

Water Rockets

Lesson Overview

In this activity, students will design and launch their own water rockets using 2-liter plastic water bottles, fins, and nose cones. By experimenting with the amount of water, pressurization, and angle of launch, students will learn what forces make rockets fly high. This lab introduces students to the engineering design process and key physics ideas: force, mass, stability, and air resistance.

Lesson Objectives

By the end of this lesson, students will be able to:

- Understand that rockets fly because of Newton's 3rd Law (action → reaction).
- Observe how the amount of water (reaction mass) affects flight height.
- Explain physics concepts such as forces, Newton's 3rd Law, and air resistance
- Test how fins, nose cones, and launch angle influence stability and distance.
- Apply the engineering design cycle: build, test, improve.

Vocabulary

1. **Force** – A push or a pull that acts on an object
2. **Thrust** – The force that is used to lift a rocket upwards
3. **Mass** – How heavy something is. More mass = harder to lift = more thrust needed.
4. **Newton's Third Law** – When you push on something, it pushes back. When water is pushed down out of the rocket, it pushes back and lifts the body of the rocket up.
5. **Air Resistance (Drag)** – The air pushing back against the rocket.
6. **Center of Mass (CM)** – The "balance point" of a rocket

Lesson Plan

INTRO AEROSPACE PRESENTATION	Objective: Provide an overview of the build and give students a physical demonstration Presentation: Google Slides ([Slides coming soon]) Topics Covered: Force, Thrust, Mass, Newton's Third Law, Air Resistance/Gravity, and how to optimize for height. Time Needed: ~15 minutes (presentation)+10
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	minutes demonstration
ROCKET BUILD + TESTING	Objective: Students build their own rockets for testing Time Needed: 35-65 minutes Materials (per group of 2–3 students): • 1 empty 2-L plastic soda bottle • Cardstock for fins and nosecone • Masking tape • Clay/Play-Doh (counterbalance) • Water source (for whole class) • Bike pump with gauge (whole class) • Water-rocket launcher w/ stopper valve/trigger • Scissors, markers, materials for decoration (optional) Instructions: 1. Find materials and build nose-cone, fins, and counterweight for rockets. 2. Assemble and present a model to the instructor for testing. 3. Track how high the rocket went (roughly) and whether or not it veered off course. 4. Adjust settings to see if launches improve. Encourage changing only one variable at a time. Lab Sheet: Students will get a worksheet to fill in and put in data from previous launches. ([Lab Sheet coming soon])
REFLECTION	Reflection: • Did you expect the rocket to fly higher or lower? • What amount of water in the rocket was the best, do you know why? • Why did we need to pressurize/pump air

	into the rocket? • How did fins and nose cones help the rocket fly better?
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Instructor Notes:

- **There is a setup to this activity.** Instructors should come with a pre-made rocket ready for use as a model.
- Consider also making pre-cut fins and cones for younger students.
- Bring extra bottles in case of leakage (or duct tape)
- Keep students away from the launcher; an instructor should be doing the pressurization. Use chalk/tape to draw a separation line if necessary
- Have paper towels ready in case of spills.