

Light: reflection, refraction and magnification

Lesson at a glance

Open with a tray of torch, mirror, water glass, coin and magnifier and ask which will bounce light, bend it, or make print look huge. Groups predict, then aim a torch beam onto a paper X, spot the bent pencil and watch the front coin demo, and estimate how many times bigger a magnifier or water-drop lens makes small print. Jots go into the Investigation Journal; the light-rays interactive names the bounce and bend rules, then the data-recorder builds a class bar chart of times-bigger estimates.

Learning objectives

- Demonstrate that light reflects and use mirrors to aim a beam at a target
- Observe and explain refraction using a bent pencil and a reappearing coin
- Estimate how many times a magnifier or water-drop lens enlarges small print

Before the bell – prep

Day before: fill one clear glass two-thirds with water per group; cut small-print strips and paper X targets; set trays with 1–2 mirrors, torch, pencil, coin, opaque mug, magnifier, clear plastic square, dropper, and books to prop mirrors. Keep extra mug, coin and jug at the front for the coin demo. Dim lights slightly if possible.

Materials

Item	Qty	Per	Source	Low-cost substitute
small hand mirror	2	group	school kit	card covered smoothly with aluminium foil, or the back of a shiny metal spoon
torch	1	group	school kit	teacher-supervised phone torch held by one pupil
clear plastic cup or drinking glass	1	group	classroom	clear jar or PET bottle cut safely by an adult
opaque mug or cup	1	group	classroom	yoghurt pot or any cup you cannot see through
coin (1c or 2c)	1	group	classroom	metal washer or button
pencil	1	group	classroom	straight straw or thin stick
hand magnifier	1	group	school kit	water-drop lens on clear plastic only
clear plastic sheet or cling film square	1	group	supermarket	clear lid from a food container
water dropper or pipette	1	group	school kit	wet fingertip to place one drop
small-print strip	1	group	classroom	any small text to hand: a paperback page, a magazine, or a few lines printed at the smallest size
paper target with a large X	1	group	classroom	sticky note with an X
jug of water	1	class	classroom	classroom tap and a large bottle
books or blocks to prop mirrors	2	group	classroom	pencil case or eraser stack

Safety watch-point

No torch beams at faces; never point a magnifier or water-drop lens at the sun or a bright lamp toward eyes. Wipe spills at once; glasses stay on the desk.

Teaching moves

- **Today's light words:** Hold up the mirror, water glass and magnifier one at a time and pin bounce, bend, bigger — then reflection, refraction, magnification — to each. Model the mirror bounce cycle aloud once (wonder → predict → tip the mirror → spot lands on X) before trays go out. Head off 'water bends the pencil' now: the object stays still; the light path bends.
- **What do you predict?:** Give groups one minute on only two predictions: can the beam hit the X, and will pouring water change what they see of the coin. Push one 'why — what is the light doing?' Take two or three spoken coin predictions; many are sure it cannot reappear.
- **Bounce, bend and bigger:** Run ~7 min mirror aim, ~3 min pencil look then front coin pour (heads still), ~8 min magnification with ruler or letter-stack for a whole-number estimate. Reveal one numbered test at a time on the IWB. Circulate: no torch at faces, wipe spills at once. Early finishers only try two-mirror corner or fat-vs-flat drop. Insist on one journal jot per test while kit is out.
- **Record what you saw:** Have pupils tidy jots into three journal sections: mirror path sketch (torch → mirror → X), pencil/coin note, and Lens / Times bigger columns. Prompt with stems: 'The light went... I noticed... The letter looked about ... times bigger.' Each group needs one agreed magnification number ready to call out.
- **The rule behind bounce and bend:** Drive light-rays in guided mode one step at a time. On the mirror scene, link matched angles to their tip-and-aim work. On the water scene, pause on the dotted false straight line — that is why the pencil looked kinked and the coin seemed to lift. Bridge once: a lens is curved so it bends light too, and that bending makes print look bigger.
- **How many times bigger?:** Open data-recorder in explore mode with columns Lens and Times bigger. Take one agreed result per group, then show the bar chart. Ask which bars are tallest, whether any water drop beat a magnifier, and why two groups might differ for the same tool. If anyone calls 20×, send them back to ruler or letter-stack.

What it should show

Mirror: a small tip moves the bright spot a long way onto the X. Pencil: a clear kink at the water line from the side. Coin: hidden by the empty mug rim, it reappears as water is poured while heads stay still. Magnifiers typically ~2–4×; rounded water drops ~2–5× and can beat a weak lens. Oddly huge estimates usually mean the drop flattened or the eye was too close — re-measure with letter-stack.



Misconceptions & interventions

- **Pupils say the water ‘bends the pencil’ or ‘lifts the coin’ — as if the object itself moved or warped.** — After the coin pour, revoice: the pencil and coin stayed put; only the light path bent, so the image looked shifted. Point to the dotted false line on the light-rays interactive to match what they saw.
- **Pupils think light comes out of our eyes to see the target or the coin.** — Trace the torch beam path with a finger: light travels from the torch, off the mirror, to the X, then to the eye — light goes to the eye, not from it.
- **A group claims the letter looked 20 times bigger.** — Have them re-check with the ruler beside the letter or by stacking ordinary letters to match one magnified one; a rough whole number (2×, 3×, 4×) is the honest result.



Differentiation

Emerging	Developing	Proficient
• Stay with mirror aiming until the spot lands on the X, with teacher-table support; use letter-stack count instead of a ruler for times-bigger; sketch torch-mirror-X with an arrow and say the estimate aloud for a partner to write.	• Complete both required tests (mirror aim and one magnification estimate) and call one agreed times-bigger number into the class chart; add a short ‘why the coin reappeared’ note after the front demo.	• Two-mirror corner challenge: bounce off one mirror onto a second then onto the X; compare a fat rounded drop with a small flat one and say which enlarges more.



Cross-curricular hook

Tie to the Maths Data strand — groups pool times-bigger estimates into the bar chart and read which lens ran tallest.

