materials

Irreversible Changes and Chemistry

Lesson at a glance

Open with a clean iron nail beside everyday rusty metal and ask whether rusting can be undone like melting ice. Pupils write balloon and nail predictions, then mix pre-portioned baking soda and vinegar under a sealed balloon to trap the new gas. The class sets up three shared nail jars (dry, water, oil) for later checks, records the fizz conclusion in the Investigation Journal, and sorts everyday changes as reversible or irreversible before linking the 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

Pre-portion about two teaspoons baking soda per balloon and 50 ml vinegar per bottle the night before so groups start without scooping queues. Ready one shared set of three labelled jars, three clean iron nails, cooking oil, trays, and balloons. Hold all kit behind the desk until Catch the gas.

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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 the fizz and after handling nails.

Teaching moves

- **Getting Started:** Hold up one clean iron nail only — leave the baking-soda kit and nail jars out of sight. Ask 'Can rusting be undone, the way melting ice can?' and take a minute of everyday examples without naming irreversible yet.
- **Question and predict:** No apparatus in hands. Drive two focus questions: will the balloon stay floppy or fill, and which nail (dry, water, oil) will change most and why. Insist both predictions are on the Investigation Journal page before any mixing.
- **Catch the gas:** Model one full cycle in about two minutes: powder in balloon, vinegar in bottle, seal, tip, watch. Then groups run on trays. Before wipe-down, every pupil jots two quick notes or a sketch of what the balloon and mixture did and which evidence they chose as proof of a new material.
- **Set up the rusting nails:** Wipe trays and wash hands first. Lead one shared class set: dry nail on a lid, water nail partly wet with air space (jar open or loose), oil nail fully under cooking oil. Agree later morning checks; remind them nothing new has appeared on the nails today.
- **Record in the Investigation Journal:** Seven lean minutes: polish balloon observations, write a short conclusion (new material? reversible or irreversible?), note dry/water/oil set-up in a few words, and leave a blank corner for later nail checks. Push '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, then slow on dissolving salt (reversible by evaporation), today's balloon fizz (irreversible from evidence), and rusting (irreversible from everyday gates). Keep the material-back test visible.
- **Make sense: what chemists study:** Start with today's balloon evidence only: was the prediction supported, what new material appeared, why the fizz is irreversible. Then briefly name Chemistry via baking powder in bread and rust-proofing on bikes and bridges — one or two concrete links, not a careers list.

What it should show

Expect a lively fizz and a clearly inflated balloon within seconds — evidence a new gas formed and the change is irreversible. A limp balloon usually means a loose seal or too little powder/vinegar; re-seat and retry once if time allows. Over later days the water nail should show orange-brown rust first, the dry nail little change, the oil nail stay cleaner; a stalled water nail often sat fully sealed with no air.

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Misconceptions & interventions

- **Pupils say a change is irreversible only if it looks dramatic or noisy.** — Contrast quiet dissolving salt (reversible by evaporating water) with the lively fizz (irreversible). Stress the test: can you get the same starting materials back?
- **Pupils call melting irreversible because the shape is lost.** — Return them to the material test on the board: freeze the water or re-set the chocolate — same material, so reversible.
- **Pupils treat the nail jars as proof already collected today, or invent rust they have not seen.** — Say the nails are being watched, not tested now. Ask what orange-brown coating they will look for on later checks, using everyday gates as the clue.

Differentiation

Emerging	Developing	Proficient
• Let less confident groups watch one successful neighbouring balloon run, then describe in their own words what filled the balloon and why the change cannot be undone. • Accept two bullet notes or a simple sketch as the balloon record; teacher scribes the irreversible label if writing stalls.	• After a clear inflate, ask pairs to name which single piece of evidence is their main proof a new material formed. • On the sort, have them justify dissolving salt as reversible using the material-back test.	• Invite gentle feel of balloon firmness or bottle coolness, recording only what they actually notice, and ask where else a gas is made on purpose (e.g. baking powder in dough). • Stretch prompt: why oil might slow rust compared with water, ready for later jar checks.

Cross-curricular hook

Link to home Economics/SPHE cooking talk — baking powder's controlled fizz in bread is the same irreversible idea under adult care.