

GIRL GUIDES, IN YOUR POCKET!



Pop Rockets

Source:

Adapted from the NASA website: <https://spaceplace.nasa.gov/pop-rocket/en/>

Girl Guides Canada site:

<https://www.girlguides.ca/web/Documents/BC/program/ScienceInABoxBooklet.pdf>

(Experiment number 22, page 30)

Scientific American: <https://www.scientificamerican.com/article/bring-science-home-homemade-rockets/>

Video of many, many pop-rockets (**don't try this at home!**):

<https://sciencebob.com/build-a-film-canister-rocket/>

Key concepts

Chemical reactions

Physics

Gravity

Rockets

Thrust

Pressurisation

Introduction

Have you ever seen fireworks, toy rockets or a real rocket launch into the air? It can be an amazing thing to witness and it's so exciting to watch something lift off against Earth's gravity. The force required to launch a spacecraft comes from a chemical reaction in its rockets. This means that every time you see a spacecraft launch, you're watching chemistry at work. We're going to use things you'll find around your house to make your own rocket and experiment with your ingredients to get the best lift off!

Background

How does a spacecraft lift off and get into space? It has rocket engines that propel it. The rockets depend on combustion to provide the thrust the spacecraft needs to overcome the force of gravity and climb into orbit. Combustion is a fast, exothermic chemical reaction between a fuel (for example, jet fuel) and an oxidizer (such as oxygen) in which the fuel burns and heat is produced. Usually the fuel is an organic compound (containing hydrogen and carbon, and sometimes metal and/or other components). During the chemical reaction, new compounds are made. These are referred to as the exhaust. The rockets push the hot exhaust out from the bottom at high pressure and thus the spacecraft is thrust upward.

In this activity instead of using rocket fuel you will use baking soda (sodium bicarbonate) and vinegar (acetic acid) to make a different kind of chemical reaction that can launch a small-scale rocket made from a film canister. The reaction produces water and carbon dioxide (which will appear as bubbles). You'll take advantage of the pressure the carbon dioxide gas makes in the capped film canister to launch your rocket.

Important Safety Note:

We recommend doing this activity outside with adult supervision and eye protection, away from windows or cars. Do not aim your rocket at another person.

Equipment:

An effervescent (fizzing) antacid tablet (e.g.: Alka-Seltzer)

Film canister or empty M&M mini container (you get to eat the M&M!)

Water

Eye protection (glasses, sunglasses, safety goggles, or swimming goggles)

Scissors

Blu-tack

Optional:

Vinegar, bicarb soda, A4 paper, coloured pens or pencils, sticky tape.

Making the rocket

1. Take your equipment outside.
2. You can use a film canister or an M&M mini container. If you're using an M&M mini container, open it, pour out the M&Ms, and cut the piece of plastic between the lid and the container to separate the lid. You can eat the M&Ms.
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3. Stick a small piece of blu-tack to the inside of the lid of your container.
4. Gently press the antacid tablet onto the blu-tack inside the lid. It doesn't matter if it breaks.
5. Slowly pour water into the container until it is one-third full. Don't put the lid on yet!
6. Put on your goggles.
7. Put the lid onto the container and find a good launch area such as your driveway or a flat area on your lawn.
8. Then quickly, turn the container upside down, put it on the ground, and stand back to watch your rocket blast off!

Did your rocket work?

How far did it go?

There should still be some of the tablet left in your container lid, so you can blast-off again if you want to! Just add some water and continue from step 5.

Extension:

Experiment with the tablet. Do you get the same blast from $\frac{1}{2}$ of a tablet? $\frac{1}{4}$ of a tablet? What about using a little more or a little less water?

Try a different fuel

1. Instead of using an effervescent tablet, rinse your container and take the blu-tack and tablet out of the lid and wipe it clean.
2. Put 2 teaspoons of baking soda into a small bowl and add $\frac{1}{4}$ water. Use your fingers to mix it into a paste.
3. Fill the inside of the lid with the paste and pack it in firmly. Hold the lid right-side up – does the paste stay in place? If not tip it back into the bowl and add a tiny bit more water then try again.
4. Slowly add vinegar to the container 1 tablespoon at a time until it's almost full.
5. Take the container and the lid to the launch pad and put on your goggles.

6. Quickly: put the lid on the container, turn it upside down, put it on the launch pad and stand well back to watch your rocket launch!

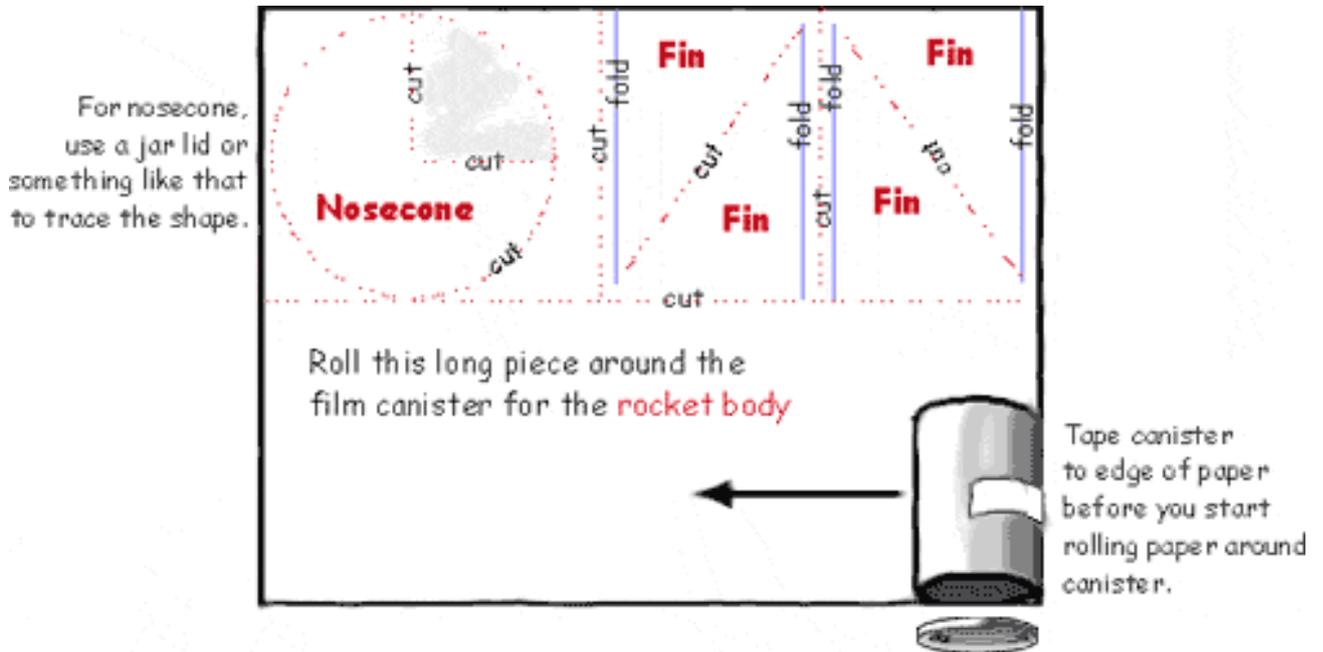
How did this compare to the tablet? Higher, further, louder, messier?

Experiment with this recipe:

Change the amount of baking soda or the amount of vinegar. How does this affect the launch?

You can also decorate your rocket!

Use the template below to design a nosecone, body, and fins.



CREATED BY GIRLS, FOR GIRLS

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