Lesson 19 · energy-forces

Magnets and magnetism

Lesson at a glance

Open by holding a magnet above a steel paperclip so it jumps, then above a plastic lid so nothing moves. Groups test a mixed tray of everyday objects, sort them into magnetic and non-magnetic piles, and start the Investigation Journal rows. Drive the sorting-tree interactive on the IWB to check class findings. Then run a fair paperclip-chain strength test on Magnets A and B: three trials each, ordered middle value, short conclusion sentence.

Learning objectives

- Classify everyday materials as magnetic or non-magnetic from testing
- Compare magnet strength using a fair method and record the results

Before the bell — prep

Night before: one tray per group with Magnets A and B that clearly differ in pull (e.g. bar vs fridge magnet), sticky labels, ~20 steel paperclips, and a mixed object set (steel paperclip, steel nail/screw, aluminium foil, plastic lid, wooden stick, rubber eraser, copper wire, card). Print Investigation Journal pages. Copper wire is the non-magnetic metal — do not use euro coins as that exemplar.

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Materials

Item	Qty	Per	Source	Low-cost substitute
bar magnet or fridge magnet (pair expected to differ in strength)	2	group	school kit	one fridge magnet per group and compare through paper sheets instead of comparing two magnets (teacher directs the through-paper method)
sticky labels or coloured sticky dots (magnet labels A/B)	2	group	classroom	masking tape with A/B written in marker
steel paperclips	20	group	classroom	small steel screws or steel nails for the chain test
mixed test objects (steel nail or screw, aluminium foil square, plastic bottle lid, wooden lolly stick or pencil, rubber eraser, short copper wire, small piece of card)	1	group	classroom	any safe mix of steel items and clearly non-metal classroom objects, plus copper wire or a pure-copper offcut
plain paper sheets (for through-paper strength measure if only one magnet is available)	10	group	classroom	pages from scrap paper
Investigation Journal pages	1	pupil	classroom	plain paper ruled into a two-group sort and a simple results table

Safety watch-point

Keep magnets away from phones, tablets, bank cards and any pacemaker. Watch fingers if two strong magnets snap together. Count paperclips back into trays — small parts off the floor promptly.

Teaching moves

- **Getting Started:** Demo only: hold one magnet just above a steel paperclip so it jumps, then above a plastic lid so nothing happens. Ask why one moved and the other did not. Keep trays off desks; do not name fair-test variables yet. Remind yourself magnets stay away from phones, tablets, bank cards and the IWB remote.
- **What magnets pull on:** Project only the short board definitions of magnetic and non-magnetic. Say the worked model aloud once: wonder, predict, bring the magnet close without touching, observe, conclude. Save magnet strength language for step 5. Head off 'all metals are magnetic' before trays go out.
- **Test and sort the materials:** Hand out one magnet per group (leave Magnet B labelled on the tray). Rule: bring the magnet close; do not scrape objects hard along it. Circulate asking 'What did you observe? Was that what you predicted?' Insist they test before they sort and jot each material on the journal page as they go. Finish with a 30-second room check on a chair leg or whiteboard rubber.
- **Sort on the board:** Drive the sorting-tree interactive in explore mode. Invite different pairs to place each card; fold the watching class in with 'Do you agree? What did your tray show?' Accept euro-coin stick results as correct science talk, not an error against the board key. Pupils finish any blank sort rows after the check.
- **Fair-test magnet strength:** Point groups to labelled Magnet B. Model one full paperclip chain at the front, then the middle-value rule with trials 5, 8, 6 → ordered 5, 6, 8 → middle 6. Change only the magnet; keep clips, pole end and adding method the same. Three trials per magnet, record immediately. If the clock is tight, skip a third magnet and protect the fair-test core.
- **Record on your journal page:** This is a complete-and-check, not a fresh write-up. Numbers stay in the table; the 'Magnet X was strongest because...' sentence comes after. If time is short, prioritise one clean strength comparison over polishing every sort row.
- **Make sense of our results:** Display-only science talk. Collect a few group middle values on the board. Draw out what stayed the same, what would make the test unfair, and that an unexpected result is still data. If anyone still claims all metals are magnetic, hold aluminium foil and a paperclip up again.

What it should show

Magnetic: steel paperclip and steel nail. Non-magnetic: aluminium foil, plastic lid, wooden stick, rubber eraser, copper wire, card. The stronger labelled magnet should hold the longer paperclip chain (higher ordered middle value). Odd short chains usually mean a rough add, a different pole end, or counting clips that already fell — re-run from a still first clip.

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Misconceptions & interventions

- **Pupils say 'all metals are magnetic' because shiny kitchen tools stick.** — Hold aluminium foil and copper wire next to a steel paperclip and retest live. Restate: everyday magnetic materials usually contain iron or steel; looks alone are not enough.
- **Pupils think the bigger magnet is always stronger, so they skip measuring.** — Point at Magnets A and B and insist on the paperclip-chain evidence. Size can help, but material and type matter — that is why we count three trials.
- **Pupils pick the middle trial as written (e.g. trials 5, 8, 6 → they take 8) instead of ordering first.** — Rewrite 5, 8, 6 on the board, reorder to 5, 6, 8, and circle 6. Say the rule every time: order smallest to largest, then take the middle number.

Differentiation

Emerging	Developing	Proficient
• Give a shorter set of 6 clear tray items and sit with the teacher table for the first chain trial so the hanging-and-counting method is secure.	• Prompt a second 'why?' after the sort: which non-magnetic item most surprised you, and what evidence moved it to that pile?	• Add a mystery object (stainless spoon or euro 1c) and justify the pile with magnet evidence; early finishers may test a third labelled magnet with the same chain method.

Cross-curricular hook

Tie to Maths Data — order three trial counts and read the middle value (or average) before claiming which magnet is stronger.