energy-forces

Electricity: switches, conductors and a quiz buzzer

Lesson at a glance

Open by asking how a quiz-show buzzer knows when to sound, linking to a simple battery–output loop pupils can already build. Name switch, closed loop and contact points with foil or a paperclip wand held up. Plan the loop together on the circuit-builder interactive, then agree five build steps on the board before trays open. Groups build a quiz buzzer or steady-hand game with foil pads or a wire track, then draw and label the circuit on the Investigation Journal page and share what closed the gap.

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

Set one tray per group the day before: battery and holder, buzzer or bulb and holder, clip leads, card, foil, paperclips, scissors. Pre-cut foil squares to save time. Keep trays closed until the build step. Low-voltage batteries only.

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 at pack-away.

Teaching moves

- **A circuit that does a job:** Hold up foil pads or a paperclip wand while you name switch, closed loop and contact points so pupils see the third idea. Model one short wonder–predict–test–observe cycle aloud before groups plan. Head off the idea that the buzzer makes its own power — power is from the battery; the switch only completes or breaks the path.
- **Plan the circuit on the board:** Drive the circuit-builder interactive in explore mode from an empty or partial grid. Invite pairs to call the next piece: battery, wires, corners, buzzer, switch. Ask where the switch must sit to break the loop, and whether foil contact points could do the same job. Keep real batteries and wires in trays until the build.
- **Agree the build steps:** Project or write the five build steps and let the class reorder them until the sequence matches a working touch-switch build. Leave the agreed order visible for the whole build. Ask why the battery goes in before testing contacts and what the deliberate gap is for.
- **Build a quiz or steady-hand circuit:** Groups choose quiz buzzer or steady-hand — that is their design decision. Circulate asking: Where is the gap? What closes it? Is the battery the right way round? Which board step are you on? If a circuit will not sound, check complete loop, battery orientation, loose clips, and whether foil is under the clip, then point them back to the board steps.
- **Draw the circuit you designed:** Pupils draw on the Investigation Journal page only. Look for a clear closed path, the gap or contact points labelled, and one plain-words job sentence. If time is tight, one shared group drawing is fine if each pupil still labels the switch gap on their own page.
- **Make sense together:** Invite one quiz-buzzer and one steady-hand group to hold up builds and explain when the circuit completed. Draw out observation versus inference: we saw the buzzer sound when metal touched metal; we think that means the loop was complete. Ask one reliability improvement an engineer would make. Disconnect batteries before pack-away.

What it should show

A working build sounds only when the wand or loop closes the deliberate gap (both foil pads, or wand on track) and stays silent when open. No sound usually means a broken loop, reversed battery, loose clip, or foil not under the clip. A buzzer that never stops means the gap was never left open or contacts are shorted together.

Misconceptions & interventions

- **Pupils think the buzzer or bulb makes its own power, or that electricity waits in the wires until needed.** — Trace the path with a finger from one battery side through the parts and back. Say the battery supplies the power; the switch only opens or closes that path.
- **Pupils think one wire or touching near the foil is enough — the circuit should work if parts are close.** — Have them lift the wand so only air fills the gap, then press foil firmly under the clip. Name the two contact points that must actually touch metal-to-metal.
- **Pupils treat any metal touch as success and do not leave a deliberate open gap for wrong answers or a clear track.** — Ask them to show the open gap on their card or track and test a wrong pad or a clear wand path. The job only works if the circuit stays silent until the right contact.

Differentiation

Emerging	Developing	Proficient
• Pair at the teacher table with a partly wired loop that already has battery and buzzer in place; pupils only add and test the two contact points. • On the Journal page, label battery, buzzer and the gap only — skip full path arrows if needed.	• After a working quiz or steady-hand build, swap the buzzer for a bulb (or add a second clear wrong-answer pad) and re-test the gap. • Prompt: Why must the switch sit in the loop, not on a wire that goes nowhere?	• Sketch one improvement for sturdier pads or a clearer wrong-answer gap and say how it makes the switch more reliable. • Critique another group's build: is the gap deliberate, and could an insulator ever close it?

Cross-curricular hook

Link to procedural writing in English — ordered build steps as clear instructions another group could follow.