

Lesson 21 • energy-forces

Light: shadows and how they change

Lesson at a glance

Dim the room and move one torch up and down behind a block so the class sees the shadow stretch and shrink. Pupils sort fair-test cards on the IWB (change torch height; measure shadow length; keep object, place and 30 cm distance the same), then each group tests three chosen heights with torch, object and rulers. They record height–length pairs on the Investigation Journal page and close by linking low torch to long morning playground shadows.

Learning objectives

- Plan a fair test of shadow length by naming the one thing we change and the things we keep the same
- Measure how shadow length changes when only the light's height changes
- Link classroom shadow changes to how the sun's position changes shadows over a day

Before the bell – prep

Gather one torch, one upright opaque object (block or card figure), one 30 cm ruler and one metre stick (or second ruler) per group. Mark a tape spot for each object. Dim lights or pick shaded stations. Check torch batteries the day before.

Materials

Item	Qty	Per	Source	Low-cost substitute
battery torch	1	group	school kit	phone torch held by an adult helper, or one class torch used at stations in turn
small upright object (wooden block or stiff card figure)	1	group	classroom	a glue stick stood on end or a short pencil in a blob of sticky tack
30 cm ruler	1	group	classroom	a 30 cm strip of card marked in centimetres
metre stick	1	group	classroom	a second 30 cm ruler used end to end for longer shadows
masking tape	1	class	classroom	a pencil mark on scrap paper taped lightly to the table



Safety watch-point

Never shine torches at faces or eyes. Point beams at the table and object only.



Teaching moves

- **Getting Started:** Dim the room, hold one torch and a small upright object, and move the torch slowly up and down once so the shadow clearly changes. Stop and ask what they notice and what might be making it change. Take three or four ideas without correcting — they become the predictions.
- **Why does a shadow change?:** Open the light-rays interactive on the shadow scene in explore mode and turn the dial yourself. Model the cycle live: predict low lamp → long shadow, test low then high, then voice that low rays skim past and stretch the shadow. Ask what they would predict for midday sun before handing out kit.
- **Plan our fair test:** Drive the fair-test-planner on the IWB; pupils call out and you drag. Target: Change = torch height; Measure = shadow length; Keep the same = object, where it sits, 30 cm horizontal distance. Show how to set the 30 cm base with a ruler laid flat, then have each group write their three chosen heights on the Investigation Journal before kit goes out.
- **Run the fair test:** Model the method once at the front in 3–4 minutes: object on mark, 30 cm horizontal base, torch height measured vertically from the table, shadow from object base to tip. Assign roles (torch holder, measurer, recorder) and leave about 15 minutes at stations. Circulate asking what is the only thing changing and whether the 30 cm mark has held.
- **Check our results:** This is a look-back, not a first write. Have groups check height–length pairs, units in cm, and whether two readings at the same height match. If two readings are far apart, re-measure that height rather than invent a middle value.
- **What did we find?:** Whole-class display-only talk. Pull three groups' height → length pairs onto the board. Draw out lower light → longer shadow, fairness (only height changed), and the playground link: morning sun low, long shadows; midday sun higher, short shadows. Ask what would have made the test unfair.

What it should show

Lower torch → longer shadow; higher torch → shorter shadow. Numbers vary with object size, but the pattern should be clear. If all shadows look the same, height steps are too close or the room is too bright — spread the heights and shade the station. Odd long shadows often mean the object drifted or the 30 cm base slipped.



Misconceptions & interventions

- **Pupils say the shadow is "made of dark" or that the object "gives out" a shadow.** — Trace the torch beam with a finger to the object and past it: the dark patch is simply where light is blocked and cannot reach the surface.
- **Pupils want to change torch distance as well as height, or think two changes still make a fair test.** — Praise the idea, then point back at the fair-test-planner cards: if two things change at once you cannot tell which caused the result. Keep only torch height in Change.
- **"The sun moves the shadow by itself."** — Link their torch results to the sky: the sun's changing height changes the angle of the rays, just as torch height did — same rule, more distant light.

Differentiation

Emerging	Developing	Proficient
• Give three teacher-suggested heights (about 10 cm, 20 cm, 30 cm) and one careful measurement at each, with an adult check on the 30 cm base. • Pair a less confident recorder with a peer who confirms each number before it is written.	• Repeat each height once and compare the two readings; if close, find a simple average. • Prompt: why must the horizontal distance stay 30 cm every trial?	• Add a fourth height or note whether the shadow edge is sharp or fuzzy and suggest why. • Critique the class design: what would make the test unfair, and how would you tighten it?

Cross-curricular hook

Tie to Maths Measures — pupils record lengths in centimetres and compare height-length pairs from their table.