

Water Bottle Rocket

GOAL: To allow Guides to learn how a rocket actually flies and to learn about Newton's Third Law of Motion and how it affects our lives.

PROGRAM AREAS COVERED: BEYOND YOU

MATERIALS REQUIRED:

- Sheets of coloured construction paper or cardboard
- Scissors
- Duct tape
- 2L Pop Bottle
- Bike pump or air compressor with basketball needle end
- Rubber stopper (that fits the mouth of the bottle)
- Water
- Launch Stand
- Stickers
- Markers

TIPS:

Collect pop bottles a week or two before hand to make sure everyone has a bottle.

Bring extra bottles in case some girls forget theirs.

It is best to do project in daylight and in warm weather.

Be prepared to get wet as the rocket takes off.

It's a good idea to practice launching the rocket beforehand.

If you have a big group more launch stations may be required.

PREPARATION TIME:

15-20 minutes to cut out fins and decorate rocket

5 minutes per girl to launch the rocket

Opening

Enjoy your usual Opening then ask everyone if they know who Isaac Newton is and what he's famous for. The most common answer is that he discovered the Universal Law of Gravitation when he got hit on the head by an apple that fell out of a tree. But for this activity we want to focus on his Third Law of Motion that states, "To every action there is always an equal and opposite reaction: or the forces of two bodies on each other are always equal and are directed in opposite directions."

Now ask if they know what makes a rocket fly. The answer to this is that a rocket carries oxygen and a combustible fuel that, when mixed, causes exhaust to shoot out of the bottom of the rocket which propels the rocket itself upwards. It's hard to get the picture with words so it's time to become master engineers to build their own rockets!

Activity

“Building a Rocket”

Give each group a 2L pop bottle, some tape, stickers, markers, coloured construction paper and scissors. Either show them how to cut out fins for the rocket or have the designs pre-drawn on the construction paper and allow them to cut it out. (Cut out a right angle triangle with a folded rectangle piece on the ninety degree side to attach to the rocket.)

Allow the kids to decorate the bottle and fins as they want.

NOTE: Fins help stabilize the bottle during flight, but any other projections or skirting could make the flight pattern unpredictable.

“Launching your Rocket”

ALLOW 5 MINUTES TO LAUNCH ONE ROCKET.

Before you go to launch the rockets you should have your launch stand set up and test fired at least once so you know the general path your rocket will take and where your rocket will end up. Make sure there are no obstacles around that the bottle could rebound off of or crash into.

The stand is made out of a cylindrical piece of plastic or PBC pipe. It should be four inches long and be three inches in diameter. The top end needs to be open so it can hold your rocket upright. Cut a square out of one side of the bottom of the pipe so that your bike pump hose can fit.

Ask the girls if they know how a rocket flies. If they don't then explain that a rocket carries oxygen and a combustible fuel that, when mixed, causes exhaust to shoot out of the bottom of the rocket which propels the rocket itself upwards, Newton's Third Law of Motion.

Then go on to explain how the water bottle rocket works using the same Law. Water goes into the bottle then it gets pressurized by air. When the pressure builds up the air forces the water out of the bottle, like the exhaust in a rocket, which propels the bottle up into the air.

Now it's time to show them what you mean. Pour water into the bottle until it is 1/3 full. Fit the stopper snugly into the bottle. It should be hard to get the stopper in, that way no air can leak from the rocket. Then put the basketball air needle through the stopper.



Rocket stand with hole made out of a cylindrical piece of plastic or PBC pipe about 4" long and 3" in diameter.



Insert bike pump nozzle through stand as shown.



Bottle rocket shown made out of a regular pop bottle. Rocket can also have fins or a cone nose.



Put the bottle rocket in upside down and make sure to point it away from you, your friends, or any other obstacle.

Next fit the rocket onto the stand and point the rocket into the direction you want it to go. Take a few steps back and make sure no one is standing too close or in the rocket's flight path. Start slowly pumping air into the bottle. When enough pressure is in the bottle it will launch on its own.

Discussion

Ask your rocketeers if there are any other ways in which they have seen Newton's Third Law of Motion. An example might be two people pushing each other away while they are on ice.

Campfire

Sing songs about rockets or space.

Closing

Congratulate them on becoming fine rocketeers!

Enjoy your regular Closing. Don't forget to sing "Taps".

