energy-forces

Light: How We Actually See Things

Lesson at a glance

Open with one taped-shut box the class peeps into and cannot see the object inside — the puzzle is the hook. After a quick think-pair-share prediction, groups get their own boxes, peep, then peel back a light hole and watch the object appear and vanish. Follow a single beam on the IWB (torch to mirror to eye), trace three everyday sights including the moon, then draw one arrowed source-object-eye path on the Investigation Journal page.

Learning objectives

- Show with a lightproof box that light must reach an object and then the eye before we can see it
- Trace the path from source to object to eye for an everyday sight
- Explain why nothing comes out of the eye, using the box as the evidence

Before the bell — prep

Prepare one lightproof box per group plus a teacher demo box the day before: a small everyday object inside (rubber, conker, toy), one peephole, and a light hole taped shut. Shoeboxes with a pinprick peephole work well. Have one torch and small mirror per group ready — essential on a dull day so the boxes still show the object.

Materials

Item	Qty	Per	Source	Low-cost substitute
shoebox with a lid, a peephole and a covered light hole (peephole poked in one end, a small square in the lid taped over)	1	group	brought from home	any cardboard box with a lid, or a large cereal box taped shut
small everyday object to hide inside the box (a rubber, a conker, a small toy)	1	group	classroom	a coin or a bottle cap
torch	1	group	school kit	a phone torch used by the teacher only
small flat mirror	1	group	school kit	a piece of shiny foil taped flat to card

Lesson 20

Safety watch-point

Torches are for shining at the box's light hole and the mirror, never into a partner's eyes — say this before handing them out.

Teaching moves

- **Getting Started:** Hold the sealed demo box and bring pupils up two or three at a time to peep, or walk it along the front rows — the whole class needs a look inside five minutes. Do NOT explain. Ask 'your eye works, the object is there, so what is missing?', take a few guesses, then move on.
- **What Do We Think Is Missing?:** Run a quick think-pair-share. Surface the two ideas: seeing comes OUT of the eye, versus light must get IN. Do not correct the 'beams out of the eye' idea by telling — say 'let's test it'. Get every pair to commit: will opening a light hole let us see it, yes or no?
- **The Box Proves It:** Model the full cycle aloud with your demo box first, then hand out one box per group so every child gets a peep. Coach them to peel back the tape rather than lift the lid — lifting changes everything at once. Have groups cover and uncover a couple of times so all see the object switch on and off. On a dull day, shine a torch through the light hole.
- **Follow One Beam of Light:** Drive the interactive on the IWB: turn the dial and have the class predict aloud where the ray lands BEFORE it moves. Reassure them a wrong guess is fine. Say aloud that the light arrives AT the eye, nothing leaves it — and that mirrors bounce light one clean way, but a jumper or whiteboard scatters it every way, which is why the whole class sees the same object from different seats.
- **Trace Three Everyday Sights:** Groups trace source-object-eye for the whiteboard, the moon and one sight of their own, with a torch and mirror to test tricky paths. Press the moon: it makes no light — sunlight bounces off it to the eye. If any group draws an arrow leaving the eye, ask: 'the box was sealed and we saw nothing, so can seeing come out of the eye?'
- **Draw the Light Path:** Pupils draw one clear sight on the Investigation Journal page with arrows source-to-object-to-eye, labelling all three. Circulate for the commonest error — an arrow leaving the eye — and gently ask those pupils to check against what the box showed.

What it should show

With the light hole open the object appears clearly and vanishes when covered again — proof that light must reach the eye and nothing comes out of it. On a dull day a box may stay dark; that's a light-level issue, not a finding, so add a torch through the light hole. For the moon, pupils should conclude it reflects sunlight rather than making its own light.

Misconceptions & interventions

- **Pupils think seeing 'shoots out' of the eye — the object lights up if you look hard enough.** — Do not correct by telling. Point back to the sealed box: if seeing came out of the eye, the box would work no matter how dark, but it didn't. Have them cover and uncover the light hole to watch the object switch.
- **Pupils think reflection only happens with shiny things like mirrors.** — After the IWB beam step, say aloud that the mirror bounces light one clean way, but a jumper or the whiteboard scatters it in all directions — which is exactly why every seat in the room can see the same object.
- **Pupils think the moon makes its own light like the sun.** — During the tracing task, ask the group: 'does the moon make light, or does light bounce off it first?' Have them use the torch as the sun and the mirror as the moon to trace sunlight arriving, bouncing, then reaching the eye.

Differentiation

Emerging	Developing	Proficient
• Pair with the teacher table for the box step and give a ready-drawn box outline on plain paper so they add only the three arrows. • Let them trace just one sight — the whiteboard — before attempting the moon.	• Ask them to predict aloud what happens if the light hole is only half-open, then test it. • Have them explain to the group why the object vanishes when the hole is covered.	• Draw the sealed box on the Investigation Journal page showing no arrow reaching the eye, so nothing is seen. • Add a second sight and take the fair-test prompt: 'how do we know nothing comes out of the eye?'

Cross-curricular hook

Links to Geography and astronomy — seeing a distant star means light left it long ago and only now reaches your eye.