

materials

Irreversible Changes and Chemistry

Lesson at a glance

Open by holding up a clean iron nail and asking whether the orange-brown on old gates and bike chains can ever be undone. Pupils write balloon and nail predictions in the Investigation Journal, then groups trap the gas from baking soda and vinegar in a balloon and jot quick observations. As a class they set up three shared nail jars (dry, water, oil) for later checks, tidy conclusions on paper, sort everyday changes as reversible or irreversible on the board, and close by linking today's fizz to what chemists study.

Learning objectives

- Observe and describe evidence that a new material has been made in the fizzing mixture
- Classify fizzing as irreversible from today's evidence, and set up rusting as a slow change to check over later days
- Connect making new materials to the wider field of Chemistry

Before the bell – prep

Night before: pre-portion ~2 tsp baking soda per balloon and ~50 ml vinegar measures; gather bottles, balloons, trays, three clear jars, three clean iron nails, cooking oil, labels. Keep the fizz kit and nail jars behind the desk until needed. Mark jar lids Dry, Water, Oil in advance.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
baking soda (bicarbonate of soda)	1	group	supermarket	share one large box across the class
white vinegar	1	group	supermarket	share one bottle across the class with small poured measures
small clear plastic bottle or sturdy clear cup	1	group	classroom	clean empty small water bottle
balloon	1	group	supermarket	stretch film held loosely over the neck to show gas push (less clear than a balloon)
plastic tray	1	group	classroom	deep baking tray or large plate
teaspoon or small scoop	1	group	classroom	folded paper scoop
iron nails (clean)	3	class	hardware shop	per-group sets of three only if kit allows
clear jars or containers with lids	3	class	classroom	clean yoghurt pots; per-group sets only if kit allows
cooking oil	1	class	supermarket	a few spoons shared across groups
tap water in a jug	1	class	classroom	none needed
Investigation Journal page	1	pupil	provided printable	plain paper with teacher-led headings said aloud

Safety watch-point

Vinegar away from eyes; no tasting. Mind sharp nail points; wipe oil spills so floors are not slippery; wash hands after fizz and nail handling.

Teaching moves

- **When a change cannot be undone:** Stay in question mode on the board. Collect two or three clue ideas (bubbles, smell, colour, heat, a filling balloon). Name new material only after pupils offer gas or colour; hold irreversible change until after the balloon run.
- **Question and predict:** No apparatus in hands yet. Get balloon and nail predictions on the Investigation Journal page before any mix. Ask: will the balloon stay floppy or fill, and is that gas new? Which nail condition will change most, and why? Note a few claims on the board to return to later.
- **Catch the gas:** Model one full cycle in about two minutes at the front, then groups run on trays. Protect one successful inflated balloon per pupil experience over a second run. Before wipe-down, every pupil jots two quick notes or a sketch and names the group's chosen evidence. If kit is tight, half watch and answer your notice questions, then swap.
- **Set up the rusting nails:** Wipe trays and clean hands first. Lead one shared class set of three jars: dry nail; water nail only partly wet with jar open or loose so air reaches it; oil nail fully under cooking oil. Remind pupils of their nail prediction without checking it yet — nothing has appeared today.
- **Record in the Investigation Journal:** Polish balloon observations, a short own-words conclusion (new material? reversible or irreversible?), brief dry/water/oil set-up notes, and a blank corner for later jar checks. Circulate pushing we saw the balloon fill versus so a new gas was made.
- **Sort: reversible or irreversible:** Whole-class board sort. Cluster melting ice, freezing water and melting chocolate fast. Slow on dissolving salt then evaporating (reversible), today's balloon fizz (irreversible from observed evidence), and rusting (irreversible from everyday metal, jars to confirm later). Skip toasting and cooking if time is short.
- **Make sense: what chemists study:** Lead with today's balloon evidence and why the fizz is irreversible, then briefly rusting as the slow candidate for later checks. Finish with one or two Chemistry links only — baking powder in bread and cakes, rust-proofing on bikes and bridges — not a career lecture.

What it should show

Expect a lively fizz and a clearly inflated balloon within seconds; pupils should treat the trapped gas as a new material and the change as irreversible. A limp balloon usually means a loose seal or too little powder or vinegar — re-seat and retry only if time allows. Over later days the water nail usually shows orange-brown rust first, the dry nail changes little, and the oil nail stays closer to clean; stalled rust often means the water jar was sealed full with no air.

**Misconceptions & interventions**

- **Pupils say a change is irreversible only if it looks dramatic or noisy.** — Hold dissolving salt beside the fizz: salt can come back by evaporating water even though it was quiet; the balloon gas and starting powder and vinegar cannot be recovered even though it was lively. The test is getting the same starting materials back, not the drama.
- **Pupils call melting irreversible because the ice or chocolate loses its shape.** — Return them to the material test on the board sort: freeze the water or let the chocolate set again — same material, so reversible. Contrast with today's balloon mixture they cannot un-mix.
- **Pupils treat the nail jars as proof of rust collected in this lesson.** — Revoice: today is set-up only. Evidence of a new orange-brown material comes on later jar checks, using rusty gates and bike chains as the clue for what to look for.

Differentiation

Emerging	Developing	Proficient
• Less confident groups watch one successful balloon run beside a neighbouring group, then describe what they saw and copy the group's chosen evidence into two simple bullet notes. • Offer a sentence starter on the journal page: The balloon... so I think a new material was...	• After the run, prompt pairs to say whether their balloon prediction was supported and which single clue best shows a new material. • On the sort, ask them to justify one contested item (salt or rust) with the material-back test.	• Confident groups gently feel balloon firmness or bottle coolness without squeezing hard and record only what they actually noticed. • Stretch prompt in make-sense: why might oil change what happens to the nail compared with water, and what will count as evidence on later checks?

Cross-curricular hook

Link to Home Economics and everyday baking — baking powder's controlled fizz that helps dough rise is the same irreversible idea pupils just trapped in the balloon.