

Water Rockets

Visitors will experiment with Newton's 3rd law by building a water rocket from a 2 liter soda bottle.

- Thrust
- Pressure
- Newton's Third Law
- Drag
- $F = ma$

Time: 10 – 20 minutes

Ages: 4 and up (with a parent) (Grades K – 6)

Staff : Supervision required, at least 1 adult volunteer.

Safety issues/special notes: Launching needs to be done outside. The rockets can go 30 or 40 feet high with quite a bit of force. Users should wear safety goggles. Observers should be kept at a safe distance (At least 2 m or 6 ft.) and reminded to watch out for the falling rocket!

Materials:

- Empty coffee can (no lid) or bucket
- Bike pump
- 2 liter soda bottle (one for each visitor or rocket maker)
- Duct tape
- Paper
- Markers
- Scissors
- Optional for parachutes:
 - String
 - Plastic grocery bags

Preparation:

1. Rockets can be made inside and launched outside or a separate assembly table can be set up outside near the launch sight.
2. Choose a launch site that is far enough away from buildings or areas where visitors may be walking in order to avoid the rocket hitting someone or something on the way down.
3. Set up the launcher tubing and bike pump as shown.



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Water Rockets continued...

Procedure:

1. The soda bottle is the basic rocket and can be used as is or the visitor can decorate it or add a parachute.
2. A sheet of paper can be taped around the bottle and decorated. The paper is likely to get wet so you may want to use clear packing tape to seal it.
3. You may also use colored duct tape on the outside of the bottle to make stripes or some other pattern.
4. Shirt board may be used to cut out side fins that can be attached with duct tape and colored.
5. **To make a parachute:**
 - a. Cut a circle from a plastic grocery bag (the diameter should be at least 30.5 cm, or 12"). Visitors could experiment with different shape and sizes for their chutes.
 - b. Punch at least 4, evenly spaced holes around the perimeter of the circle.
 - c. Cut 4 lengths of string (about 46 cm, or 18" long)
 - d. Tie one piece of string through each hole (the string could also be taped on with a small piece of duct tape)
 - e. The heaviest part of the rocket is the neck. This end will descend first. Attach the strings of the chute to the bottle using duct tape, making sure to orient the base of the soda bottle as the top of the rocket.
6. **To Launch:**
 - a. Fill the bottle about 2/3 full with water.
 - b. Place the neck of the bottle inside the coffee can.
 - c. If the rocket has a parachute attached, fold it on top of the rocket before launch.
 - d. Pump air into the tube until the rocket launches.

Questions to Think About:

What effect does varying the amount of water in the rocket have? Try it. What are some ways you could measure how high the rocket flies? What are some of the factors that affect the rocket's ability to go faster or higher? What slows it down?

Science Content:

Jet airplanes and rockets use the principle of Newton's 3rd Law for propulsion. This law states that for every action or force there is an equal and opposite reaction or force. In a jet engine, air comes in the front of the engine. The air is compressed and pulled into the combustion chamber. Fuel in the combustion chamber is burned to produce highly pressurized gasses. These hot gasses are pushed out through the engines exhaust. The backward force of the gasses being expelled through the exhaust results in an equal but opposite push forward. This push propels the plane forward. Rocket engines carry their own oxygen in space.

Related activities:

- *Balloon Rockets, Combustion Engine Demonstration, Mini-hovercraft*
- Place a small wad of paper just inside the neck of an empty bottle. Try blowing the paper into the bottle. It flies out because air pressure forces air out of the bottle.