STEM on Site Summer Program

Create Your Own Foam Rocket

Image Source: Jet Propulsion Laboratory

Recommended for Grade Levels: 3-5

Content Notice

This activity has been put together as a free, open source resource from the Milwaukee School of Engineering STEM team for self-guided, at home learning. Unless otherwise noted, in person or live instruction is not provided and questions should be directed to stem@msoe.edu.

Curriculum has been adapted from Jet Propulsion Laboratory.

Safety Notice

Parents or guardians should review activity materials before students begin the activity. Some activities from MSOE may require cutting, hot gluing, electricity, manipulating sharp objects, and other tasks that may warrant adult supervision. MSOE is not liable or responsible for any injury, property damage, or other incidents that arise from completing these activities at home. If you have questions or concerns about any activities, please contact stem@msoe.edu

Note about this Activity

Welcome to your Build a Foam Rocket Kit! Below you will find a few links to learn a little bit about Newton's Third Law of Motion. We encourage you to watch the videos before starting your project and review the Engineering Design Process worksheet.

This activity has been adapted from NASA's Jet Propulsion Laboratory Curriculum. MSOE has added videos and modifications to adapt this activity to fit the at-home learning models currently being used during the pandemic.

Goals

- Use the Engineering Design Process.
- Describe Newton's Third Law of Motion.
- Understand that the launch angle changes the flight pattern of the rocket.

Learning at Home

While we have tried to select activities that utilize materials you might have around your home or able to procure without too much difficulty, we know that may not be the case for everyone.

One of our favorite parts of engineering is the problem solving and critical thinking skills required, and we encourage you to consider the following question when looking at the materials list for this activity:

If I don't have a certain material, what is the material being used for in this activity? Is there something else I could substitute that serves the same or a similar purpose? How can I modify this activity with what I have at home?

Materials List

Note that items marked with an asterisk (*) are not included in your kit if you ordered one from MSOE

	NAME
	30 cm- long piece of foam pipe insulation (for 1/2" size pipe)
	Rubber Band size 64
	Carboard or foam square approximately 9.5cm x 9.5cm
	String - 70 cm long
	3 Zip ties- 8 inches
	Quadrant pattern print out (Optional- linked in activity directions)
	Tack (*) Optional
	String (*) Optional
	Washer or small weight to tie to string (*) Optional

REQUIRED TOOLS

	Scissors (*)
	Meter Stick (*) Optional
	Tape Measure (*)Optional

Background Knowledge

Newton's Third Law of Motion:

https://youtu.be/MUgFT1hRTE4

Foam Rocket Video:

https://youtu.be/UuywS-7HuV4

The launch of a foam rocket is a good demonstration of Newton's third law of motion. The contraction of the rubber band produces an action force that propels the rocket forward while exerting an opposite and equal force on the launcher.

When the foam rocket is launched at an angle of less than 90 degrees, its path is an arc whose shape is determined by the launch angle. For high launch angles, the arc is steep, and for low angles, it is broad.

Optional worksheet to record data. (linked from original activity)

Constructing a Foam Rocket

1. Using scissors, cut one 30-cm length of pipe foam.

2. Cut four equally spaced slits at one end of the tube. The slits should be about 12 cm long. The fins will be mounted through these slits.

Assembling the Insides of the Rocket

1. Cut a piece of string 70cm long and tie it into a large loop. Be sure to make sure the knot is tied tight!

2. Attach the string to the rubber band by looping a zip tie around them and pulling it tight. (see Foam Rocket video at 1:50) Trim off the excess of the zip tie.

3. Drop the string through the hole in the foam down towards the end with the slits. The zip tie will be inside the rocket. The rubber band will be sticking out at the top.

4. Take a second zip tie and wrap it around nose of the rocket, be sure the rubber band is sticking out a bit and pull it very tight. (see video at 2:25) Trim off the excess zip tie.

5. Cut fin pairs from the foam food tray or stiff cardboard. Refer to the Foam Rocket Video linked above around the 3-minute mark. Both fin pairs should have slits in the middle so that they can slide together as shown in the video.

6. Different fin shapes can be used, like the picture to the right, but they should still slide together.

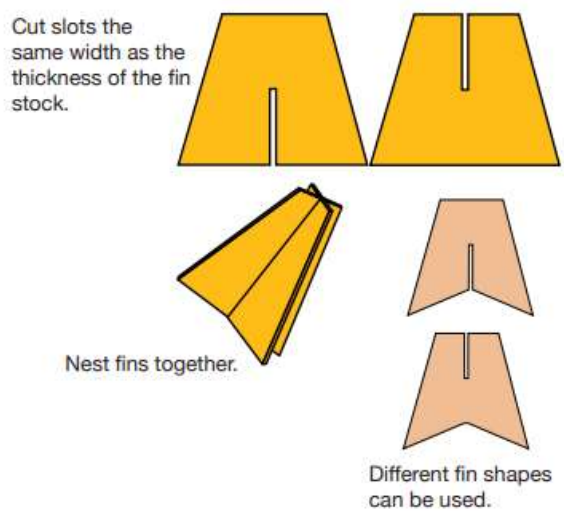

Image Source: **Jet Propulsion Laboratory**

7. Pull the string to the side and slide the fins into the slits cut in the rear end of the rocket. Make sure the string is pulled down and not caught in the fins. Close off the slits with a third zip tie. Wrap the zip tie around the foam tube under the fins and pull tight. The rocket is finished.

Making the Launcher

The Launcher can be a hand and arm. Place the rubber band between thumb and finger and pull the rocket back until the rubber band reaches your elbow each time.

1. Print the quadrant pattern on card stock paper.

2. Cut out the pattern and fold it on the dashed line.

3. Tape the quadrant to the meter stick so that the black dot lies directly over the 60 cm mark on the stick.

4. Press a tack into the black dot.

5. Tie a string to the push tack and hang a small weight, such as a nut or a washer, on the string. The weight should swing freely.

6. Refer to the diagram to see how the launcher is used. (Below)

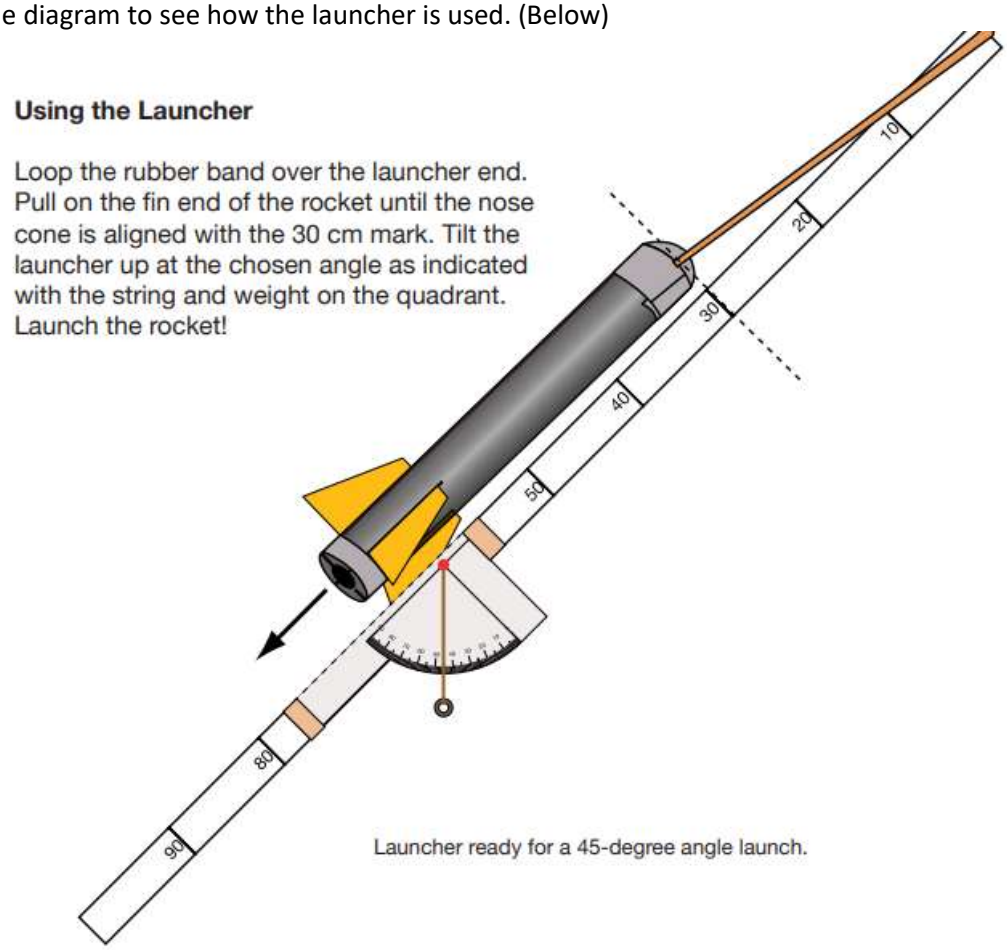

Image Source: **Jet Propulsion Laboratory**

Ready to Launch

1. Find an open area outside.

2. Can you determine the best angle to launch your rocket from in order to achieve the greatest travel distance?

3. If you are using your arm as the launcher start with your arm more extended and then slowly bend your elbow more each time. This will increase the angle and help you determine which angle launches the rocket the farthest.

4. After each launch measure the distance the rocket travels.