energy-forces

The force of moving water

Lesson at a glance

Open by pouring a jug into a tray and asking whether moving water can do a real job. Pupils build a cork-or-cap water wheel with stick paddles on an axle over a tray, then plan a fair test on the fair-test-planner interactive, choosing pour height or flow strength and measuring turns in 10 seconds. They run shared-timer trials, record on the Investigation Journal page, and close by linking the push on the paddles to Ardnacrusha hydropower on the Shannon.

Learning objectives

- Build a simple water wheel that turns under a pour of water
- Fair-test one factor that changes how fast the wheel spins
- Explain that moving water carries energy that can do work, linking to Irish hydropower

Before the bell — prep

Fill jugs and set one tray per group. Kit each group: cork or bottle-cap hub, 4–6 cocktail sticks or short skewers, spoon/plastic paddles, straw or thin skewer axle, two yoghurt pots or books as supports, tape. Pre-cut paddles if build time is tight; have spares ready.

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Materials

Item	Qty	Per	Source	Low-cost substitute
cork (wine-bottle size) or sturdy plastic bottle-cap hub	1	group	brought from home	tight ball of tinfoil or a thick cardboard disc as the hub
cocktail sticks or short wooden skewer pieces	6	group	supermarket	strip of stiff card taped as paddles
small plastic spoons or pre-cut plastic paddle pieces	4	group	supermarket	card rectangles covered with sticky tape to resist water briefly
thin wooden skewer or straight plastic straw (axle)	1	group	supermarket	a straight pencil
yoghurt pots or similar supports for axle ends	2	group	classroom	two equal stacks of books with a gap for the wheel
sticky tape	1	group	classroom	elastic bands to hold paddles; use a pen mark on one paddle if tape is short
shallow tray or basin	1	group	classroom	a deep roasting tin or large lunch box lid
plastic jug of water	1	group	classroom	a large drinks bottle used as a pourer
class timer or stopwatch	1	class	classroom	teacher counts seconds aloud
cloths or paper towels for spills	4	class	classroom	old tea towels
Investigation Journal page	1	pupil	classroom	ruled paper with headed sections for plan and results

Safety watch-point

Cocktail sticks and skewers are sharp — no running; adult help for firm pushes into corks. Wipe spills before each "Go"; no climbing for pour height; no tasting tray water; wash hands at pack-away.

Teaching moves

- **Moving water can do work:** Project only the short board text and tie force and water wheel back to the jug pour they just watched. Say plainly the push on the paddles is a force that transfers energy so the wheel can spin — not two names for the same thing. Keep Ardnacrusha light; ask what one thing they might change to spin faster.
- **Build a water wheel:** Name each part, then model once: paddles on hub → hub on axle → axle on supports over the tray → finger-spin check → mark one paddle. Release groups. If a wheel will not spin, fix one issue at a time (uneven paddles, jammed axle, pour missing paddles). Stop free play once most wheels turn under a short pour.
- **Plan a fair test:** Drive the fair-test-planner interactive in explore mode. Model pour height as Change and turns in the set time as Measure; keep counting time, wheel, jug and the unused factor the same. Tell groups they may swap Change to flow strength — both sorts are fair. Pupils write question, prediction, change, measure and keeps-the-same on the Investigation Journal page.
- **Test what makes it spin faster:** Lead every trial from the board: check dry floors, call "Go", run the shared 10-second countdown, call "Stop". Run four windows (two trials each setting). Roles cover pour, count the marked paddle, watch the timer, record. Between trials, mop, refill and ask if the next test still looks fair. No climbing for height — shoulder height is enough.
- **Record your results:** Circulate while pupils finish the Investigation Journal table. Check the changed factor is named, two trials sit under each setting, and one conclusion sentence links counts to the prediction. Offer stems: "We changed… We kept the same… We counted… So we think…"
- **What the evidence shows:** Invite only two groups (one height, one flow) to share counts first, then meaning; others thumbs-up. Draw out observation versus inference, the force–energy bridge, and what would make a test unfair. Link the tray model to Ardnacrusha: river water turns turbines and keeps flowing downstream — same push, scaled up.

What it should show

Higher pours and stronger flows usually give more turns in 10 seconds because the water hits the paddles with a greater push. A low pour might give roughly 4–8 turns; shoulder height noticeably more — compare within one wheel, not across groups. Little change usually means settings too similar, stream missing paddles, or a sticking axle; fix one thing and re-run.

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Misconceptions & interventions

- **Pupils say the water "gives the wheel energy and then the energy is gone."** — Point at the tray: energy is transferred, not used up. The moving water pushes the paddles so the wheel gains movement; the water slows and collects in the tray — it is not magically empty of energy.
- **Pupils think hydropower "uses up the river until it is empty."** — Use the Ardnacrusha link: water passes through the turbines and keeps flowing downstream. The useful transfer is the push on the paddles or turbines, same as their tray model.
- **Groups change pour height and flow strength together, or count for different times.** — Hold up the fair-test-planner cards and re-sort: only one Change card; counting time, wheel and jug stay the same. Re-run the next shared "Go/Stop" window.

Differentiation

Emerging	Developing	Proficient
• Offer a half-built hub with two paddles already fixed so the group can finish the wheel and join the pour test. • Provide the Investigation Journal stems "We changed… We kept the same… We counted…" and pair a less confident counter with a peer.	• If two trial readings differ a lot, run a third shared window and talk about careful pouring. • Ask why the higher or stronger pour gave more turns, linking push to spin count.	• Critique fairness: what would happen if height and flow changed together, or if counting time slipped? • Suggest one wheel or method improvement (extra paddle, better balance) and predict its effect on turns.

Cross-curricular hook

Link to Geography and Irish heritage — Ardnacrusha on the Shannon as a real hydropower site nearly a century old.