deSTEMber
SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH
PRESENTED BY: girlstart

Foam Rockets

How do rockets fly? How do engineers design them to know which direction they will travel? Launch your own rocket to test the best ways to keep it in the air.

TEKS:

SCI 4.6A: The student is expected to differentiate among forms of energy, including mechanical, sound, electrical, light, and thermal.
SCI 4.6D: The student is expected to design a descriptive investigation to explore the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.
SCI 6.8A: The student is expected to compare and contrast potential and kinetic energy.
SCI 6.8B: The student is expected to identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.
SCI 8.6C: The student is expected to investigate and describe applications of Newton's three laws of motion such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

Materials:

Engineering the Rocket:

- Cardstock for fins (template attached)
- Duct tape
- 6-inch piece of polyethylene foam pipe insulation (for 0.5-inch size pipe)
- Rubber band (size 64)
- Scissors

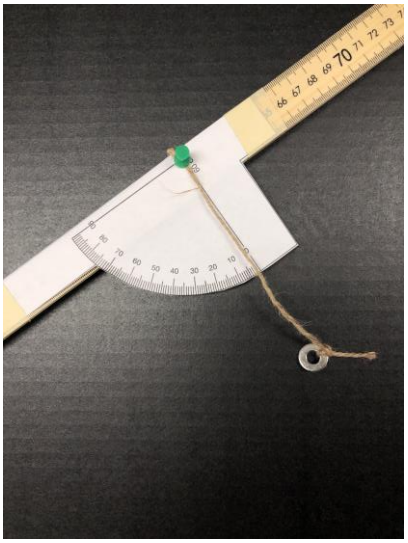
Testing Rocket:

- Cardstock for Launch Quadrant Pattern (attached)
- String
- Tape
- Thumb tack
- Washer
- Yard stick

How To:

Part 1: Creating the Launcher

1. Print the Launch Quadrant Pattern (at the end of the lesson) on cardstock paper.
2. Cut out the pattern and fold it on the dashed line. Lay the fold on the upper edge of the yard stick and wrap the paper around to the other side.
3. Tape the pattern to the yard stick so that the black dot lies directly over the 24-inch mark on the stick.
4. Press a thumb tack into the black dot and into the yard stick. Tie a string around the thumb tack and tie a washer on the opposite end of the string. The washer should swing freely.

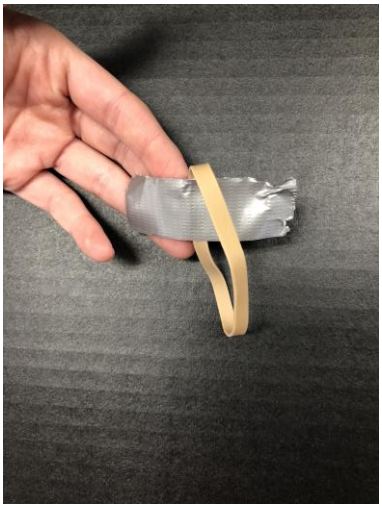


Part 2: Creating the Rocket

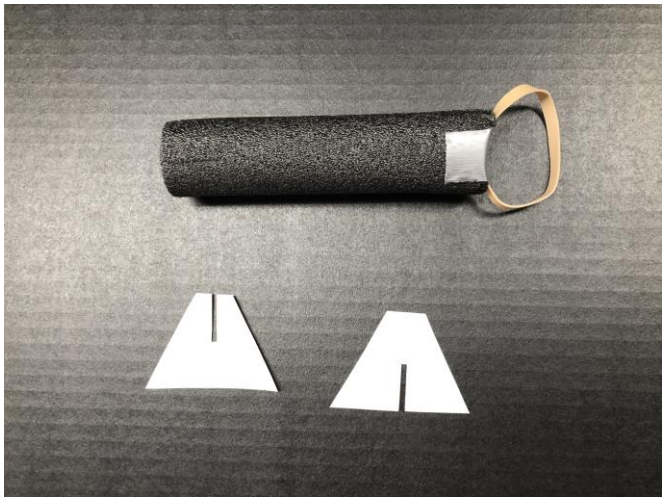
1. Cut four equally spaced slits at one end of the tube. The slits should be about 2.5 inches long. The fins will be mounted through these slits.

2. Cut a piece of duct tape to 2.5 inches in length. Cut the tape down the middle to make two long, skinny pieces. Place one piece over the other, sticky to shiny side, to make the tape double-strong.

3. Slip a rubber band over the tape and position it in the center.

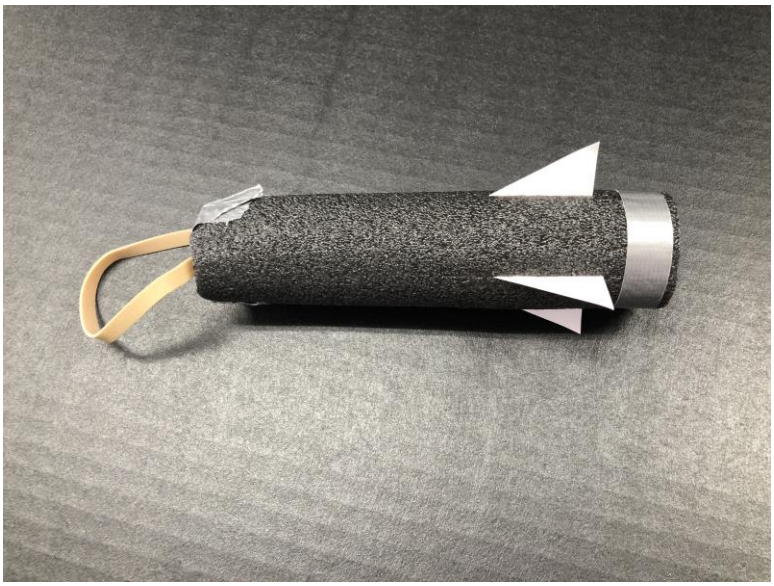


4. Press the tape around the nose end of the rocket (opposite the end with the slits). Reinforce the rubber band with an additional piece of duct tape around the rocket and rubber band.

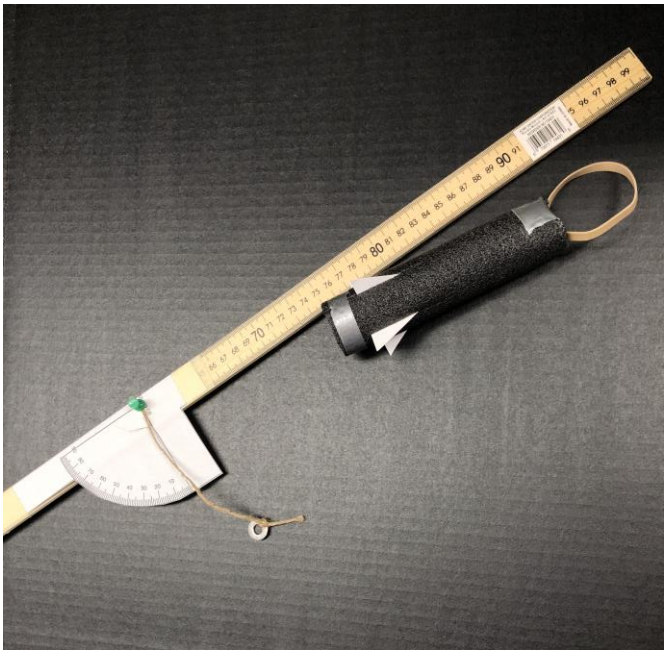


5. Print the *Rocket Fin Template* on cardstock. Cut out the two rocket fins from the template along the outline and dotted lines. Both fins should be notched so that they can slide together, as shown below.
6. Slide fins together.

7. Slide the nested fins into the slits cut in the rear end of the rocket.
8. Close off the slits with a piece of duct tape wrapped around the foam tube below the fins. The rocket is finished!



9. Loop the rubber band over the launcher end (this should be at the 36-inch mark on the yard stick). Pull the fin end of the rocket back until the nose cone is aligned about 12 inches from the end of the yard stick. Choose an angle to launch your rocket from by tilting the launcher until the string with the weight lines up with that angle. For example, if the string falls along the 30° mark on your template, the rocket will launch at a 30° angle from the ground. Test the rocket by launching at different angles to see how far it can fly!



STEM Explanation:

Why don't rockets need wings like airplanes do? Wings make the air move in a way that keep the plane flying, but in space beyond Earth's atmosphere there's no air! Instead, rockets use thrust to keep them flying – the rocket's engines push on the body of the rocket and make it move forward.

The foam rocket receives its entire thrust from the force produced by the elastic rubber band. The rubber band is stretched and when the rocket is released, the rubber band quickly returns to its original length, launching the foam rocket in the process. 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. The rubber band's elasticity builds up potential energy when stretched that converts into the rocket's kinetic energy when launched.

Technically, the foam rocket is a rocket in appearance only. The thrust of real rockets typically continues for several seconds or minutes, causing continuous acceleration, until propellants are exhausted. The foam rocket we created gets a quick pull and then coasts. Nevertheless, the flight of a foam rocket is like that of real rockets. Its motion and course are affected by gravity and by drag or friction with the atmosphere.

Thrust makes our rockets move, but it doesn't control how they move. To keep the rocket's flight pattern stable, it needs fins. The fins, like feathers on an arrow, keep the rocket pointed in the desired direction.

Career Connection:

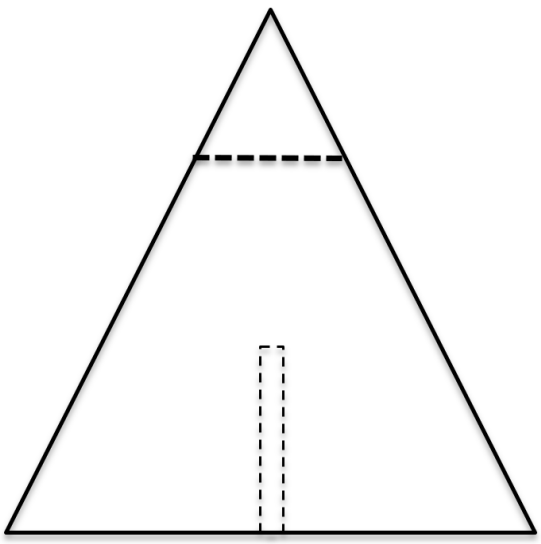
Aerospace engineers are responsible for the design, construction, and application of the science behind the forces and physical properties of aircrafts, rockets, and spacecraft. The field also covers their aerodynamic characteristics and behaviors, airfoil, control surfaces, lift, drag, and other properties.

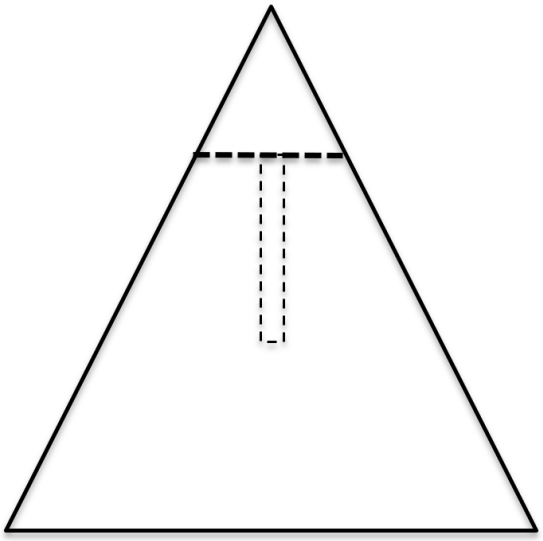
Resource:

https://www.nasa.gov/pdf/295787main_Rockets_Foam_Rocket.pdf

Foam Rocket Fins Template

(actual size)





Launch Quadrant Pattern
(actual size)