

OUTTA THIS WORLD

EXPERIMENT: WATER ROCKET



Your mission to space starts with a rocket launch. Pump air through a water-filled bottle rocket to create enough pressure to push the rocket skyward. Stand back so you don't get soaked on liftoff!

MATERIALS

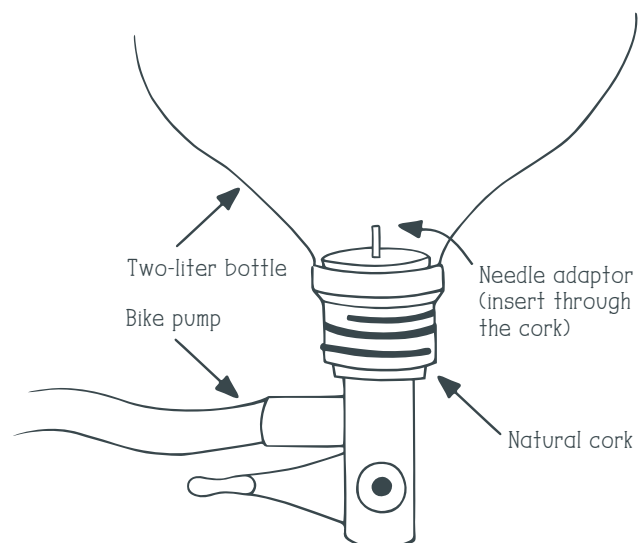
- Two-liter bottle
- Natural bottle cork
- 18-ounce plastic cup
- Tape
- Water
- Scissors or utility knife
- Bike pump with needle adaptor
- Materials to decorate your rocket (paper, cardboard, toy figurine)



INSTRUCTIONS

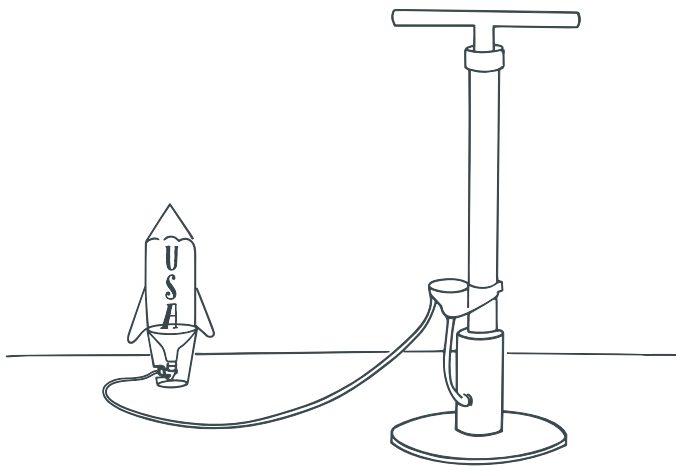
Make sure the cork fits snugly in the bottle opening. Cut the cork in half horizontally – most corks are longer than the bike pump needle, and the needle needs to reach all the way through the cork. Force the needle through the cork and make sure air is able to pass through; you may need to pick some cork bits out of the needle. Attach the needle to the bike pump nozzle.

Prepare your rocket by turning the bottle upside down and removing the label. The bottle opening will be the base of the rocket, so add a paper nose cone to the bottom of the bottle (which will point up) and tape fins to the sides.



Turn the plastic cup into a launch pad by cutting a hole about 2-by-1-inches on one side of the cup near the bottom. The hole should be big enough for the cork and bike pump nozzle to fit through. If the edges of the hole are sharp, cover them with tape. Slide the bike pump nozzle with the cork on it through the hole.

Fill the rocket one-third to one-half full with water (this will be a variable you can change later to see how it effects your rocket). Fit the cork very snugly into the bottle opening. Turn the bottle upside down – it shouldn't leak – and place it onto the cup, with the bike pump tube extending through the hole in the side of the launch pad cup.



To launch, find an open area with no cars, pedestrians or buildings within 50 feet. Pump until the bottle flies into the air and stand back! Make sure no one, including you, is in the the flight path and don't stand over the rocket while you're pumping it.

WHAT'S HAPPENING?

The water rocket demonstrates two basic science concepts: air pressure and Newton's Third Law of Motion. By forcing air into a confined space, you are increasing the air pressure inside the bottle. This happens all the time – when you open a bottle of soda, the “pfffft” you hear is pressurized air escaping. When you force air into the bottle the pressure builds until something has to give. In this case, the cork shoots out of the bottom of the bottle and the pressurized air forces the water out. This causes the bottle rocket to lift off due to Newton's Third Law, which says for every action there is an equal and opposite reaction. The water shooting out of the bottom is the action, and the bottle flying up is the opposite reaction.

GAME ON

Rocket science is pretty complex, and this experiment just covers the basics of getting something off the ground. Try changing some of the variables to see if your rocket flies differently. What happens if you add more or less water to the bottle? What if the fins are a different shape or size? No rocket is complete without a payload. Can you add a compartment so a toy astronaut can take a ride on your rocket?

TIPS

Warning: do not aim the rocket at anyone! The rocket launches with quite a bit of force, so make sure the launch area is clear before pressurizing the rocket. Don't stand over the rocket while pumping it.

MORE WAYS TO PLAY WITH ROCKETS

Experiment with air-powered bottle rockets in MSI's Henry Crown Space Center. Don't miss favorite Space Race artifacts like the Apollo 8 spacecraft and the Apollo 11 training mock-up.

RECOMMENDED READING

“On the Launch Pad”
by Michael Dahl

“Rocketry: Investigate the Science and Technology of Rockets and Ballistics” by Carla Mooney