

materials

Clean the dirty water: apply it

Lesson at a glance

Hold up a jar of muddy water and challenge groups to design a bottle filter that cleans it. After sorting fair-test variables on the fair-test-planner interactive and agreeing a shared 1–5 clearness scale, groups stack cotton wool, sand, gravel and optional filter paper in their own order, then pour the same measured muddy water and wait on one class countdown. Cups line up from muddiest to clearest; pupils record design, score and conclusion in the Investigation Journal, then link the model to Irish water treatment.

Learning objectives

- Design and build a multi-layer filter from everyday materials
- Fair-test which filter design cleans muddy water best
- Connect the challenge to water treatment and clean water as a real issue in Ireland

Before the bell: prep

Adult-cut one plastic bottle per group the night before. Wash sand and gravel; pre-mix a closed jug of muddy water. Trial one multi-layer pour so you know the shared wait time. Set stability supports (jug, cut base or tray hole), trays, spoons, sticky notes and collection cups on tables.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
clear plastic bottle with base removed (adult-cut)	1	group	brought from home	large clear cup with holes punched in the base by an adult
stability support for inverted bottle (jug, spare cut bottle base, or tray with cut-out hole)	1	group	classroom	a second cup or small tub the bottle can sit inside
clear collection cup or beaker	1	group	classroom	clean glass jam jar
cotton wool	1	group	supermarket	piece of clean cloth or kitchen paper
washed sand	1	group	hardware shop	clean play sand from the school sand tray
washed gravel or small stones	1	group	hardware shop	rinsed aquarium gravel or small clean pebbles
filter paper	1	group	school kit	circle of kitchen roll
muddy water (soil stirred into water in a jug)	1	class	outdoors	water mixed with a little cocoa powder for a less gritty mess (still never tasted)
measuring cup or small cup with a fill mark	1	group	classroom	identical yoghurt pots filled to the rim
tray or newspaper for spills	1	group	classroom	old plastic bag opened flat
spoons for placing layers	2	group	classroom	clean hands for dry materials only
sticky notes for labelling layer order and scores	2	group	classroom	small scrap paper and tape

Safety watch-point

Adults only cut bottles. Never taste, drink or put filtered water near mouths. Mop spills at once; wash hands after muddy water and sand.

Teaching moves

- **Getting Started:** Hold one well-stirred jar of muddy water only: no bottles yet. Ask what is still in the water that we do not want, and remind them they already know ways to separate mixtures. Stress once: classroom filter water is never drunk.
- **How a filter cleans water:** Give one short spoken definition each for filter, filter design and water treatment, using the materials photo. Run a quick turn-and-talk on which layer might trap fine mud, then revoice: clearer is not drinkable.
- **Plan the fair filter test:** Open the fair-test-planner interactive with cards unsorted. Drag filter design to Change, clearness to Measure, and amount, bottle size and wait time to Keep the same, inviting hands-up before each drag. Agree and leave the 1–5 clearness scale on the board. If tight, one whole-class prediction stem beats a full round of group predictions.
- **Build your filter:** Model for two minutes: neck-down bottle in its support over a cup, thin cotton-wool base with a spoon, then sand, sticky-note label. No pour yet. Circulating, ask why that order and what the bottom layer should catch. Loosen packed cotton if nothing drips; add a cotton base if sand falls straight through. Designs must differ; shared kit only.
- **Test which filter cleans best:** Stir the class jug, measure the same amount per group, and start every pour on one signal with one countdown from your pre-lesson trial. Scores go on the bottle sticky note immediately. One runner per group lines cups from muddiest to clearest and calls design plus score aloud. A total block is still data: note no flow and score what little collected.
- **Record results and conclusion:** On the Investigation Journal page only: layer order, clearness score, one observation, one evidence-linked conclusion from the cup line-up, and one improvement idea. Push observation vs inference with stems: Our design was... The water looked... The evidence shows... Next time we would...
- **Make sense: filters and real water:** Point at cups and scores, not confident voices. Draw out that a fine bottom layer often traps small bits and gravel alone usually fails. Link factually to Irish lakes, rivers and treatment works: filtration is one real step among others, and our bottles are only a simple model. Revoice again: clear does not mean drinkable.
- **Reflect and tidy:** Lead wet pack-down first: leftover water to sink or outdoor bucket, sand/gravel on newspaper to dry, wipe trays and floor, everyone washes hands. Close with each group naming one design choice to keep and one to change.

What it should show

Expect multi-layer designs with a fine layer (cotton wool or paper) under sand/gravel to score higher (clearer) than gravel-only or sand-only filters. Sand at the bottom often washes into the cup and scores low: useful, not a failure. A blocked filter was packed too tight; loosen cotton and still score any liquid collected. Surprising high scores on coarse-only builds usually mean a short wait or uneven muddy mix. Check the shared countdown and jug stir.



Misconceptions & interventions

- **If it looks clear, it is safe to drink.** Point at the clearest cup and say: our filters only trap some visible mud. Real Irish treatment uses more steps and careful testing: that is why we never taste ours.
- **Sand at the bottom will still catch the mud.** If sand has washed into the cup, ask what the biggest gaps let through and what a thin cotton-wool base would catch first. Link to the line-up evidence, not a lecture.
- **Pouring more water or waiting longer will make our filter win.** Return to the fair-test planner: design is the only Change card. Different amounts or wait times make the cup line-up meaningless.



Differentiation

Emerging	Developing	Proficient
• Start them on cotton wool, then sand, then gravel and sit briefly at the teacher table to label the order together. • Offer spoken sentence stems for the journal: Our design was... The water looked... The evidence shows...	• After the line-up, ask why their bottom layer helped or failed, still on the same journal page. • If their filter finished early and minutes remain, allow one quiet re-pour off the front of the room only.	• Deepen design choice within the shared kit: finer bottom layer, different order, or optional filter paper, still with one bottle and the same pour amount. • Fast finishers sketch an improved layer order on the same journal page and state how they would keep a re-test fair.



Cross-curricular hook

Link to Geography: Irish tap water often starts in a nearby lake, river or reservoir before treatment works and pipes.

