

Mini Rockets

WORKING SCIENTIFICALLY · VARIABLES & FAIR TESTING · ~1 HOUR

Baking-soda & vinegar film-canister rockets — the fun bit is the launch; the learning is designing a fair test to find what flies highest.

OBJECTIVES

What students learn

- Define **independent**, **dependent** and **control** variables.
- Identify the variables in an investigation of their own.
- Describe how to **control** variables — keeping factors constant so a test is fair.

TIMING

~1 hour (or a double)

GROUPINGS

Pairs / small groups

LEVEL

KS3 · adaptable up

THE CONCEPT, IN ONE LINE

"Make the best rocket" is a fair-test problem: change one thing (independent variable), measure one thing (dependent variable), keep the rest the same (control variables).

Per group – kit & quantities

- ~6 **film canisters** with snap-on lids (+ ~25% spares)
- **White vinegar** – ~100 ml in a labelled beaker
- **Bicarbonate of soda** – ~50 g tub + spatula
- A **5 ml** teaspoon / measuring spoon
- Safety goggles – one per student
- A tray or launch mat + paper towels
- A metre rule / tape measure (to measure height)
- Optional: thin card + tape (to build/decorate)

Preparation

- **Test the lids.** Snap-fit lids vary – trial-fire 2–3 canisters and set aside any that pop weakly or leak. Loose lids won't build pressure.
- Decant vinegar into labelled beakers; provide bicarbonate in tubs with a spatula.
- Keep **spare canisters and lids** to hand – lids get lost and cracked in use.
- Mark or provide a clear **launch zone** (tray / mat / floor area away from faces and electrics).

Safety

- **Goggles on** the moment vinegar and bicarbonate are out.
- Launch **cap-side down** in the launch zone; everyone **steps back ≥ 2 m**.
- A primed canister can take up to ~10–20 s to fire – **never lean over or peer into it**. Wait; if it hasn't fired, approach from the side after a clear pause.
- Wipe spills promptly – vinegar makes floors slippery.

CLEANUP & DISPOSAL

Vinegar and bicarbonate neutralise to a harmless salt solution – rinse residues down the sink with plenty of water and wipe surfaces. Canisters and lids are reusable: rinse and dry.

1 Launch one • 10 MIN

Fire a demo rocket (or let each group fire one to the basic method). Ask: *what just happened?* Draw out the reaction — vinegar (acid) + bicarbonate (base) makes carbon-dioxide gas; pressure builds and pops the lid; gas down, canister up (Newton's third law).

2 Define "best" • 10 MIN

"Who can make the best rocket?" — but *best how?* Push the class to a **measurable dependent variable**: launch height, time in the air, or distance. This is the thing every group will measure.

3 Plan on the variable wheel • 15 MIN

Dependent variable in the centre; all the factors that could affect it around the outside (vinegar volume, bicarbonate amount, canister size, water added, temperature, fin design...). Each group picks **one** factor as its **independent variable** — everything else becomes a **control** to hold constant.

4 Method + results table • 10 MIN

Groups write a **method anyone could follow** and rule up a **results table** (independent variable vs dependent variable, with room for repeats).

5 Investigate & compete • 15 MIN

Run the trials, record results, then hold a **competition** using each group's best settings. Close by asking whose data they'd actually trust — and why.

PROMPT QUESTIONS

- What makes a rocket "the best" — and how will you measure it?
- Which one thing will you change? What must stay the same, and why?
- How will you make your result reliable rather than a fluke?

Basic wheel. Name the dependent variable (centre), list the factors around it, pick one independent variable, and identify what to keep the same. Enough to plan a fair test.

Wheel 2.0 (stretch). Adds rigour: give the dependent variable its **units** and an **end-point** (when you stop measuring); give the independent variable a **range** and units; and for each control variable, state *how* you'll keep it constant and *why* it matters — "the how and the why."

SUPPORT & STRETCH

- **Support:** sentence starters — "I will change... , I will measure... , I will keep the same..."; a part-filled wheel with the dependent variable given.
- **Stretch:** plan repeats and a mean; predict and explain anomalies; justify the chosen range; add a graph of the results.

PAIR IT WITH

- The **interactive companion** (mini-rockets-lab-companion.html) — the reaction, an interactive variable wheel, and an exam-style data question.
- Student **variable-wheel** and **method / results** sheets for the bench.

Original Biology by Bradford teacher guide for a baking-soda & vinegar film-canister rocket practical. Variable-planning wheels and flow-chart method organisers are common science-planning graphic organisers, redrawn here in the Biology by Bradford style.