

**Build an**



**Bottle Rocket**

**(FMA Live! Blast Off Demonstration / Part 3 of 3)**

At last it's time to construct your very own FMA Live! Bottle Rocket—the final step in the series of three activities that teach students Newton's Third Law of Motion: Action/Reaction. With this exercise everything finally comes together scientifically speaking, but also literally speaking because once the countdown begins you and your students will have a blast.

**So get ready for two liters of fun!**



Let's begin...

### **THE OBJECTIVE**

- To construct and launch a bottle rocket (and have a blast)!

### **ACTIVITY DESCRIPTION**

- Students will work in teams to construct simple (but fun) bottle rockets out of plastic 2-liter bottles and other everyday items.

### **SCIENCE STANDARDS COVERED**

- Physical Science: Position and motion of objects
- Science & Technology: Abilities of technological design

### **PROCESS SKILLS INCLUDED**

- Measuring
- Making Models

### **MATHEMATICS STANDARDS COVERED**

- Measurement
- Mathematical Connections
- Geometry & Spatial Sense

### **HOW TO**

You'll want to start this project well ahead of time by first saving a bunch of 2-liter bottles (maybe bringing them in could be extra credit until enough are collected). And, if students work in teams, it will reduce the amount of materials required to start. In addition to the bottles, you will also need to have at least one rocket launch pad (see instructions in FMA Live! Launcher).

Next, it's time to construct the Bottle Rocket. Using low-temperature electric glue guns (available at craft stores) are key as the hotter glue guns will simply melt away all those plastic bottles you and your students worked so hard to collect. You can offer a glue gun to each team or set up glue "stations" in the classroom.

Then, to spice things up a bit, consider giving your students the creative outlet to decorate their rockets and encourage them to gather these supplies ahead of time. This gives their rockets some pizzazz in addition to their whiz-bang! And finally, when the rockets are ready to rock...drum roll...it's launch time! (refer to the FMA Live! Altitude Tracker demo for instructions and tips).



### **IMPORTANT SAFETY NOTES**

And remember, when launching rockets, it's very important for the other teams of students to stand back. So countdowns are key—letting everybody know when to prepare for lift off.

It's also a good idea to discuss launch safety rules with the class including how far back observers should stand, how many people should prepare the rocket for launch, who's responsible for retrieving the rocket, etc. Perhaps this is a quiz each student must pass pre-launch.

### **MUST HAVE MATERIALS**

- 2-liter plastic soft drink bottles
- Low-temperature glue guns
- Poster board
- Tape
- Modeling clay
- Scissors
- Safety glasses
- Launch pad (see *Build an FMA Live! Launch Pad*)

### **EVALUATION**

- Make sure to check out the Bottle Rocket's quality of construction.
- Note how well fins align and attach to the bottle.
- Observe how straight the nose cone is at the top of the rocket.
- If you choose to measure how high the rockets fly, you can compare the altitude the rockets reach based on the design and quality of the construction.

### **FURTHER DISCOVERY**

- Have a night-launch party! Tape chemical light sticks onto your rockets and watch them light up the night sky.
- Conduct "flight testing" experiments by varying the amount of air pressure and water to the rocket before launch. Students can create experimental test procedures and control for variables.
- Challenge rocket teams to invent a parachute that will deploy on the rocket's way back down. Then "race" to see who's is the slowest to float back down to the ground.

## FMA Live! Bottle Rocket

### NEWTON'S LAWS AT WORK

Launching your FMA Live! Bottle Rocket is a great way to see Newton's Three Laws of Motion at work.

- For example, the rocket itself, which is at rest on the launch pad, will remain that way until it is acted upon by an outside force—pumped air (**Law #1: Inertia**).
- The amount of force depends upon how much air you quickly pumped into the rocket (**Law #2: Force=mass x acceleration**). Now, you can actually increase the force (which is more fun) by adding a small amount of water to the rocket. This, in turn, increases the mass the rocket expels (also Law #2).
- Finally, the action of this force (air and water) as it spurts out the nozzle creates an equal and opposite reaction as it shoots the rocket skyward (**Law #3: Action/Reaction**).

### BOTTLE ROCKET CONSTRUCTION INSTRUCTIONS

1. First, wrap and glue poster board around the 2-liter bottle.
2. Then, cut out several fins (choose any shape) and glue them to the tube.
3. Form a nosecone, holding it together with tape or glue.
4. Then, press a ball of modeling clay (2-4 ounces in weight) into the top of the nosecone to stabilize the rocket's weight.
5. Glue or tape nosecone to the upper end of bottle.
6. And finally, dazzle up your rocket a bit with some creative decorating—if it doesn't win points for altitude at least it will win points for attitude 😊.

