



# Minds in Motion

## Baking Soda Bottle Rockets

### Activity Rundown:

Put on your spacesuits, it's time to go to space! Well, maybe not all the way into space, but hopefully this homemade rocket fueled by a simple chemical reaction will make it a few dozen feet into the air. With just a few easy-to-find kitchen ingredients and some craft materials you may already have, we'll be airborne in no time!

### You will need:

- + 500mL plastic bottle
- + Scissors
- + Ruler
- + Cork
- + Funnel
- + Paper towels
- + Strong tape (We recommend duct tape!)
- + 3 pencils/markers/ or chopsticks
- + 250mL vinegar
- + 1 tablespoon of baking soda

### Let's do it!

1. With an adult's help, cut a 30 cm piece of duct tape with your scissors.
2. Using this piece of tape, secure the three pencils around the plastic bottle at equal heights. This is going to be used as your rocket's legs, so make sure it stands up straight with the opening facing the bottom!



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*This is how your rocket should be standing once you attach the pencils!*

\*Don't have any "legs" for your rocket? Try making a stand for your rocket using legos, cardboard, or any other materials you have on hand! Just make sure it's strong enough to hold your rocket upright before launch.



*Example of a rocket stand.*

3. Rip a paper towel in half and place a tablespoon of baking soda in it's center. (**Tip:** if your paper towels are thick and layered, try separating into thinner layers.)
4. Carefully fold and wrap the piece of paper towel with the baking soda inside until it's small enough to fit inside the opening of your plastic bottle. It should look like a miniature hotdog!



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5. This part might get messy, so it's time to go outside! We recommend doing this experiment on your driveway or on a big patch of grass.
6. Using a funnel and with an adult's help, slowly fill your bottle rocket about halfway with vinegar.

\*These next parts have to be done quickly, so make sure you read ahead and prepare yourself!

7. Take your piece of folded paper towel containing the baking soda and quickly push it through the opening of your plastic bottle.
8. **Quickly** place the cork snugly into the opening, you don't want any vinegar escaping!
9. Give the plastic bottle a quick couple of shakes and then **quickly** place it with the cork facing downwards on the ground.
10. Take a step back and wait for takeoff!

## Background:

What's happening inside the plastic bottle rocket?

- When you mix vinegar and baking soda, you'll soon see an **acid-base chemical reaction** taking place! The fizzing and bubbling created by mixing the two together is actually the **production of carbon dioxide (CO<sub>2</sub>) gas**.
- The acid (in this case, vinegar) reacts quickly with the base (baking soda) to form two new chemicals: carbonic acid and sodium acetate! Once made, the carbonic acid starts to break apart into water and CO<sub>2</sub> gas.

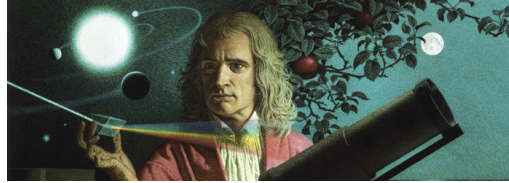
How does the rocket launch?

- As the chemical reaction makes more and more CO<sub>2</sub> gas, the **pressure** inside the bottle starts to increase. With no exit, the gas starts to look for it's easiest exit point: the cork! When the cork can no longer hold in the CO<sub>2</sub> gas, both it and the gas explode out of the rocket sending it flying into the air!
- Because the cork and the contents of the bottle explode downwards, the rocket goes flying upwards due to **Newton's Third Law of Motion!**

"For every action, there is an equal and opposite reaction!"

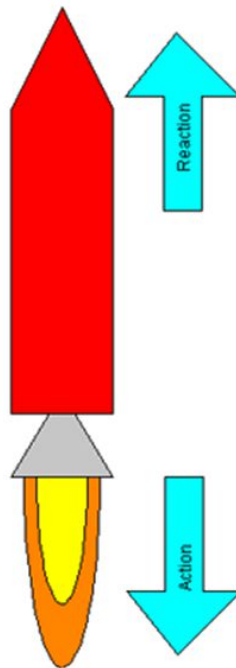


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*Isaac Newton: Pretty cool dude!*

The initial action is the rush of material being forced out of the opening going one way pushing hard against the air behind the bottle. The reaction is the air pushing back with the same amount of force going the other way.



*Newton's Third Law of Motion!*

Want to see how much  $\text{CO}_2$  gas is created? Try standing the bottle upright, with the opening facing the sky. Add in the same amount of vinegar and baking soda, but this time instead of plugging the bottle with a cork, pull a balloon over the opening instead! The balloon should start getting bigger and bigger because it's being filled up with  $\text{CO}_2$  gas.



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\*\*\*CO<sub>2</sub> gas is NOT the same as helium and should NOT be inhaled! Let the balloon deflate in a well ventilated area.\*\*\*

**Tip:** Try filming your rocket takeoff with a smartphone that has the ability to take slow-motion videos! We would love to see your launches.

## **Reach out!**

We would love to hear from you about all the amazing STEM projects you are doing at home! Show us your finished products on any of the following social media platforms by tagging us or by using the following hashtags. We hope these projects have brought some excitement to your day during these difficult times.

Let us know how we did! Please [click here](#) to fill out a short survey on how well we did and what you would like to see more of in the future. Thank you!

Twitter: **@MyMindsInMotion**

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**#ucalgarycamps #ucalgarytogether**