

Make it move: a force fair test

Lesson at a glance

Open with a quick hands-up: does a steep or gentle hill send a toy car further, and how could we find out fairly? Pupils plan on the fair-test-planner interactive—change ramp height only, measure roll distance, keep car, start line and floor the same—then copy the plan into the Investigation Journal. Groups roll from rest at 1, 2 and 3 books, take three trials each, and circle the middle value. One group's middle values go into the data-recorder chart; close with talk on what the evidence shows.

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

Print Investigation Journal pages. Per group: board/ramp, toy car, metre stick, masking tape start mark, and 3 identical books. Mark start lines the day before. Plan clear floor lanes (hall, corridor or staggered classroom waves)—simultaneous runs need long clear paths.

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 stacking or removing books.

**Teaching moves**

- **Question and predict:** Board only force and fair test now—save middle value for the modelled run. Collect two or three whispered predictions without judging; leave the answer open. Head off the idea that only a hand-push makes things go further: today the force change is ramp height.
- **Plan the fair test:** Drive the fair-test-planner interactive: Change = ramp height (1/2/3 books); Measure = distance in cm; Keep the same = car, starting point, floor. Narrate why swapping cars would spoil the result. Agree no extra push—car rolls from rest at the tape. Pupils write the locked plan in the Investigation Journal.
- **Roll and measure:** Model one height only in under 4 minutes: three rolls, order the distances, circle the middle value (e.g. 78, 81, 84 → 81 cm). Name roles (release, spot, measure, record) and protect ~20 minutes for all three heights. Walk the room watching for pushes, twisted boards or measuring from different ends of the car. Discard trials that hit a foot or chair.
- **Record our results:** Open the data-recorder interactive. One group shares three middle values; type those and show the chart. Ask which bar is tallest before pupils add one meaning sentence in the journal. Help messy groups order and pick the middle value—do not switch the class standard to averages.
- **Make sense of the evidence:** Lead with what the middle values show, then which ramp won, whether predictions were supported, and what was changed, measured and kept the same. Revoice answers into force and fair-test language. Draw out unfair examples: shove, different car, start halfway down.

What it should show

Higher ramps usually send the car further on a smooth floor—steeper slope, more speed, longer roll. If all three heights look the same, the run is too short or the floor is grippy; clear a longer path. Odd short high-ramp results often mean a push on some trials, a twisted board, or measuring from different ends of the car.



Misconceptions & interventions

- **Pupils think you need a bigger hand-push to make the car go further.** — Point to the tape mark and restate: hands off—the car rolls from rest. The force change today is ramp height (how steeply gravity pulls), not a shove at the start.
- **Pupils pick the second try they did, or average the three numbers, instead of ordering and taking the middle value.** — Write three live distances on the board, order smallest to largest, and circle the middle one. Say: middle value is the middle number after ordering, not the second roll.
- **Pupils change two things at once (different car or a shove) and still call the test fair.** — Hold up the fair-test-planner cards again: if the car and the height both change, we cannot tell which made the difference. Re-run from the same car at the tape, hands off.

Differentiation

Emerging	Developing	Proficient
• Co-measure the first trial with the group and restate role rotation so they still reach 3 books. • Help order the three distances and circle the middle value together before they change height.	• 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 have them sketch what they would keep the same if the class changed the floor next time.

Cross-curricular hook

Tie to Maths Measures and Data—pupils record centimetres, order three values, and read the rising bars on the class chart.