materials

Repeat, evaluate and share

Lesson at a glance

Open by holding up one group's first-trial reading and asking whether a single number is enough to trust. Model why repeats beat flukes, then groups re-run their own heating or cooling fair test for Trial 2 and Trial 3 with the same cups, wrappings and timers. Raw times go on the Investigation Journal; middle value, conclusion and one method improvement go on the Results and Conclusion page. Pool trustworthy numbers on the data-recorder interactive, then name differences between groups before tidying.

Learning objectives

- Repeat a fair test and explain why repeats make results more trustworthy
- Pool, chart and evaluate evidence to decide whether the prediction held
- Present findings and one improvement to the method

Before the bell — prep

Night before: freeze a full tray of matching ice cubes and photocopy a blank Results and Conclusion page per pupil. Before the bell, return each group's cups/wrappings and timers, write today's measure or fixed observation window on any planner still blank, and set warm water (hand-warm only) ready for you to pour.

Lesson 13

Materials

Item	Qty	Per	Source	Low-cost substitute
identical ice cubes from the same tray	8	group	school kit	freeze water in identical bottle caps the day before (same count: enough for every cup on two further full runs)
warm water in a jug (teacher-poured only)	1	class	classroom	use ice-cube investigations only if warm water is awkward
assorted wrapping materials (wool, foil, paper, bubble wrap)	1	group	classroom	scraps of fabric, newspaper and kitchen foil from home
identical cups	3	group	classroom	identical clean yoghurt pots
stopwatch or classroom timer	1	group	school kit	shared classroom clock with a second hand
thermometer	1	group	school kit	same pupil judges warm, cooler, cold by fingertip on every trial
cloths for spills	2	class	classroom	newspaper layers under cups
Investigation Journal pages from earlier in this project (Investigation Journal page and Investigation Journal page with first readings)	1	pupil	classroom	group plan sheet and trial table kept from the previous session
Investigation Journal Results and Conclusion page	1	pupil	classroom	ruled page with headings: Matching trials, Middle value or pattern, Did prediction hold?, One improvement

Safety watch-point

You pour any warm water — warm to the hand, never hot. Wipe spills at once. No tasting of ice or water from the test; wash hands once the wet kit is away.

Teaching moves

- **Getting Started:** Keep it light. Hold up one group's first-trial reading from earlier in this project and ask whether the class would trust a big decision on a single number. Seat groups with the same partners and open journals at the plan-plus-Trial-1 page. Do not re-stage the full apparatus yet.
- **Why repeats matter:** Write only repeat and evidence on the board. Model the worked cycle aloud with one volunteer group's story: same ice, same place, same timer, Trial 2 and Trial 3, then the middle value. Stress that the middle value is what we trust even when it disagrees with Trial 1. Save the word evaluate until they have numbers of their own.
- **Repeat our fair test:** Say the same-measure rule once, then move straight into set-up and Trial 2 — no re-planning. Circulate asking 'Is this trial the same as the other repeats in every way that matters?' Raw numbers stay on the Investigation Journal page only. Pupils who should not handle ice or water become timer or recorder.
- **Record results and decide:** Board-model ordering three sample matching numbers and circling the middle one before anyone writes. Offer stems: 'Our middle value shows... so our prediction did/did not hold because...' and 'Next time we would keep ___ the same more carefully.' If a group has only two clean matching trials, use both numbers or the halfway figure — never invent a third trial.
- **Pool and chart the class results:** Drive the data-recorder on the IWB in explore mode. Enter each group's trustworthy number only. Chart ice-wrap groups as one run and warm-cup groups as a second run; announce which run is on screen before typing. Never switch class average on if bars mix unlike units or windows. Keep watchers on the screen: 'Are they reading the matching-trial number, or Trial 1?'
- **Whose number differs, and why?:** Do not run four-part reports. Each group says one number — their middle value — round the room while the chart stays up. When two careful groups differ, take every cause the class offers, then land it: one trial can be any of those; a middle value from three is harder to fool. Pull one or two written improvements into the summary only if they fix a difference just heard.
- **Reflect and tidy:** Start wet-kit clear-down at once and take one or two spoken answers to 'Why do scientists repeat and share?' while hands are busy. Target: repeats catch flukes; sharing lets others check the method. Keep journals together as the project log.

What it should show

Matching trials for the same wrap or cup should cluster; the middle value is more trustworthy than Trial 1 alone and may agree or disagree with the group's prediction. A group whose Trial 2 wildly disagrees with Trial 3 usually changed place, start time or amount — re-check the fair-test constants before trusting either number. Ice-wrap and warm-cup runs must stay on separate chart comparisons.

Lesson 13

Misconceptions & interventions

- **Trial 1 is the 'real' answer and the repeats are optional extras.** — Point at their three matching numbers and circle the middle one on the board model: 'This is what we trust, even when it disagrees with Trial 1.'
- **I still think wool is best — the numbers don't matter if I'm sure.** — Gesture at the data-recorder bars: 'Evidence is what the chart shows, not what we hoped. What do the bars actually say?'
- **We can average ice-melt minutes with warm-cup minutes on one class chart.** — Stop before typing. Split the runs aloud — ice-wrap groups first, warm-cup groups second — and only compare bars that share a unit and window.

Differentiation

Emerging	Developing	Proficient
• Pair as timer or recorder only; teacher helps order the three matching numbers and circle the middle value on their Results and Conclusion page. • If a planner was missed, set that group to the class default short window in under a minute and write it on their page.	• Prompt: 'Name one thing that stayed the same across your three trials and one thing you would tighten next time.' • If only two matching trials exist, guide them to state close/far and the halfway number rather than forcing a middle value.	• Fair-test critique: from the class chart, name one difference between two groups and propose the method fix that would shrink it. • Stretch stem: 'Three groups agreeing is harder to fool than one middle value because…'

Cross-curricular hook

Tie to the Maths Data strand — order three matching trials, find the middle value, and read the tallest bar on the class chart.