energy-forces

Storing and transforming energy

Lesson at a glance

Open with a wound-up toy that sits still then moves, and ask where the energy was hiding. Demo a cotton-reel car once with one wind, take a class prediction, then run more winds from the same line. Groups build elastic-band cars from pre-threaded trays and fair-test low vs high winds on a shared 1–2 m floor run. The flow-builder interactive orders the chain stored elastic → movement → sound and heat. Pupils draw and label that chain on the Investigation Journal page and write what more stored energy did to travel distance.

Learning objectives

- Build a device that stores energy and releases it to do a job
- Trace and label a full energy-transformation chain from store to output
- Test how changing the amount of stored energy changes the output

Before the bell — prep

Pre-build and check one working demo cotton-reel car. Pre-thread an elastic through each group's reel; set short stick, long pencil, card circle and tape on each tray. Clear a 1–2 m smooth floor run. Print one Investigation Journal page per pupil. Optional: labelled tray photo on the board naming the parts.

Lesson 20

Materials

Item	Qty	Per	Source	Low-cost substitute
wind-up or pull-back toy (class demo)	1	class	classroom	pre-built demo elastic-band cotton-reel car from the build kit
pre-built demo elastic-band cotton-reel car	1	class	classroom	twist an elastic band between two fingers to spin a pencil if a full demo car fails
cotton reels or empty thread spools (elastic pre-threaded)	1	group	classroom	cardboard tube short section with holes punched for the axle
elastic bands (mixed sizes)	4	group	supermarket	cut rings from a clean party balloon
pencils (short stick and long axle)	2	group	classroom	wooden dowel pieces or sturdy straws for axles
card offcuts for washers	4	group	classroom	stiff cereal-box card from home recycling
sticky tape	1	group	classroom	masking tape or a small blob of reusable adhesive putty
masking tape or paper scraps for start and stop marks	1	group	classroom	chalk mark on floor or a shoe as a start line
Investigation Journal page	1	pupil	provided printable	blank A4 with a title box for the chain drawing

Safety watch-point

Aim cars and flying elastic ends away from faces; never fire at people. Do not overstretch bands until they snap. Clear feet from the run; stop if a band looks frayed.

Teaching moves

- **Getting Started:** Show a wind-up toy, pull-back car, or the pre-built demo cotton-reel car held still then released. Ask only: where was the energy while nothing seemed to be happening? Do not hand out build trays yet — keep eyes on the demo.
- **Energy that waits:** Board only two words: stored energy and output. Wind the demo once from a marked line, mark the stop, then take hands-up predictions before any high-wind run. Wind several more times from the same line, mark the new stop, and model I wonder → I predict → I test → I observed → I think in that order.
- **Build a stored-energy device:** Point to the board steps and the labelled tray parts. Circulate for slipped bands — add a tape tab or thicker card circle. Success look-for: the car only moves after the band is wound, and groups can point to where the energy was waiting. Fast finishers practise one careful wind and a clean release, not decoration.
- **Test more stored energy:** Call two groups at a time to the shared run; seated groups stay in the fair test by answering what must stay the same and whether the release matched. Voice: change only winds or twist; measure distance in tiles, book-lengths or paper marks; re-run if a bump or slipped band spoils a trial. Keep each round inside two to three minutes.
- **Notice what changed:** Two minutes of talk only before any journal marks. Push past 'it went more' toward precise notices: left the line faster, reel hummed, stopped sooner than expected, or flipped with too many winds. Ask which trial sounded different and whether anything felt warm.
- **Trace the energy chain:** Introduce energy transformation with the three flow-builder cards. Class predicts order before anyone drags: energy stored in the wound elastic → movement energy of the car → some energy as sound and heat. Say 'the elastic unwinds' aloud but do not add a fourth card. Paper cards on the board work if the interactive is unavailable.
- **Record the chain:** Pupils draw and label on the Investigation Journal page only. Look for start at stored energy, then movement, then sound and heat, with arrows. Board starter: When we stored more energy, the car... Keep journals in class; no digital homework.
- **Make sense of our results:** Pool findings: most groups should report further travel with more winds; treat slip, flip or uneven floor honestly. Draw out the chain and everyday Irish stores — clockwork toys, wall-clock springs, batteries after wind generation, old mill ponds behind a sluice. Spoken reflect only: what would you change next time? Collect bands and small parts before anyone leaves.

What it should show

More winds or a tighter twist usually give a larger output — the car travels further along the run. Messy or short runs often come from elastic slip, uneven floor, or a push instead of a still release; re-run from rest with the band gripped. Too many winds can spin or flip the car — still useful data; mark the furthest point along the run.

Lesson 20

Misconceptions & interventions

- **Pupils say the energy is 'used up and gone' when the car stops.** — Revoice: energy changes form — a little becomes sound and heat through friction and the unrolling band, so the car stops, but it has not vanished. Point back to the third card on the flow-builder chain.
- **Pupils change how they let go, or shove the car, and still call it a fair test of more stored energy.** — Stop the run and ask what must stay the same. Re-run both trials from a still start at the marked line; only winds or twist may change.
- **Pupils think sound and heat appear only at the final stop, like a switch-off moment.** — Trace the chain again: sound and heat build along the whole run. Ask which trial hummed louder or warmed hands while it was still moving.

Differentiation

Emerging	Developing	Proficient
• Pair at the teacher table with a partly assembled reel (band already caught on the short stick); supply the board sentence starter When we stored more energy, the car…	• Add a third wind count on the same device and same start line, or mark where sound or heat might appear on the journal drawing.	• Critique another group's fair test aloud: what stayed the same, what spoiled a run, and how they would redesign the grip or release next time.

Cross-curricular hook

Link to Maths measures — record travel in floor tiles or book-lengths and compare low-wind vs high-wind results as a class.