

materials

Choosing the right material for the job

Lesson at a glance

Open with a real raincoat and the two-jobs puzzle: keep rain out yet let sweat escape. Each group draws one object brief (raincoat, lunchbox or school-bag strap) and tests cotton, plastic sheet, foil and card against two competing properties, scoring 1–3 each. An IWB worked example lays one group's scores side by side so the trade-off pattern is visible. Groups then recommend a material, name what they gave up, and defend the choice against challenges from other object groups.

Learning objectives

- Test the same materials against two properties that pull against each other
- Recommend a material for your group's object and justify the choice from your own scores
- Explain what you traded away, and why another group's object needed a different material

Before the bell: prep

Cut equal-size pieces of cotton fabric, clear document-wallet plastic, foil and card: one set per group. Print the three object brief cards from the lesson's card sheet, one per group. Have a raincoat, a dropper or spoon of water, and one 100 g weight ready. Same-size pieces keep the tests fair.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
fabric sample (cotton scrap, roughly 10 cm square)	4	group	brought from home	an old tea towel or T-shirt cut into squares
plastic sheet sample (cut from a clear document wallet, roughly 10 cm square)	4	group	classroom	cut from an empty clear water bottle
kitchen foil square (roughly 10 cm square)	4	group	supermarket	foil from a clean food wrapper
card square (roughly 10 cm square)	4	group	classroom	cereal-box card
water in a jug	1	group	classroom	any clean container
syringe or dropper	1	group	school kit	a teaspoon counted out
small weights for strength and rigidity testing (e.g. 100 g masses)	2	group	school kit	a small stone or a full glue stick
object brief cards (raincoat, lunchbox, school-bag strap)	1	group	provided printable	write the object, its two jobs and their test methods on the board

Safety watch-point

Breath-through test: hold material near the mouth, do not put it between the lips. Supervise the firm pull on strap materials and keep water drips on the tray, not the floor.



Teaching moves

- **Getting Started:** Hold up a raincoat (or point to the coat hooks) and pose only the puzzle: it must keep rain out and let sweat escape. Take two or three quick guesses. Do not reveal the test tray yet.
- **Two jobs that pull against each other:** Name property and trade-off briefly from the pupil screen, then hand each group one object brief card. Tell them breathable waterproof fabric is a real engineer solution to this exact problem, and that it is not a fifth material they will test today.
- **Test four materials, two ways:** Model one full raincoat cycle aloud with foil before groups start: predict, drip, breathe-through, score both jobs. Then release groups to their own two tests. Watch for both properties scored, same water amount / same-size pieces / same weight, and scores agreed by the group not one child.
- **Put the scores side by side:** On the IWB type one group's four materials into the two score columns as a single worked example. The chart plots job 2 only, so read the table and ask: is any material high in both score columns? Which would you pick, and what does that cost you? Other groups keep their own Investigation Journal scores ready.
- **Defend it and get challenged:** Each group names its material and the trade-off. Push listeners to challenge: would a lunchbox group have chosen the same material? Give the challenges real time: this is where pupils explain why a different object needs a different trade-off.
- **What you covered:** Keep the wrap short. Pupils finish the Investigation Journal page: four materials, two property scores, recommendation and what they gave up.



What it should show

No material tops both jobs. Foil and plastic score high on waterproofing/rigidity but low on breathability or softness; cotton scores high on breathability/softness but low on waterproofing/rigidity. A group that crowns one material the overall winner without naming a trade-off has missed the point: send them back to the lower column.



Misconceptions & interventions

- **One material will win both tests, so we just pick the best overall.** Point at their own score row where the high number in one column sits beside a low number in the other. Ask: what did that top material cost you on job 2?
- **The right material is the same for every object: foil is just good or just bad.** Have a raincoat group and a lunchbox group swap recommendations. Foil is a poor raincoat but a fine lunch wrap: the job decides the trade-off.
- **We can score from one person's feel or one quick drip.** Stop the group and restate: same-size pieces, same water amount or same 100 g weight, and scores by group agreement. That is what makes the comparison fair.



**Differentiation**

Emerging	Developing	Proficient
• Sit with the teacher table and run only the modelled raincoat pair of tests first, scoring together before the group continues alone. • Provide a partly filled score row so they only complete the second property column.	• Prompt: if your object also had to be cheap, would you change your pick? • Re-test the borderline material once more and check whether the scores still hold.	• Critique another group's fairness: did they keep piece size, water amount or pull force the same? • Explain to the class why the lunchbox and raincoat groups should not recommend the same material.

Cross-curricular hook

Link to Maths Data: pupils read two score columns side by side and compare which material ranks highest and lowest.