energy-forces

Light: shadows and how they change

Lesson at a glance

Open by dimming the room and moving one torch up and down behind a block so the class sees the shadow stretch and shrink. Build the language of shadow, light height and fair test, then model the pattern on the light-rays interactive. Pupils sort the five variable cards on the fair-test-planner and choose three torch heights on their Investigation Journal page. Groups measure shadow length at each height with the 30 cm base fixed, check their pairs, and link the pattern to morning and midday sun.

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

Per group: one torch, one upright object (wooden block or card figure), one 30 cm ruler, one metre stick or second ruler, Investigation Journal page. Mark a tape spot for each object the night before. Dim lights or plan shaded stations so shadows read clearly.

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

Lesson 21

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 so a clear shadow falls on the table or wall. Move the torch slowly up and down once, then stop. Ask what they notice and what might be making the shadow change; take three or four ideas without correcting — they become predictions.
- **What makes a shadow?:** Say the three ideas in your own words as they come up: a shadow is where light is blocked, not something the object gives out; light height is how high the source sits; a fair test changes only one thing. Give the hand-in-front-of-torch example and the morning-vs-midday playground link.
- **Why does a shadow change?:** Open the light-rays interactive in explore mode on the shadow scene only. Run the wonder–predict–test–observe cycle live: turn the dial low then high so grazing rays show long then short shadows. Fold the class in — are they right that low light makes a long shadow? What would they predict for midday sun?
- **Plan our fair test:** Drive the fair-test-planner on the IWB. Pupils call the bin for each card: Change = torch height; Measure = shadow length; Keep the same = the object, where it sits, and the 30 cm horizontal distance. Show the flat-ruler 30 cm base and vertical height measure. Each group writes three chosen heights on the Investigation Journal before kit goes out. If a group wants to change distance too, praise then hold them to height only.
- **Run the fair test:** Hand out kit and assign roles: torch holder, measurer, recorder, extras on the 30 cm check. Model once at the front in 3–4 minutes — object on mark, 30 cm base, height vertical, shadow from base to tip, record in cm. Circulate asking what is the only thing changing and whether the 30 cm mark has drifted. Leave about 15 minutes at stations.
- **Check our results:** This is a look-back, not a first write. Prompt: which height gave the longest and shortest shadow, do repeat readings match, are both columns in cm. If two readings at one height are close, they may average; if far apart, re-measure that height rather than invent a middle.
- **What did we find?:** Pull three groups' height→length pairs onto the board. Draw out lower light → longer shadow, fairness (only height changed), and the real-world link: morning and evening sun low, long outdoor shadows; midday sun high, 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 across the three heights. If all shadows look the same, height steps are too close or the room is too bright — spread the heights and shade the station. A group with no pattern often let the 30 cm base drift or measured from different points on the object.

Misconceptions & interventions

- **The shadow is "made of dark" or the object "gives out" a shadow.** — Hold the torch and block and trace the straight-line path with a finger — the dark patch is simply where light cannot reach the surface. Have them watch the shadow vanish when the object is removed.
- **"The sun moves the shadow by itself."** — Point back at their height→length pairs and the light-rays model: the sun's changing height in the sky changes the angle of the rays, just as torch height did.
- **Changing torch height and distance together still counts as a fair test.** — Praise the idea, then ask which change caused the result if two things moved. Hold every group to torch height only with the 30 cm base fixed.

Differentiation

Emerging	Developing	Proficient
• Give three teacher-suggested heights (about 10 cm, 20 cm, 30 cm) and one careful measurement each; pair the recorder with a peer who checks units.	• Repeat each height once and compare the two readings; prompt why the 30 cm base must stay fixed.	• Add a fourth height, or note whether the shadow edge is sharp or fuzzy and why; critique what would make the test unfair.

Cross-curricular hook

Tie to Maths Measures — pupils record height and shadow length in centimetres and compare the ordered pairs.