energy-forces

Forces change motion: an open force investigation

Lesson at a glance

Open with one quick release of a pull-back car and collect guesses about what will start, slow, stop or turn it. Name force, motion and change of motion with a two-minute live model. Groups rotate marble-run, balloon-rocket and pull-back-car stations, then design one short demo from a kit they actually tried. Table runs lead into a two-or-three-group showcase; pupils record question, prediction and forces on the Investigation Journal page. Close with a make-sense talk linking those forces to bikes, Luas, DART and local roads.

Learning objectives

- Show and describe how forces change how things move, stop and turn
- Design a simple demonstration of a force changing motion
- Link forces that change motion to everyday Irish transport (bikes, Luas or DART, local roads)

Before the bell — prep

Set three stations before the bell: marbles with cardboard tubes or folded-card channels and books for height; balloon rockets with string pre-stretched between two chairs, straws, balloons and tape; one pull-back car ready per turn. Clear a short run at each station and mark a start line with tape. Stations beat full table kits if space is tight.

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Materials

Item	Qty	Per	Source	Low-cost substitute
pull-back toy cars	1	group	school kit	a wind-up toy car or a small car rolled by hand from a marked start
marbles	4	group	school kit	smooth round beads or small balls of similar size
cardboard tubes or folded card channels	3	group	classroom	books and a length of card or a ruler as a simple ramp run
hardback books for ramp height	4	group	classroom	wooden blocks or stacked copybooks
balloons	3	group	supermarket	one shared balloon station if stock is low
drinking straws	2	group	supermarket	a short length of narrow tubing or a rolled paper tube taped shut along the seam
string or yarn for balloon-rocket lines	1	station	classroom	wool, twine, or fishing line; or skip balloon rockets and use only pull-back cars and marble runs
chairs or stands for balloon-rocket string lines	2	station	classroom	table legs, door handles, or clamp stands already in the room
sticky tape	1	group	classroom	masking tape or reusable putty for light joins
masking tape for a floor start line	1	class	classroom	a chalk line or a metre stick laid as a start marker
Investigation Journal pages	1	pupil	classroom	ruled page headed with: Our question; I predict… because…; What we found out; Start force; Slow, stop or turn force; Did the result match your prediction?

Safety watch-point

Roll marbles and cars away from feet and faces; never aim balloon air at anyone's face; keep string lines at a safe height; collect stray marbles immediately.

Teaching moves

- **Getting Started:** Hold one pull-back car so the class can see it and do one quick release only. Ask what made it start, slow or turn, and collect two or three ideas on the board without correcting them — you will return to them after the demos.
- **What can a force change?:** Pull the car back once on a clear stretch and narrate only three moments: spring push starts it, floor friction slows and stops it, a sideways force at the wheels can turn it. Invite one or two pupil echoes of those force names, then move on — keep the live model to about two minutes.
- **Try the force kit:** Before groups start, name the shared start forces: spring push, air push from the balloon, gravity down the slope. Circulate asking what started it, what slowed it, and which kit felt easiest to show. Stop once each group has one solid try — a second kit is a quick look, not a full second build.
- **Design your force show:** Keep each group with a kit they actually handled. Prompt them to name the start force, the slow-stop-turn force, and one deliberate change (start height, pull-back, or air). Predictions stay in the group as 'We think ... because ...'; sample two or three as you circulate and keep this to five minutes.
- **Show a force changing motion:** Give 6–7 minutes for table runs to refine once, then call a clear stop. Invite two or three groups with different kits onto a clear central run. Fold watchers in with: What force started that? What changed the direction? Was that the same as your group's demo?
- **Record the forces:** Model the filled board example aloud once, then release pupils to the Investigation Journal page. Coach the split: motion details under What we found out; force names on the force lines. The prediction they write is the one already agreed in the design step. Offer the stem 'How can a force change how our [kit] moves?' if a group stalls.
- **What did the forces do?:** Part A: draw out start push/pull, friction for slow/stop, and a sideways force for turns — invite different kit choices. Part B: hang the same ideas on Luas and DART braking, bike brakes on the school run, and a bend or hill on a local road. Close with a 30-second partner sentence: 'A force can change motion by ...'

What it should show

A successful demo clearly names a start force (spring push, air push, or gravity down the slope) and a change force (usually friction; sometimes a curve, bump or steered wheels), with one deliberate change the class can see. Balloon rockets that go nowhere usually need a straighter straw, tighter string and firmer tape; marbles leaving the track need lower sides or a gentler slope.

Misconceptions & interventions

- **It stopped because it ran out of energy.** — Ask what was touching or rubbing against it when it slowed. Revoice: friction with the floor, track or string was the force that changed the motion.
- **The balloon rocket stopped because the air ran out.** — Revoice: the air push stopped, so friction could slow it. Trace start (air leaving) then slow (string/floor friction) on the empty balloon.

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Differentiation

Emerging	Developing	Proficient
• Pair at the teacher table with a kit already set up from the station try-out; offer the shared question stem and one scribe while others add a path sketch with arrows.	• Prompt one clearer deliberate change (higher/lower start, bigger/smaller puff, harder/softer pull-back) so the motion difference is easy for the class to see.	• Fast finishers add one change that would make the demo clearer next time; stretch watchers to name a sideways force for any turn they spot in a showcase.

Cross-curricular hook

Link to Geography and everyday Irish transport — Luas and DART braking, bike brakes, and bends or hills on a familiar local road.