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 or only splash. Name the force of moving water and water wheel, then groups build a cork- or cap-hub paddle wheel on a tray axle. On the Investigation Journal they plan a fair test changing pour height or flow strength and measuring turns in 10 seconds. Shared board countdowns run the trials; close by linking class counts 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 or shallow basin per group. Kit each group: cork or sturdy bottle-cap hub, 4–6 cocktail sticks or short skewers, plastic spoons or pre-cut paddle pieces, thin skewer or straw axle, two yoghurt pots or books as supports, sticky tape. Pre-cut paddles if the build must stay under 12 minutes; keep spares ready.

Lesson 17

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	provided printable	ruled paper with headed sections for plan and results

Safety watch-point

Cocktail sticks and skewer ends are sharp — no running; adult help for firm pushes into corks. Mop spills at once; keep floors dry; no climbing for extra pour height; no tasting tray water; wash hands at pack-away.

Teaching moves

- **Getting Started:** Hold a full jug beside an empty tray and pour a short stream so the class hears and sees the hit. Do not show a finished wheel yet. Ask where they have seen moving water push something, and whether it could turn a wheel — keep the five minutes light and curious.
- **Moving water can do work:** Project only the short board text. Tie force of moving water and water wheel back to the jug pour they just watched. Say once: the push is a force; that push transfers energy so the wheel can do work — do not treat the words as synonyms. Mention hydropower only in passing; save Ardnacrusha for the evidence talk.
- **Build a water wheel:** Name each part on the board first: hub, paddles, axle, supports. Model once — paddles on hub, hub on axle, axle on two supports over the tray, finger-spin check, mark one paddle with tape — then release groups. If a wheel will not spin, fix one thing at a time: uneven paddles, jammed axle, or pour missing the paddles. Stop free play once most wheels turn under a short pour.
- **Plan a fair test:** Run the fair-test-planner interactive as a whole-class model sort only. Worked sort: Change = pour height; Measure = number of turns in the set time; Keep the same = flow strength, the water wheel, counting time, the jug. Then say groups may swap so flow strength is what they change. Everyone measures turns in an agreed 10 seconds; each group finalises question, prediction, change, measure and keep-the-same on the Investigation Journal page.
- **Test what makes it spin faster:** Run repeated shared 10-second countdowns on the board; groups pour only when their tray is ready. Two trials at each setting. Watch for anyone changing height and flow together — stop and re-voice what must stay the same. Fold watchers in by asking what they predict for the pouring group's next trial and whether the test still looks fair. Shoulder height is the ceiling — no climbing on furniture.
- **Record your results:** Circulate the Investigation Journal page. Check the changed factor is named, at least two trials per setting are written, and a short conclusion links counts to the prediction. Offer stems: We changed… We kept the same… We counted… So we think… Keep what they saw separate from what they think it means.
- **What the evidence shows:** Invite two groups only first — one pour-height, one flow-strength — to share turn counts before meaning. Revoice observation before inference and the force–energy bridge in pupil words. Draw out what kept tests fair and that different wheels spin differently. Link lightly to Ardnacrusha on the Shannon: same push scaled up; the river passes through the turbines and keeps flowing.
- **Reflect and tidy:** One quick pair share on one improvement to wheel or method, then a full wet-kit pack-away: empty trays, dry tables, collect sticks and hubs, check the floor is dry, wash hands. Do not rush the floor check before the next class arrives.

Lesson 17

What it should show

Higher pours and stronger flows usually give more turns because the water hits the paddles with a greater push. Within one wheel, a low pour might give around 4–8 turns in 10 seconds and shoulder height noticeably more — designs differ, so compare within the same wheel. If counts barely change, settings may be too similar, paddles may miss the stream, or the axle may stick; fix one thing and re-run.

Misconceptions & interventions

- **Pupils say the water "gives the wheel energy and then the energy is gone."** — Trace the pour: the moving water pushes the paddles so the wheel gains movement; the water slows and collects in the tray. Energy is transferred, not used up — the tray is full of water, not "empty of energy."
- **Pupils think hydropower uses up the river until it is empty, like emptying the classroom jug.** — Name Ardnacrusha on the Shannon: water passes through the turbines and keeps flowing downstream. The useful transfer is the push on the turbines, the same push they felt on their paddles.
- **Pupils change pour height and flow strength together and still call it a fair test.** — Point at their journal plan and ask which one factor they chose to change. If both moved, re-run one setting with only that factor different and compare the new counts.

Differentiation

Emerging	Developing	Proficient
• Offer a half-built hub with two paddles already in place so the group can finish the wheel and still join the fair test. • Pair at the teacher table for the first shared countdown; scribe turn counts if writing slows them.	• If two trial readings differ a lot, prompt a third trial and talk about careful pouring. • Ask why the higher pour or stronger flow gave more turns, using the force–energy bridge in their own words.	• Add a sixth paddle or check balance, then judge whether another group's test stayed fair while watching. • Stretch: design one improvement to wheel or method and say how it would change the turn counts next time — still on paper.

Cross-curricular hook

Tie to Maths Data — pupils compare turn counts across two settings and read which pour gave the higher mode.