

energy-forces

Simple machines: ramps and levers

Lesson at a glance

Open by asking whether pushing a heavy bag up a slope feels easier than lifting it straight. Live-model sliding a book up a board versus a straight lift, naming effort as how hard the push feels. Groups build a gentle desk ramp and a ruler-on-marker lever, then feel three lifts—straight up, ramp, lever—with the same book to the same height. They record hard/medium/easy ratings and one sentence on the Investigation Journal page, then share that ramps and levers help a small force do a big job.

Learning objectives

- Show that a ramp can make lifting a load feel easier
- Use a simple lever to lift a book with less effort
- Explain that ramps and levers help a small force do a big job

Before the bell – prep

Pre-build and test one full kit per group: smooth board, stack of books for a gentle desk ramp, wooden ruler or paint-stirrer (not bendy plastic), marker/triangular eraser as rest, and a book light enough that one finger tips the lever. Adjust slope, rest position and load until both machines clearly feel easier before the bell.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
smooth stiff board or firm clipboard (ramp surface)	1	group	classroom	ring-binder cover or a large firm textbook cover
light or medium hardback books, or exercise books (load and to raise the ramp gently)	4	group	classroom	a small bag of rice or dried beans as the load; a sturdy low box to raise the ramp
wooden 30 cm ruler or stiff paint-stirrer	1	group	classroom	a straight piece of stiff card doubled over, or a thin wooden offcut
thick marker pen or triangular eraser (rest for the lever)	1	group	classroom	a short cardboard tube, a thick crayon, or a rubber blocked on one side so it does not roll
plain paper or Investigation Journal page	1	pupil	classroom	any scrap paper headed with the four recording prompts from step 5

Safety watch-point

Keep fingers out from under rising books on the lever; two hands on the straight lift; stand clear if a book slips; never force a bowing ruler.

Teaching moves

- **How ramps and levers help:** Do the full live ramp think-aloud before groups touch kit: lift the book straight onto a low chair, then slide it up the board to the same height. Voice ‘hard pull straight up... less hard on the ramp, though it travelled further’ and leave Effort = how hard the push feels on the board.
- **Build a ramp and a lever:** Send groups to build ramp first, then lever. Circulate for gentle slope (one–two books high), rest nearer the book end, and no bowing ruler—swap to wood or a lighter load if it flexes. Early finishers hands-up freeze; spot-check stability before anyone tests.
- **Compare the lift:** Frame the question, pause for spoken predictions, then run straight lift → ramp → lever with same book and same finish height. If a ramp still feels hard, lower it, smooth the board, and have them slide gently rather than shove. Keep this talk-and-feel only—no writing yet.
- **Feel how the effort changed:** Prompt pairs to show with their hands how hard each way felt, then write hard/medium/easy plus one sentence on which machine helped most on the Investigation Journal page or plain paper. Keep the write-and-draw in class; shorten to ratings plus one sentence if time is tight.
- **What did we find out?:** Draw out that the ramp felt easier, the lever often worked with one finger, and same book/same height kept it fair. Revoice the key idea—ramps and levers help a small force do a big job—and optionally link Newgrange stone-moving for one minute.

What it should show

Almost every pupil should find the ramp easier than the straight lift and lift the book with the lever using less effort (often one finger) when the rest is nearer the book. A ramp that still feels hard is usually too steep, too grippy, or shoved not slid—lower and smooth it, then re-feel. A lever that will not tip usually has the rest too central or a bowing ruler.

Misconceptions & interventions

- **Pupils say ‘the ramp made the book lighter’.** — Revoice with the book still in hand: the book weighs the same; the ramp spreads the work so each moment of effort feels smaller, even though the book travels further.
- **Pupils put the lever rest in the middle or nearer the free end and conclude levers do not help.** — Move the marker clearly nearer the book, press the long free end with one finger, and have them feel the difference with the same book.

**Differentiation**

Emerging	Developing	Proficient
• Offer a shorter gentler ramp and a pre-marked rest spot nearer the book; pair at the teacher table for the first feel of each lift.	• After recording, ask why the same book and same height made the comparison fair, using effort language from the board.	• Move the lever rest toward the middle with the same book and feel whether effort changes; say which rest position needed the smallest push.

Cross-curricular hook

Optional History link: Newgrange builders moved huge stones with ramps and levers long before modern machines.

