Lesson 21

energy-forces

Electricity: switches, conductors and a quiz buzzer

Lesson at a glance

Open by holding up a battery–buzzer kit and asking when a quiz buzzer should sound or stay silent. Use the circuit-builder interactive to show a gapless loop that never stops, then draw out that a closable break and a conductor are needed. Groups design and build either a foil-pad quiz buzzer or a steady-hand track with a paperclip wand. They draw and label the circuit on the Investigation Journal page and close by comparing designs in a display-only talk.

Learning objectives

- Add and control a switch in a working circuit
- Design a circuit that completes only when two conductors (metal contact points) touch
- Draw and explain the circuit they designed for a real job

Before the bell — prep

Pre-cut foil into rough squares and set one tray per group: battery pack, buzzer, wires/clips, card, paperclips. Have the circuit-builder interactive ready on the board with a complete loop loaded. Mark battery polarity clearly on trays.

Materials

Item	Qty	Per	Source	Low-cost substitute
1.5V battery with holder	1	group	school kit	one shared class battery kit used in rotation on the front desk
buzzer or bulb with holder	1	group	school kit	share one buzzer between two groups, or use a small LED with resistor from a basic kit
wires with crocodile clips	4	group	school kit	foil strips taped along card paths
aluminium foil pieces and paperclips	1	group	supermarket	clean metal bottle caps or coins as contact pads
card rectangles for the quiz or track base	1	group	classroom	recycled cereal-box card
scissors	1	group	classroom	teacher pre-cuts card and foil

Lesson 21

Safety watch-point

Low-voltage batteries only — never mains. No batteries in mouths. Adult help with fiddly clips. Wipe foil scraps off the floor; disconnect batteries on pack-away.

Teaching moves

- **Getting Started:** Hold up the battery–buzzer kit without building. Ask hands-up what a switch does, then the key question: when should the buzzer stay silent, and when should it sound? Link briefly to the simple battery–bulb loop pupils can already make.
- **A circuit that does a job:** Hold up foil pads and a paperclip wand while naming switch, closed loop and contact points. Model one short wonder–predict–test–observe cycle aloud so groups hear the thinking before they plan.
- **A buzzer that will not stop:** Open the circuit-builder with a complete working loop and let it buzz. Do not build the answer. Draw out in order: something must break the loop; the break must be closable; whatever closes it must conduct. If a pupil says 'a switch', push to 'two bits of metal that touch'.
- **Two things before you start:** Five minutes, board only, no kit. State the two non-negotiable rules plainly and leave them visible. Do not sequence the build for them — if a group asks what first, hand it back: what has to be true before anything can happen?
- **Build a quiz or steady-hand circuit:** Groups choose quiz buzzer or steady-hand. Circulate asking: Where is the gap? What closes it? Is the battery the right way round? If silent, check complete loop, battery orientation, loose clips, and whether foil is under the clip not just near it.
- **Draw the circuit you designed:** Pupils draw on the Investigation Journal page: closed path, labelled contact points, one sentence stating the job. If time is tight, one shared group drawing is fine, but each pupil should still label the switch gap on their own page.
- **Make sense together:** Invite one quiz and one steady-hand group to hold up builds and explain the gap. Draw out battery supplies power, switch only opens or closes the path, conductors complete the loop. Disconnect batteries on pack-away so none drain.

What it should show

A working build sounds only when metal contact points touch (wand on both foil pads, or wand on the track) and stops when they separate. Silent circuits usually mean a gap still open, reversed battery, loose clip, or foil not pinched under the clip — rebuild the loop on the board grid before returning to kit.

Misconceptions & interventions

- **Pupils think the buzzer makes its own power or that electricity 'waits' in the wires until the switch is pressed.** — Trace from battery through the parts and back with a finger on their build. Point out the battery is the only power source; the switch only completes or breaks the path.
- **Pupils think one wire or one foil pad is enough, or that plastic/card can close the gap the same way metal does.** — Have them try touching with the card side of a pad or a plastic part of the wand — no sound — then metal-to-metal. Name conductor vs insulator on the spot.
- **Pupils leave the loop fully closed so the buzzer never stops, or bury the gap so they cannot see what opens and closes it.** — Ask 'where is the gap right now?' and have them lift the wand to prove silence, then touch to prove sound. A clear, visible gap is the design goal.

Differentiation

Emerging	Developing	Proficient
• Sit at the teacher table with a partly-wired loop already on the tray; pupil only places the two foil pads and tests the wand contact. • Use a simpler Investigation Journal row: draw battery, buzzer and the two touch points only.	• After a working quiz buzzer, add one clearly open 'wrong' pad and explain why it stays silent. • Prompt: why did it fail the first time, and what did you change?	• Sketch one improvement for sturdier pads or a clearer wrong-answer gap, and say how it makes contact more reliable. • Critique another group's build: is the gap obvious, and could an insulator accidentally complete the loop?

Cross-curricular hook

Link to English procedural writing — pupils' one-sentence job statement is a clear purpose line for a how-it-works explanation.