

Make it move: a force fair test



Lesson at a glance

Open with a hands-up vote: will a steep or gentle ramp send a toy car further? Pupils plan the fair test on the fair-test-planner interactive, changing only ramp height (1, 2 or 3 books) while keeping car, start mark and floor the same. Groups release from rest, measure three rolls per height and take the middle value. One group's results feed the data-recorder chart; close with a display-only talk on force, fairness and the pattern.

Learning objectives

- Plan a fair test of how one force change affects how far a car travels
- Measure distance carefully, repeat and take a middle value
- Explain what was changed, measured and kept the same

Before the bell – prep

Gather one board/ramp, three identical books, one toy car, metre stick and start-line tape per group. Mark tape once so every release starts square. Plan clear floor lanes (hall, corridor or staggered classroom waves) before the bell – space is the bottleneck.

Materials

Item	Qty	Per	Source	Low-cost substitute
toy car	1	group	school kit	a marble or small ball rolled down the same ramp
board or stiff ramp (about 30–50 cm)	1	group	classroom	a hardback book cover or a stiff folder
books to raise the ramp (same thickness)	3	group	classroom	same-size wooden blocks or stacked copybooks
metre stick or measuring tape	1	group	school kit	a piece of string marked every 10 cm plus a 30 cm ruler
masking tape for start lines	1	class	classroom	a chalk mark or sticky note on the ramp
Investigation Journal pages	1	pupil	provided printable	plain paper ruled into a simple results grid

**Safety watch-point**

Roll cars away from feet and faces; keep the floor run clear. Mind fingers under the raised board edge when groups add or remove books.

**Teaching moves**

- **Getting Started:** Keep kit off the desks. Hold one car only if you want a prop, take a quick steep-vs-gentle vote and one or two reasons, then move on. Remind them they already know how to keep a test fair — today that skill meets forces and movement.
- **Question and predict:** Board only force and fair test here; leave middle value for the modelled run. Collect two or three whispered predictions aloud — higher goes further, lower is safer, or all the same — and leave the answer open. Head off the idea that an extra hand-push is the only way to make something go further.
- **Plan the fair test:** Drive the fair-test-planner interactive: cards are ramp height, how far the car rolls, the car, starting point, the floor. Lock Change = ramp height, Measure = distance in cm, Keep the same = car, start, floor. Agree nobody shoves; the car rolls from rest at the tape. Pupils copy the plan into the Investigation Journal while you lock it on the board.
- **Roll and measure:** Model one height only (1 book) in under four minutes: three rolls, order the distances, circle the middle value and name the term live. Then groups run all three heights with roles rotating (release, spot, measure, record). Walk the room watching for shoves, twisted boards or measuring from different ends of the car — stop and re-voice fairness if you see it. Discard any roll that hits a chair or foot.
- **Record our results:** Open the data-recorder interactive with rows for 1, 2 and 3 books. Type one group's three middle values (or a pooled class set if that group's data is incomplete), show the chart, and ask which bar is tallest. Pupils finish their own journal table first, then one meaning sentence after the chart talk.
- **Make sense of the evidence:** Lead with What do the middle values show? before Who was right? Revoice answers into force and fair-test language: what changed, measured and stayed the same, and what would have made it unfair. If one high ramp did not win, treat it as data and check floor grip, a twisted board or a push.
- **Reflect and tidy:** Quick pair share: one thing that kept the test fair, and one outside ramp (driveway, slide, kerb, wheelchair access) where steep or gentle matters. Stack books, collect metre sticks and cars, lift trip-hazard tape.

**What it should show**

Expect middle-value distance to rise with ramp height: 3 books furthest, 1 book shortest, because the steeper slope lets gravity pull the car faster along the board. A group whose heights look the same usually has too short a run or a grippy floor — clear a longer path. Oddly far carpet-side rolls often mean a shove at the start; re-run from rest.





Misconceptions & interventions

- **A bigger hand-push is the only way to make the car go further.** — Point to the release rule: nose on the tape, hands off. The force change today is ramp height — how steeply gravity pulls the car — not an extra shove.
- **The middle value is the second try we did, or the average of the three.** — Write three live distances on the board, order them smallest to largest, and circle the middle number. Say clearly: middle after ordering, not the second roll and not the mean.
- **If we change the car or the floor as well as the height, we still know height caused the difference.** — Hold up two keep-the-same cards and narrate: if we swapped cars halfway we would not know whether height or the car made the difference.

Differentiation

Emerging	Developing	Proficient
• Co-measure the first trial with the group and restate role rotation so they still reach three heights. • Help them order the three numbers and circle the middle value before changing books.	• After height 1, ask what one extra book might do to the middle value and why three trials beat a single roll.	• Ask whether they would still trust a single roll, and invite a journal sketch of a next-time fair test that changes the floor instead of height.

Cross-curricular hook

Tie to Maths Measures and Data — order three lengths, find the middle value, and read the tallest bar on the class chart.