

Simple machines: ramps and levers

Lesson at a glance

Open with the everyday question of pushing a heavy bag up a slope versus lifting it straight. After a live teacher think-aloud—straight lift of a book onto a chair, then the same book slid up a gentle board—groups build a desk-top ramp and a ruler-on-marker lever. They feel three lifts (straight, ramp, lever) with the same book and height, then record hard/medium/easy ratings and one sentence on the Investigation Journal page. Close by pooling which felt easiest and naming ramps and levers as simple machines.

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 feel-test one full kit: wooden ruler or stiff paint-stirrer (not bendy plastic), marker or triangular eraser as rest, smooth board, and a book light enough that the lever tips with one finger. One kit per group on desks; Investigation Journal or plain paper ready for the recording step only.

**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 from under rising books on the lever; two hands on the straight lift; never force a bowing ruler—swap load or bar instead.

Teaching moves

- **How ramps and levers help:** Project only ramp, lever and the effort gloss. Do the full live ramp think-aloud before any group builds: lift the book straight, then slide it up the board to the same height, voicing that arms worked less hard though the book travelled further. Leave ‘Effort = how hard the push feels’ on the board. Skip a separate lever demo—groups will feel that next.
- **Build a ramp and a lever:** Circulate kit by kit. Ramp: raised end only one or two books high, board steady and smooth. Lever: rest clearly nearer the book end, free end empty, ruler not bowing—swap to wood or a lighter load if it flexes. Early finishers freeze hands-up until the class starts trials together.
- **Compare the lift:** Frame the question, take open predictions, then run straight lift, ramp, and lever by feel only—no writing yet. Same book, same finish height. If a ramp still feels hard, lower it, smooth the board, or guide the slide lightly; if the lever fails, nudge the rest closer. Revoice any ‘the book got lighter’ claim on the spot.
- **Feel how the effort changed:** This is the only writing beat. Prompt pairs to rate hard/medium/easy and one hand, two hands or one finger for each way, then one sentence on which machine helped most. Optional quick sketch. Short on time: ratings plus the sentence only. Early finishers may shift the lever rest and re-feel with the same book.
- **What did we find out?:** Draw out: ramp easier than straight lift; lever often one-finger; same book and height kept it fair. Land the key line—ramps and levers help a small force do a big job. Optional one-minute Newgrange link only if time allows.

What it should show

Almost every pupil should feel the ramp easier than the straight lift, and the lever lift the book with one finger when the rest sits nearer the load. A ramp that still feels hard is usually too steep, rough, or shoved—lower, smooth, and slide gently, then re-feel. A stuck lever usually means a bowing ruler, rest too central, or a heavy load.

Misconceptions & interventions

- **Pupils say ‘the ramp made the book lighter’.** — Revoice with the class: the book still weighs the same; the ramp spreads the work so each moment of effort feels smaller. Point back to the effort gloss still on the board.
- **Pupils place the lever rest in the middle or nearer the free end and conclude levers do not help.** — Move the rest clearly nearer the book end together, press the free end again, and ask how the finger effort changed.

**Differentiation**

Emerging	Developing	Proficient
• Start with a shorter, gentler ramp and a pre-marked rest spot nearer the book; pair at the teacher table to feel one machine first.	• After recording, move the lever rest and re-feel whether effort changes with the same book.	• Critique fairness aloud (same book, same height) or design a better classroom ramp or lever using only kit already on the table.

Cross-curricular hook

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