- Books to hold the torch at fixed heights
- Pencil

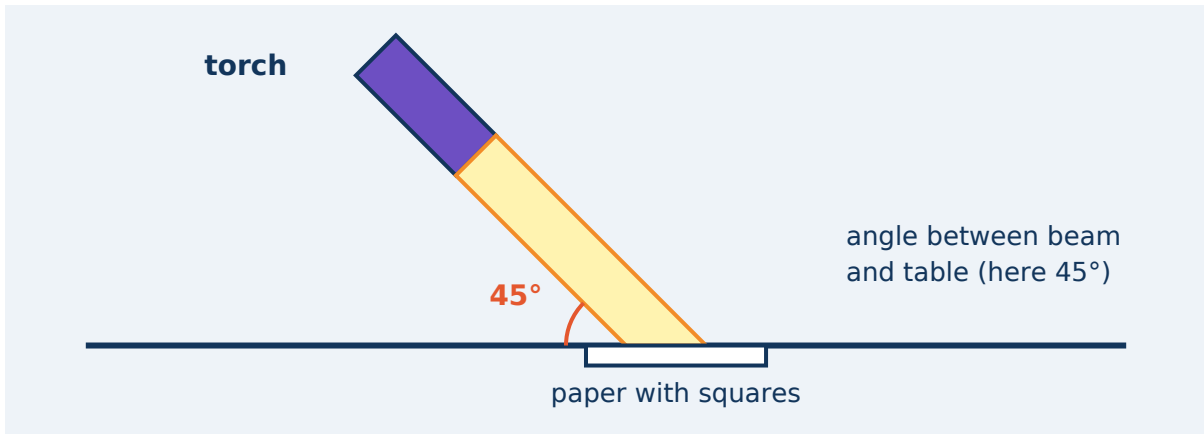
## Safety

### Safety

Never shine the torch into anyone's eyes. Work in a dim room with the bench clear, and keep bags away from the walkway.

## Method

1. Hold the torch so the beam hits the paper at 90°. Draw round the lit spot and measure its length and width.
2. Keep the torch the same distance from the paper (measure along the beam) and repeat at 60°, 45° and 30° to the table.
3. Record the length and width of the spot each time.
4. Calculate the area as  $0.785 \times \text{length} \times \text{width}$ .
5. Calculate relative brightness as the area at 90° divided by each area.



Set-up: the smaller the angle, the longer the lit spot.

## Results

| Angle to table | Length (cm) | Width (cm) | Area (cm <sup>2</sup> ) | Relative brightness |
|----------------|-------------|------------|-------------------------|---------------------|
| 90°            | 4.0         | 4.0        | 12.6                    | 1.00                |
| 60°            | 4.6         | 4.0        | 14.4                    | 0.88                |
| 45°            | 5.7         | 4.0        | 17.9                    | 0.70                |
| 30°            | 8.0         | 4.0        | 25.1                    | 0.50                |

## Analysis questions

### Question 1 Pattern

1. Describe how the area of the lit spot changes as the angle decreases.

### Question 2 Brightness

1. State what happens to the relative brightness as the angle decreases and explain why.

### Question 3 Check a value

1. Show how the area 25.1 cm<sup>2</sup> at 30° was calculated.

### Question 4 Link to seasons

1. Which angle models summer sunlight in Leeds and which models winter? Explain.

### Question 5 Predict

1. Predict the length of the lit spot at 20°, assuming the length equals  $4.0 \div \sin(\text{angle})$ . Use  $\sin 20^\circ = 0.342$ .

### **Question 6 Errors**

1. Give two sources of error in this lab and one way to reduce each.

### **Question 7 Limits of the model**

1. Name one thing this model does not show about the real seasons.