

SMART CHELI

STEM challenge #05 Bottle Rocket



Age: 9-13years

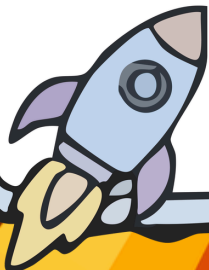
Time: 30-45 min

STEM Areas:

Chemistry + Science + Engineering

Difficulty: ★★☆☆☆

Internet needed: No





Mina loved solving mysteries. She enjoyed searching for hidden clues that others might miss. She often wondered how giant rockets could blast off beyond Earth and disappear into the dark night sky.

One day, her teacher gave the class a challenge. On the table were a water bottle, some vinegar, baking soda, a few pencils, and a rubber stopper.

"Today, you are going to launch your very own rocket," her teacher said.

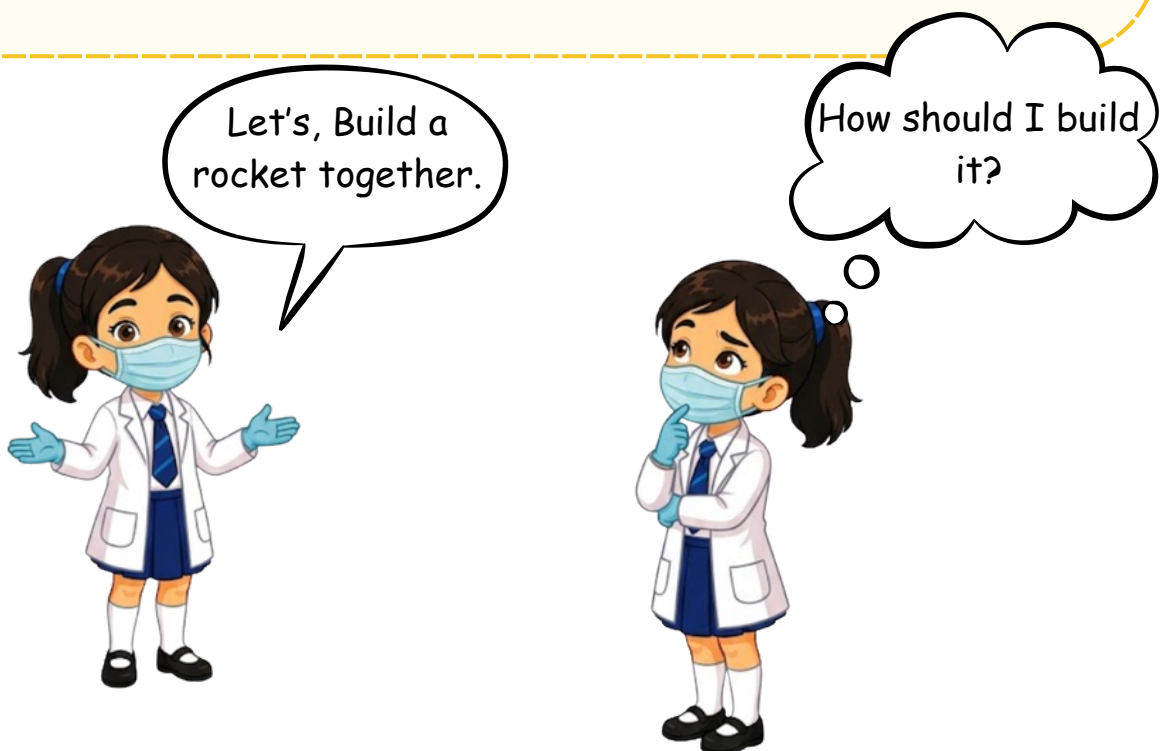
Mina looked puzzled at the materials. "Where is the engine? Where is the rocket fuel? How can these simple materials possibly make a rocket fly?"

Her teacher smiled. "That's the mystery you have to solve."

Mina began searching for the hidden clue. Could these simple materials hold the secret to launching a rocket?

She had one big question:

Can I build a working rocket and launch it using a simple chemical reaction?





1. SPOT THE PROBLEM

What does Riya want her rocket to do?

What materials does Mini have available to solve the problem?

What do you think could create enough force to make the bottle move upward?



1. EXPLORE

Before you Build your bottle rocket, think about the materials.
Look at the baking soda and vinegar.



Engineers make predictions and then test them!



Think about it:

1. Which direction does the air move?
2. Which direction does the balloon move?
3. What happens when something is pushed in one direction?
4. Could a similar idea help a rocket move?



Make your prediction

I think my bottle rocket will move upward because:





2. WHAT YOU'LL NEED



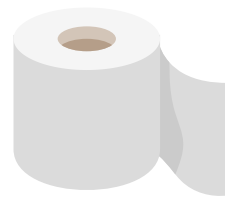
Funnel



Baking soda
2 table spoon



Tablespoon



Tissue



3 pencil
unsharped



water proof tape



Vinegar



500ml Water
bottle



Scissor



This experiment must be done outdoors in a clear, open area with adult supervision.



Look around your home, What everyday materials could you reuse to design your rocket?



3. IMAGINE

Before you start building, become the rocket designer.

What will your lamp look like?



What will you hide?



Think about:

- How will your rocket stand?
- Where will the three rocket legs go?
- How will the bottle stay balanced?
- What will happen when pressure builds inside the bottle?
- Which direction do you think the rocket will move?

I think my rocket will:



4. CREATE

Follow the steps in order. go slowly and watch carefully.

Step 1 — Build the rocket legs

- Tape three pencils around the water bottle using waterproof duct tape.
- Arrange them so they create three legs that allow the bottle to stand upside down.
- Make sure the rocket is stable.



Step 2 — Add the vinegar



- With the help of a funnel, carefully pour vinegar into the bottle.

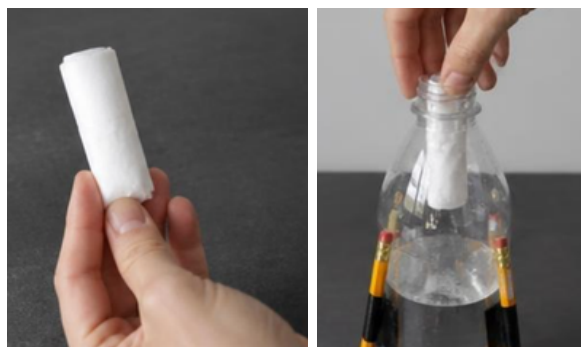
Step 3 — Prepare the baking soda

- Place two tablespoons of baking soda onto a piece of tissue paper.
- Fold and wrap the tissue paper around the baking soda.
- This will delay the reaction until the rocket is ready.





Step 4 — Start the reaction



- Place the folded tissue paper containing the baking soda into the bottle.
- Immediately secure the rubber stopper into the bottle.

Step 5 — Launch!

- Carefully place the bottle rocket in its launch position with the pencil legs supporting it.



SAFETY FIRST

1. Keep your face and body away from the bottle during launch.
2. Never point the bottle toward a person, animal, building, or vehicle.
3. Once the reaction begins, move away from the rocket.
4. Do not hold the bottle during the reaction.
5. Follow your teacher's instructions carefully.



5. TEST IT !



Scientists and engineers don't just build — they
test and observe.

Watch your rocket carefully during the launch.

What happened?

Did your rocket launch?

☐ Yes

☐ No

Did it move upward?

☐ Yes

☐ No

What did you observe?

What surprised you?



Think like an engineer

What could you change in your design to make your rocket more stable?



ANSWER

5. IMPROVE IT!



Engineers rarely stop after the first test.

Think about your rocket.

What could you improve?

- ☐ Make the rocket more stable.
- ☐ Improve the three-leg support.
- ☐ Improve the balance.
- ☐ Change the rocket design.
- ☐ Try a different idea.



My improvement:

I predict:

Now test the Rocket again after the improvements

What happened?



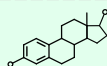


6. WHAT'S THE SCIENCE ?



Acids and Bases

Vinegar contains acetic acid, while baking soda is a base. When they are mixed, they react and produce carbon dioxide gas.



Chemical Reaction

The carbon dioxide gas builds up inside the bottle, creating pressure. When the pressure becomes strong enough, it pushes the stopper out.



Pressure and Thrust



As the gas and materials move downward, the bottle moves upward. This pushing force is called thrust.



Newton's Third Law

This demonstrates Newton's Third Law of Motion:

"For every action, there is an equal and opposite reaction." $\sum \vec{F} = m\vec{a}$

The rocket pushes hot gases downward, and the gases exert an equal and opposite force that pushes the rocket upward.



7. STEM AROUND US

How Real Rockets Work

- A real rocket uses fuel to make hot gases.
- The gases rush down through the bottom of the rocket, pushing the rocket upward.
- Our rocket experiment shows the same basic idea: Fuel → Hot gas → Gas moves down → Rocket moves up
- When fuel burns inside a rocket, it makes hot gas.
- The gas rushes down, and the rocket is pushed up. Our experiment shows this same idea in a simple way.

Rockets are not only used to go to space. They help us explore and learn about Earth and the universe.

- **Explore the Moon and planets** – Rockets send spacecraft to other worlds to study them.
- **Launch satellites** – Rockets carry satellites into space for GPS, communication, weather, and more.
- **Study Earth** – Rockets carry tools that help scientists learn about Earth's atmosphere.
- **Explore space** – Rockets send telescopes and spacecraft to study stars, galaxies, and other objects in space.
- **Carry people and supplies** – Rockets carry astronauts and important equipment into space.

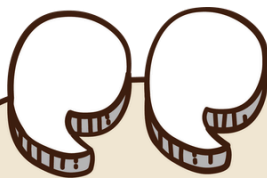




8. My STEM Discovery

One thing I discovered today:

One thing I am proud of:

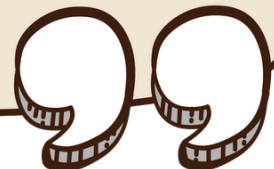


REMEMBER

Mini didn't know how a simple bottle could become a rocket.

She asked a question, made a prediction, tested her idea, watched what happened, and learned from it.

That's what scientists and engineers do—they ask questions, test ideas, and learn from what they discover!



Every time you **imagine, build, test, learn, and try again**, you are thinking like an engineer. Keep exploring!