

materials

Everything has mass, even air

Lesson at a glance

Open by holding up a clear cup that looks empty and ask whether something invisible is inside. Pupils jot predictions for two claims — air takes up space, and air has mass — then run a dry-paper cup-in-water test in groups and watch a whole-class beam-balance demo where one of two matched balloons is carefully deflated. They record observations and an “I think...” line on the Investigation Journal page, then attach the particle idea to both results before a short exit talk.

Learning objectives

- Demonstrate that air takes up space and has mass using evidence from fair tests
- Explain in simple terms that materials, including air, are made of tiny particles

Before the bell – prep

Night before: dry-run the beam balance from the back of the room until the tip is obvious — prefer two identical well-inflated balloons; keep sealed sandwich bags as the primary fallback. Gather clear tubs, cups, dry paper scraps and cloths per group. Pre-inflate matching pairs and mark equal hanging points on the ruler.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
clear plastic tub or washing-up bowl of water	1	group	classroom	a deep baking tray or large mixing bowl
clear plastic cup	2	group	classroom	any stiff disposable cup that holds its shape under water
small dry paper scraps	4	group	classroom	torn scrap from an exercise book
identical balloons	2	class	supermarket	two identical sealed sandwich bags inflated equally with air (preferred primary fallback on the same beam)
spare identical sealed sandwich bags (inflated equally)	2	class	classroom	a second pair of matching balloons
30 cm ruler	1	class	classroom	a straight metre stick used as a shorter beam with strings closer in
string	1	class	classroom	wool or thin ribbon of equal lengths
pivot for the beam balance (pencil, dowel or triangular block)	1	class	classroom	a marker pen or the edge of a sturdy book used as a fulcrum
cloths or paper towels for spills	1	group	classroom	old tea towels
bucket or second sink access for staggered tub emptying	1	class	classroom	empty tubs two at a time into the classroom sink

Safety watch-point

Wipe floor spills as they happen and keep water tubs away from edges. Deflate balloons away from faces; if one bursts, clear pieces before hanging a spare matched pair.

Teaching moves

- **Getting Started:** Hold up one clear cup only — keep tubs off the desks so eyes stay on the question. Collect two or three ideas about what is inside, then state the two claims to test: air takes up space, and air has mass.
- **What will we find out?:** Write both questions and the plain mass line on the board. Give one quiet minute for both predictions on the Investigation Journal page before any apparatus is touched. Expect many to accept space but doubt mass — keep both predictions visible to return to later.
- **Does air take up space?:** Model the full cycle once in about three minutes: paper high inside, cup level, push straight down, lift, then tip to show bubbles. Circulate for level cups; if paper wets, dry a new scrap and retry straight down. Cue one pupil per finished group to empty the tub early so sinks are not swamped at the end.
- **Does air have mass?:** Drive the three-option vote on the interactive before you touch either balloon. Deflate slowly — never pop — and restate what stayed the same. After the beam settles, let pairs judge whether the tip is clear enough; if not, hang farther out once or switch to the sealed bags on the same beam.
- **What did we notice?:** Give groups one minute to choose one observation for each claim before hands go up. Keep talk on what was seen: dry paper, bubbles and water in, inflated side down. Revoice any “suction” or “magic” talk toward matter already in the cup or leaving the balloon.
- **Record on your Investigation Journal page:** Pupils complete observations and a short “I think...” line now, while tests are fresh — not as homework. Check that dry paper stays in observe and “so air takes up space” goes in think. Leave one blank line free for the particles sentence next.
- **Tiny particles make up materials:** Point back to the cup and the balance first, then name particles as the scientist’s word for that “something.” After partner talk, require shared answers to restate both tests in particle language. Half a minute for “I think air is made of particles because...” naming something seen today.
- **What we learned and tidy up:** Hear three pairs finish “Air is not nothing because...” while table dryers and balance packers work in parallel. Strong answers link space, mass or particles to one of today’s tests. Stagger any remaining tub emptiers two at a time.

What it should show

Cup test: paper stays dry when the cup goes straight down level; tipping frees bubbles and water rushes in. Balance: the still-inflated side dips after careful deflation. Wet paper usually means a tilted cup or paper too near the rim — retry straight down. An unclear tip means hangers too close to the pivot or mismatched balloons — move hangers out or switch to matched sealed bags.



Misconceptions & interventions

- **“Air is nothing / the cup is empty, so only heavy solid things have mass.”** — Return to the two predictions after both tests. Point to the dry paper and the dipped inflated side and ask: what left the balloon that the balance could detect?
- **Pupils want to pop the balloon, thinking a bang will “prove” air better.** — Refuse politely: popping changes the rubber and the air at once, so the test is no longer fair. Deflating lets only the air leave.
- **“Particles” means dust motes you can see in a sunbeam.** — Say these particles are far smaller than anything we can see; visible dust is itself made of many particles. Keep the word tied to the cup and balance evidence.



Differentiation

Emerging	Developing	Proficient
• Offer board stems: I predicted... I observed... I think this shows... and sit with the teacher table for the first cup push so the level-cup move is modelled hand-over-hand. • Accept a labelled sketch of dry paper or the dipped beam in place of a full sentence observation.	• Prompt a second cup trial after a wet result and ask what they changed to keep the paper dry. • Add one journal sentence on why deflating (not popping) kept the balloon test fair.	• Ask them to restate both tests in particle language and name what stayed the same on the balance. • Invite a fair-test critique: how would unequal string lengths or different balloon sizes spoil the mass claim?



Cross-curricular hook

Tie to Maths measures and equality — a level beam means equal mass each side until one variable changes.