Lesson 20

energy-forces

Electricity: building simple circuits

Lesson at a glance

Open by holding up an unconnected battery, bulb and wires and taking unsettled guesses about what must happen for the bulb to light. Introduce the complete-loop idea, then use the circuit-builder interactive with one deliberate gap so pupils predict light versus dark before the gap closes. Groups build a real battery–bulb–switch circuit from tray kits, then leave a gap and test classroom materials as conductors or insulators, recording predictions and results live on the Investigation Journal before a class two-column share.

Learning objectives

- Build a battery, bulb and switch circuit that lights the bulb when the switch is closed
- Test materials and classify them as conductors or insulators
- Explain that a complete loop is needed for the bulb to light

Before the bell — prep

Day before: one tray per group with battery in holder, bulb in holder, four crocodile-clip wires and one switch; test every battery and bulb lights. Add a shared materials tray (paperclip, coin, foil, plastic ruler, rubber, wood). Open the circuit-builder interactive ready with a single-gap dark circuit.

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Materials

Item	Qty	Per	Source	Low-cost substitute
1.5V battery with battery holder	1	group	school kit	a fresh AA battery in a simple holder prepared by an adult
small bulb with bulb holder	1	group	school kit	prefer a filament bulb in a holder so the loop and switch story stays clean; use an LED only if the teacher has already verified it lights safely on the same battery (with a series resistor if required) and has checked polarity
connecting wires with crocodile clips	4	group	school kit	bell wire with ends prepared into safe loops by an adult
simple switch	1	group	school kit	two paperclips on card that can touch or separate
test materials set (metal paperclip, plastic ruler, coin, rubber, aluminium foil strip, wooden lolly stick)	1	group	classroom	any safe classroom mix of metal and non-metal objects approved by the teacher
Investigation Journal page	1	pupil	provided printable	plain A4 sheet ruled into a simple materials table (material, prediction, result, conductor or insulator) plus space for a circuit sketch

Safety watch-point

Low-voltage batteries only—never mains. Batteries never near mouths. No sharp test objects. Stop if a wire or battery feels more than slightly warm.

Teaching moves

- **Getting Started:** Hold up one battery, one bulb and two wires without connecting them. Take three or four hands-up guesses only—do not correct. Keep real trays visible but out of hands until the build step.
- **A complete loop:** Project only the short board text on complete loop. Stay on path-and-gap language; name switch, conductor and insulator later when groups meet them. After the first lit model, revoice: out one battery end, through the parts, back in the other.
- **A bulb that will not light:** Open the circuit-builder with one gap and a dark bulb—do not assemble it live. Draw out that a gap stops the whole path and a switch is a gap you close on purpose. Take a hands-up prediction, close once, open once, then stop. Clear the finished circuit off the screen before groups build.
- **Build your circuit:** Groups build from the tray kit with no Journal writing yet. Circulate asking where the path starts and ends and what happens when the switch opens. When one group lights, ask others if their loop matches. If dark: loose clip, flat battery, broken bulb or open switch—swap one part at a time.
- **Conductors or insulators?:** Groups leave a gap and choose at least four tray materials. Before each test they jot material and prediction; after, light or no light. Model prediction language for metal versus plastic. Press fair-test talk: same battery, dry hands, one change only.
- **Record your findings:** Journal tidy-up, not a full rewrite: labelled sketch of the battery–bulb–switch loop, switch closed versus open, finish conductor/insulator labels, short complete-loop conclusion. Help stuck groups separate observation (stayed dark) from inference (likely insulator).
- **What does the evidence show?:** Build a two-column Conductors | Insulators list from group reports. Challenge soft claims with 'What did you see that makes you sure?' Draw out loop breaks, plastic wire coatings, and that electricity is not used up in the bulb.
- **Reflect and pack away:** One-minute pair share on the first check if a circuit will not light, then calm pack-away: open switches, disconnect batteries, return wires and materials, count batteries back in.

What it should show

Bulb lights with switch closed and goes dark when open—complete loop required. Metals (paperclip, coin, foil) usually light the bulb; plastic, rubber and wood usually do not. Dark bulb on a 'metal' often means painted surface or clips not touching both sides of the gap; also check loose clip, flat battery or open switch.

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Misconceptions & interventions

- **Pupils think electricity is 'used up' in the bulb, so it does not need to return to the battery.** — Trace the path with a finger around a lit loop and back into the second battery end. Open the switch and ask where the path broke—stress return, not use-up.
- **Pupils think one wire from battery to bulb is enough, or both wires can touch the same battery end.** — Hold up the open single-wire attempt beside a complete two-end loop. Have them complete the return path and watch the bulb light.
- **Pupils think electricity can jump a visible gap through the air without a material in between.** — Use the circuit-builder gap and the real open switch: close only with a conductor bridging the gap, then reopen—light only when the path is continuous.

Differentiation

Emerging	Developing	Proficient
• Place a photo card of a simple battery–bulb–switch loop on the tray and build one joint at a time with teacher-table support. • Offer a scrap slip with two ready rows (coin / plastic ruler) so prediction and light/no-light can be ticked before transferring to the Journal.	• After a working loop, ask them to open and close the switch three times and say aloud where the path breaks. • Prompt a fair-test critique: what would make the materials test unfair?	• Sketch or explain on paper how a second bulb could join the same loop—only try two live filament bulbs if the kit still gives a clear glow. • Link wire plastic coatings to insulator-outside, conductor-inside and suggest one safer classroom design change.

Cross-curricular hook

Link to Maths Data: tally class conductor vs insulator counts and read which material type was most common.