World Space Week 2026

Theme : Rocket Revolution

BAKING SODA & VINEGAR ROCKET LAUNCH

SUPARCO

SEAD
Space Education & Awareness Drive

World Space Week PAKISTAN

BAKING SODA AND VINEGAR ROCKET LAUNCH

CHALLENGE

Build a lightweight bottle rocket using a plastic bottle, baking soda and vinegar. The chemical reaction produces carbon dioxide (CO_2) gas. As gas pressure builds inside the bottle, it forces the liquid/air mixture out and the bottle moves in the opposite direction.

Design a stable rocket, launch it safely outdoors, and observe how changes in the design or ingredient quantities affect its flight.

MATERIALS NEEDED

You will need:

- Empty plastic PET bottle — 500 mL or 1 L
- Baking soda (sodium bicarbonate)
- Vinegar (acetic acid solution)
- Lightweight cardboard for the nose cone
- Cardboard or lightweight plastic for 3–4 fins
- Adhesive tape
- Scissor
- Measuring spoon/cup
- Safety goggles
- Bottle-rocket launch stand/stomp launcher
- Open outdoor launch area

Keep the rocket **lightweight**. Heavy decorations can reduce its flight height.

STEP-BY-STEP GUIDE

Step 1

Build Your Rocket

- Attach **3 or 4 lightweight fins** evenly around the bottle using tape. Attach a lightweight paper/cardboard nose cone to the **bottom end of the bottle** (the end that will point upward during launch).
- Make sure the fins are equal in size and securely attached.

Step 2

Add Vinegar

- Remove the bottle cap.
- Measure the **teacher-approved amount of vinegar** and carefully pour it into the bottle.
- Do not fill the bottle completely.

Step 3
Prepare the Baking Soda

- Measure the **teacher-approved amount of baking soda**.
- Keep the baking soda separate from the vinegar until you are ready to begin the launch.

Step 4
Add Baking Soda & Seal

- Add the measured baking soda to the bottle.
- **Immediately secure the approved launch stopper/connector according to the launcher manufacturer's instructions.**
- Do **not** hold the bottle in your hands once the reaction has started.

Step 5
Prepare for Launch

- Place the bottle securely on the approved launch stand.
- Check that:
  - The rocket is pointing straight upward.
  - The launch mechanism is properly secured.
  - The launch area is completely clear.
  - Everyone is wearing safety goggles.
  - Students are standing at the designated safe distance.
- Only the teacher/facilitator should operate the launcher.

Step 6
Launch

- Move everyone to the designated safe area.
- The teacher/facilitator activates the launcher.
- As the vinegar and baking soda react, **CO_2 gas is produced and pressure builds inside the bottle**. The pressure forces the rocket away from the launcher.
- **Never approach or touch the rocket during the launch sequence.**

Step 7
Observe

Watch the rocket's flight carefully.
Observe:

- How high it travels
- How far it travels
- Its flight direction
- Whether it remains stable
- Where it lands

Step 8
Measure and Record

After the launch area has been declared safe by the teacher/facilitator, retrieve the rocket. Record:

- Rocket design
- Vinegar quantity
- Baking soda quantity
- Approximate flight height
- Landing distance
- Flight observations

Step 9
Improve and Try Again

Change **one variable at a time**, such as:

- Fin size or shape
- Nose-cone design
- Rocket weight
- Approved ingredient quantities

Make a prediction, test it, record the result, and compare it with your previous launch.

Remember:
Predict → Build → Test → Measure → Record → Improve → Test Again!

Safety rule: This activity should always be conducted **outdoors under the direct supervision of a trained teacher/facilitator**, using an appropriate bottle-rocket launcher and following its operating instructions.

BAKING SODA & VINEGAR ROCKET

STOMP LAUNCH CHALLENGE!

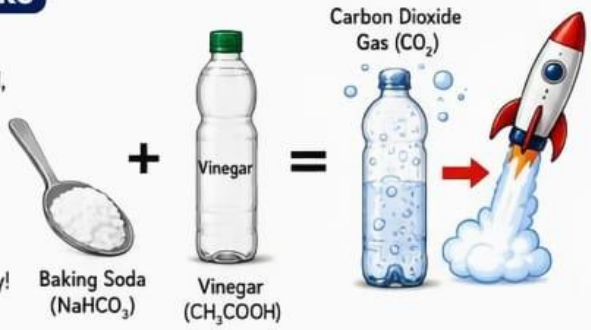
SIMPLE SCIENCE. BIG LAUNCH!

SUPARCO

Use a safe chemical reaction to build and launch your own rocket high into the sky!

HOW IT WORKS

When baking soda and vinegar are mixed, they produce carbon dioxide (CO_2) gas. The gas builds up pressure inside the bottle and pushes the rocket into the sky!



Baking Soda ($NaHCO_3$) + Vinegar (CH_3COOH) = Carbon Dioxide Gas (CO_2)

MATERIALS NEEDED

- Plastic Bottle (500 mL / 1 Litre)
- Baking Soda ($NaHCO_3$)
- Vinegar (CH_3COOH)
- Rocket Nose Cone (Paper / Cardboard)
- Fins (3–4) (Paper / Cardboard)
- Tape
- Scissors
- Measuring Spoon/Cup
- Safety Goggles

* Outdoor Launch Area & Launch Stand

STEP-BY-STEP TUTORIAL

1 BUILD YOUR ROCKET

Attach fins to the bottle using tape. Attach and secure the nose cone. Decorate your rocket!

2 ADD VINEGAR

Pour vinegar into the bottle. Use the amount shown in the chart below.

3 ADD BAKING SODA

Using a measuring spoon, add the baking soda to the bottle. Immediately attach the nose cone.

4 SECURE THE NOSE CONE

Make sure the nose cone is firmly in place and sealed with tape. Do not over-tighten.

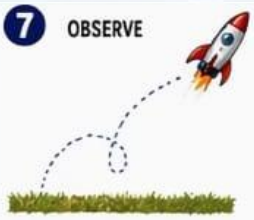
5 PREPARE FOR LAUNCH

Place the rocket on the launch stand. Make sure the area is clear. Everyone must stand at a safe distance.

6 LAUNCH!

Press the launch button (or stomp on the stomp pad). The gas pressure will launch the rocket!

7 OBSERVE



Watch how high and far your rocket goes!

8 MEASURE & RECORD

Measure the height, check the landing spot, and record your results.

9 IMPROVE & TRY AGAIN

Make changes to your design or ingredient amounts and try again to go higher!

THE SCIENCE

Chemical Equation: $NaHCO_3 + CH_3COOH \rightarrow CO_2 + H_2O + CH_3COONa$

TIPS FOR BETTER FLIGHTS

- Use a lightweight rocket.
- Make fins equal in size.
- Keep the rocket straight on the launch stand.
- Use correct amounts of ingredients.
- Launch in a wind-free and open area.

SAFETY FIRST!

- ⚠ Always launch outdoors.
- ⚠ Wear safety goggles.
- ⚠ Wear sturdy shoes.
- ⚠ Do not point at people, animals, or buildings.
- ⚠ Only teacher/facilitator operates the launcher.
- ⚠ Keep a safe distance.

RECORD YOUR RESULTS

Rocket Name: _____

Vinegar Used: _____

Baking Soda Used: _____

Flight Height (approx.): _____

Landing Distance: _____

Notes / Observations:

_____

CHEMICAL REACTION: HOW IT WORKS

1. VINEGAR is added to the bottle.
2. BAKING SODA is added to the vinegar.
3. GAS (CO_2) is produced.
4. PRESSURE builds up inside.
5. THE ROCKET launches into the air!

LAUNCH SETUP (STOMP LAUNCHER)

Press down firmly on the stomp pad to launch!

AMOUNT CHART (Per Launch)

BOTTLE SIZE	VINEGAR AMOUNT	BAKING SODA AMOUNT
500 mL	100 mL	1 level tbsp (≈ 15 g)
1 Litre	200 mL	2 level tbsp (≈ 30 g)
1.5 Litre	300 mL	3 level tbsp (≈ 45 g)
2 Litre	400 mL	4 level tbsp (≈ 60 g)

* 1 tbsp = tablespoon (15 mL)

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