

## Build a Pop Rocket: A Motion Experiment

**Introduction:** Newton's Third Law of Motion states that "for every action there is an equal and opposite reaction." This law explains what happens when two bodies exert forces on each other. Whenever an object pushes another object it gets pushed back in the opposite direction equally hard.

**Objective:** In this simple but fun activity students will explore Newton's Third Law of Motion by examining the motion of a rocket. They will learn how a basic chemical reaction can cause an object to move. This experiment serves as an introduction to understanding how chemical energy can be converted to mechanical energy to put a life-size vehicle in motion.

### Materials:

- Empty 35-mm film canister with a snugly fitting lid
- Alka-Seltzer tablets (or other fizzy antacid tablets)
- Goggles, sunglasses, or other eye protection
- Water
- Paper (optional)



### Safety:

- Students handling the rocket must wear safety glasses at all times.
- NO eating or drinking is allowed during the lab activity.

### Procedure:

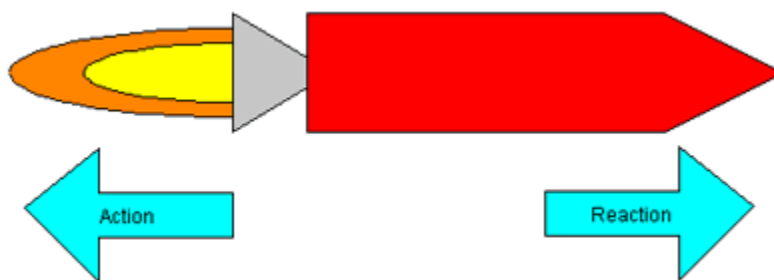
1. Don't try this experiment inside—your rocket will shoot right into the ceiling! Instead, pick a level space outdoors. Don't forget to put on safety glasses or other eye protection.
2. Ideally, your film canister should be one with a cap that fits inside the rim, not over the outside of the rim. This makes the experiment work much better. But whatever kind you've got, open it up and fill it between  $\frac{1}{4}$  and  $\frac{1}{3}$  full of water.
3. This next step needs to happen very quickly (in just a few seconds!) so get your antacid tablet unwrapped and ready. Break it in half and put the film canister lid right next to it.
4. Drop the half tablet into the film canister and quickly snap on the lid. Make sure it's tight. Then place the rocket with the lid down on a level, firm surface.
5. Stand back and watch it rocket to the sky!

### Discussion:

1. What happened inside the canister that caused it to behave the way it did?
2. Describe the motion of the canister or rocket.
3. What is the function of the gases inside the rocket?
4. Using Newton's Third Law of Motion to explain what happens, what is the action and what is the reaction?

Sometimes when you combine two materials (like the Alka-Seltzer and the water) you get a chemical reaction. In this case, a gas is created and lots of bubbles form. Since the bubbles of gas have nowhere to go in order to escape, they push against the sides of the canister, pushing against the lid until there's so much pressure, the lid pops off! The rocket moves upward as the gases are exhausted downward. The escaping gases provide the power that causes the rocket to be launched the opposite way.

Using Isaac Newton's Third Law of Motion we can identify that the rocket's **action** is to push down on the ground with the force of its powerful engines, and the **reaction** is that the ground pushes the rocket upwards with an equal force.



**Extending the experiment:**

Ask students what they think would happen if you tweaked the amount of water you put in the film canister or added more or less antacid tablet. Try adding some paper decorations to the canister, to make it look more like a rocket. Ask them if they think this will weigh it down or cause it to fly differently. Then try it out and see if their predictions are correct!

**Source:** This lab is a modified version of an activity from the website [education.com](http://education.com) that goes by the name "Build a Pop Rocket."