

## materials

# Keeping the heat in

## Lesson at a glance

Open with a thin T-shirt versus a thick wool jumper on a cold Irish morning and ask which keeps you warmer. Pupils plan a fair test on the fair-test-planner interactive and the Investigation Journal, then wrap identical cups in wool, foil, paper, bubble wrap or leave one bare. Teacher pours hand-warm water; after a shared wait they rank warmth on a 1–5 hand-feel scale. Class results pool on the data-recorder bar chart, then partners link better insulators to jackets and lagged hot-water cylinders.

## Learning objectives

- Plan a fair test of which wrapping keeps warm water warm longest
- Record which materials keep warmth in better
- Link the results to everyday Irish uses such as jackets and hot-water cylinders

## Before the bell – prep

Day before: pre-cut wool, foil, paper and bubble-wrap pieces large enough to cover cup sides; pre-mark identical fill lines on five cups per group; label bases W, F, P, B, X. Set trays, elastic bands or tape strips, and one jug of hand-warm water ready. Thermometers only if you locked that method before the lesson.

**Materials**

| Item                                                | Qty | Per   | Source             | Low-cost substitute                                                                                            |
|-----------------------------------------------------|-----|-------|--------------------|----------------------------------------------------------------------------------------------------------------|
| identical clear plastic cups                        | 5   | group | classroom          | identical clean yoghurt pots                                                                                   |
| trays to hold each group's cups                     | 1   | group | classroom          | a sturdy cardboard box lid or baking tray from home                                                            |
| wool fabric scraps or cut pieces from an old sock   | 1   | group | brought from home  | a thick glove or fleece scrap                                                                                  |
| aluminium foil sheets                               | 1   | group | supermarket        | clean foil from a food tray, flattened                                                                         |
| paper wrap (newspaper or kitchen paper)             | 1   | group | classroom          | a page of scrap paper                                                                                          |
| bubble wrap pieces                                  | 1   | group | classroom          | a puffy padded envelope cut open                                                                               |
| elastic bands or sticky tape strips to fasten wraps | 4   | group | classroom          | string or a rubber hair band per wrap                                                                          |
| jug of warm (hand-safe) water for teacher pouring   | 1   | class | classroom          | water from a warm tap, checked by the teacher                                                                  |
| class timer or stopwatch                            | 1   | class | school kit         | classroom clock with a second hand or minute hand                                                              |
| classroom thermometers                              | 1   | group | school kit         | no thermometer: one agreed pupil judges every cup by hand after unwrapping (same judge, same hand, same order) |
| cloths or paper towels for spills                   | 4   | class | classroom          | scrap cloth from home                                                                                          |
| Investigation Journal pages                         | 2   | pupil | provided printable | plain paper ruled for a fair-test plan and a simple results table                                              |

**Safety watch-point**

Teacher only pours hand-warm water — never hot. Wipe spills at once; no tasting; walk, do not run, near cups.

## Teaching moves

- **Getting Started:** Hold up a thin fabric scrap and a thick wool scrap. Take quick hands-up guesses about which would keep a warm drink warmer and why. Keep cups and wraps out of sight so the opening stays a question, not a set-up. Three minutes is enough.
- **Heat keepers and heat leavers:** Name heat insulator first with the jumper example, then briefly name heat conductor via the metal-spoon idea. Keep activity language on which wraps keep warmth in. Flag that foil is metal and may not win just because it looks shiny — let the evidence decide.
- **Question and predict:** Write the question exactly: Which wrapping keeps warm water warm longest? Keep the five options visible. Take three or four spoken predictions with the stem I think ... will stay warmest because ... If a pupil names a material with no reason, push for thickness, fluffiness or trapped air.
- **Plan our fair test:** Open the fair-test-planner interactive. Lock Change = wrapping material, Measure = how warm the water stays, Keep the same = cup, amount of water, wait time. Stress that every cup is filled from the same warm jug to the same mark so start warmth is equal. Pupils copy the plan onto the Investigation Journal page.
- **Wrap and wait:** Groups wrap first with no water. You alone pour hand-warm water to the fill line from one jug. Start one shared class wait. During the wait, talk jackets, attic lagging and hot-water cylinders. After the wait: unwrap first, then the same judge feels the side of the cup — never the outside of the wool or bubble wrap — and ranks 5 very warm to 1 room temperature.
- **Record our results:** Open the data-recorder with columns Wrapping and Warmth left (1–5). Enter one row each for wool, foil, paper, bubble wrap and bare. If groups disagree, take the most common rank aloud. Pupils copy onto the Investigation Journal; show the bar chart and ask which bar is highest.
- **What does the evidence show?:** Point at the tallest and shortest bars. Partners say one sentence naming a good insulator today and one everyday place they see the idea. Draw out trapped air and thickness as inferences, and run a quick fairness check: different water amounts, wait times or cups would spoil the test.

## What it should show

Expect wool and bubble wrap to rank warmest (more trapped air) and bare or thin paper coolest. Foil often sits in the middle or cools faster when wrapped tight with little trapped air — treat that as useful data, not a failure. A group whose bare cup feels warmest usually felt the wrap outside instead of the cup side; re-rank after unwrapping.



### Misconceptions & interventions

- **Foil is always best because it looks shiny and scientific.** — Point at the foil bar on the chart. Remind them foil is metal: with little trapped air it can let heat leave faster than wool. Let today's ranks settle the argument.
- **Warmth stays in because the material is magic.** — Revoice simply: some materials slow heat leaving; some let it leave faster. Link wool and bubble wrap to trapped air, not magic.
- **Pupils rank by touching the outside of the wool or bubble wrap and call the thick wrap coldest.** — Stop and re-model: unwrap first, then feel the side of the cup. A thick insulator often feels cooler outside while the water inside stays warmer.

### Differentiation

| Emerging                                                                                                                                                                                                                                                                                                      | Developing                                                                                                                                                                                                                              | Proficient                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Pair at the teacher table for wrapping and ranking; supply a partly-labelled Investigation Journal row with the five wrapping names already written.</li><li>• Let them judge only warmest versus coolest first, then fill the middle ranks with a partner.</li></ul> | <ul style="list-style-type: none"><li>• Prompt why the winning wrap worked (thickness, fluffiness, trapped air) after they record their ranks.</li><li>• Ask one fairness check: what would happen if one cup had more water.</li></ul> | <ul style="list-style-type: none"><li>• Critique the fair test: name one thing that could still have been unfair and how to tighten it next time.</li><li>• Stretch link: design a better cup wrap from the materials already on the tray and say what they would change and measure.</li></ul> |

### Cross-curricular hook

Tie to Maths Data — build the class bar chart of warmth ranks and read which wrapping was the mode.