

Stomp Rockets

Overview:

In this activity, youth will build paper rockets to be launched by stomping on a 2L soda bottle. Students will explore rocket parts and how the launch angle affects the trajectory of the rocket.

Goals:

- Learn about the parts of a rocket.
- Learn how launch angle affects the trajectory of a rocket.

Time Required: 1-2 hours

Materials:

For each group:

- Stomp Rocket Launcher (resources at the end of lesson)
- Empty 2L Soda Bottles
- Hula hoop, rope or chalk to mark out the target area
- Extra pieces of PVC pipe are helpful for constructing rockets

For each student:

- 1 sheet of paper and 1 sheet of cardstock
- Tape
- Stickers/markers to decorate the rockets
- Worksheets
- Crayons / Color Pencils

This activity will need to be set up in a large open space, preferably outdoors.

Procedure:

Before beginning:

1. Build 1 launcher for every 1-2 groups.
2. Mark off target areas using hula hoops, rope, or chalk.
3. NASA has a great video on building stomp rockets (<https://www.jpl.nasa.gov/edu/teach/activity/stomp-rockets/>). 4-H has a Soda Bottle Rocket Launcher available for purchase on the Shop 4-H Website.

Build your rocket:

1. Tell students, in this activity we will build and test stomp rockets.
2. Review the basic parts of a rocket: body or fuselage, nosecone, fins.
3. Start by placing the PVC at the narrow end of one sheet of regular paper.
4. Roll the entire sheet of paper around the PVC. You want the paper tight, but not too tight. The paper should slide easily on and off the tube.



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5. Use tape to completely seal the seam of the paper closed, be careful not to tape the paper to the PVC pipe. This makes the body or fuselage of the rocket. The body or fuselage holds the fuel for the rocket.
6. Slide the fuselage off the PVC pipe, it should slide off easily.
7. Make a nosecone either by:
 - a. pinching one end of the fuselage, folding it over and taping it to the rocket body *OR*
 - b. cutting out a 3/4 circle (pac man shape) out of the cardstock and rolling it into a cone shape and taping it to the fuselage. Secure the nosecone with plenty of tape to make sure the rocket is airtight
8. Check for leaks in your rocket by blowing through the rocket from the bottom. The nosecone is where the spacecraft or payload rides. This is also where the astronauts ride on human spaceflight missions.
9. Cut fins (of any shape) out of cardstock and attach them to the lower part of the fuselage (opposite the nosecone). Be sure to leave the opening at the bottom clear and free of tape.
10. Color and decorate your rocket so you will be able to identify it!

Ready for launch:

1. The launcher is able to launch the rocket at different angles. Ask students to think about at what angle they want to launch their rocket. The angle at which their rocket is launched will affect its trajectory. Trajectory is the path an object takes when it is moving through the air.
2. Review launch safety. All participants must be behind the launch area before any rockets are launched. Rockets should only be launched when the command is given by the Launch Control Officer (adult-in-charge).
3. Start by setting the launch angle by moving the PVC pipe to the desired angle.
4. Slide the rocket down the launch tube.
5. Make sure the landing zone is clear of people.
6. The Launch Control Officer will give the countdown (3-2-1-Launch)
7. On the command to launch, stomp or jump on the bottle.
8. Wait for the command from the Launch Control Officer before going and retrieving the rocket.
9. To reinflate the bottle, separate the PVC with the bottle taped to it from the rest of the launcher. Wrap your hand around the pipe end to make a loose fist and blow through the opening into the pipe. Lips should NOT touch the PVC pipe. Use your other hand to help flex the bottle back into shape. Bottles should be good for several launches before they need to be replaced.
10. After each launch, have students record results on their data table. Encourage them to think about 1 thing they will change (remember in good experimental design we change one variable and keep everything else the same) and record that on their data table. Some examples of things they might change include: fin design/shape, how they stomp on the bottle (1 foot vs 2 feet), angle of launch, etc.



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11. Once everyone has made 3-5 launches, encourage students to get in their groups and discuss what went well and what didn't work. Students should complete the questions and definitions in their Mission Notebook.
12. As a whole group, discuss students' observations on this activity. Talk about some of the other factors that might have affected their launches (wind, how many times the bottle was used, etc).

Common problems / Additional guidance:

- Having several extra pieces of PVC with the bottles duct taped to the ends will make replacements quicker during launches – these could be the same extra pieces you use in constructing the rockets.
- Demonstrate how to reinflate the bottles – make sure students DO NOT place their mouths directly onto the PVC. If this is a particular concern, have one person in charge of reinflating the bottles.
- Use the Stomp Rocket Protractor to determine the launch angles. Print on cardstock and cut out the partial circle in the lower left corner to fit over the PVC pipe. This protractor only works with the 4-H Soda Bottle Rocket Launcher design.

Resources:

“Educator Guide: Stomp Rockets.” *NASA Jet Propulsion Lab*, NASA, 23 May 2024, www.jpl.nasa.gov/edu/teach/activity/stomp-rockets/.

National 4-H Council. “Rockets to the Rescue Facilitator Guide - 4-H.” *4-H NYSD Rockets to the Rescue*, 2014, 4-h.org/wp-content/uploads/2016/03/4-H-NYSD-Rockets-to-the-Rescue-Facilitator-Guide-BW.pdf.

Shearer, Deborah, and Gregory Vogt. “Foam Rocket.” *NASA*, NASA, 17 May 2023, www.nasa.gov/stem-ed-resources/foam-rocket.html.

Stomp Rocket Launcher Kit / Instructions:

- 4-H Soda Bottle Rocket Launcher Kit available at shop4h.org: <https://shop4h.org/products/soda-bottle-rocket-launcher-kit>
- NASA Stomp Rocket Build Instructions available at: <https://www.jpl.nasa.gov/edu/teach/activity/stomp-rockets/>

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