

Build your own Rocket

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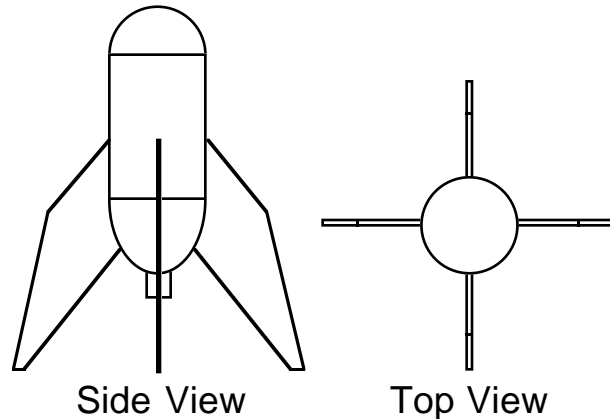
The principle of action-reaction (Newton's Third Law) can be dramatically demonstrated using an empty 2-liter bottle and an air pump.

Materials:

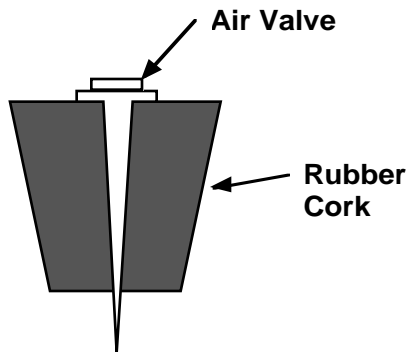
- Empty 2-liter plastic bottle
- Sheet of foam-core board
- Size 3 solid rubber cork (available from science supply houses or chemistry labs)
- Manual air pump (the kind you pump with your foot is best)
- Air valve (or inflating needle, the kind you use to inflate a basketball or football)
- Scissors or a sharp hobby knife
- Hammer and a large nail
- Tape (duct tape works best of course!)

Use the template provided to trace out the shape of a fin on the foam-core board. Cut the fin out with the knife. Do this four times. Use the tape to attach the fins to the bottle as shown in the diagram. The rocket itself is now ready.

I like to use foam core board for the fins. you can find it at any art supply store. You will need a nice sharp hobby knife to cut the foam core.



Use the hammer to drive a nail through the rubber cork and remove it. Next, carefully shove the valve through the hole made by the nail. It will be tight. This is necessary so that the air can't escape from the rocket through the hole. Attach the air pump to the valve.



Fill the bottle about 1/3 full of water. Shove the cork into the bottle opening. You want it nice and tight. Turn the rocket over and stand it up on its fins. You are now ready to launch.

Operate the pump. You will notice the air bubbling up through the water. Keep pumping more and more air into the rocket. You are building up pressure inside so that eventually the cork will be forced out of the bottle. When this happens, the water will be violently forced out by the air inside and the rocket will launch. You will not be able to do a countdown, since there is no way of telling exactly when the rocket will launch. The tighter you shove the cork in, the longer you will have to pump. However, a tighter cork will make the rocket go higher when it eventually does

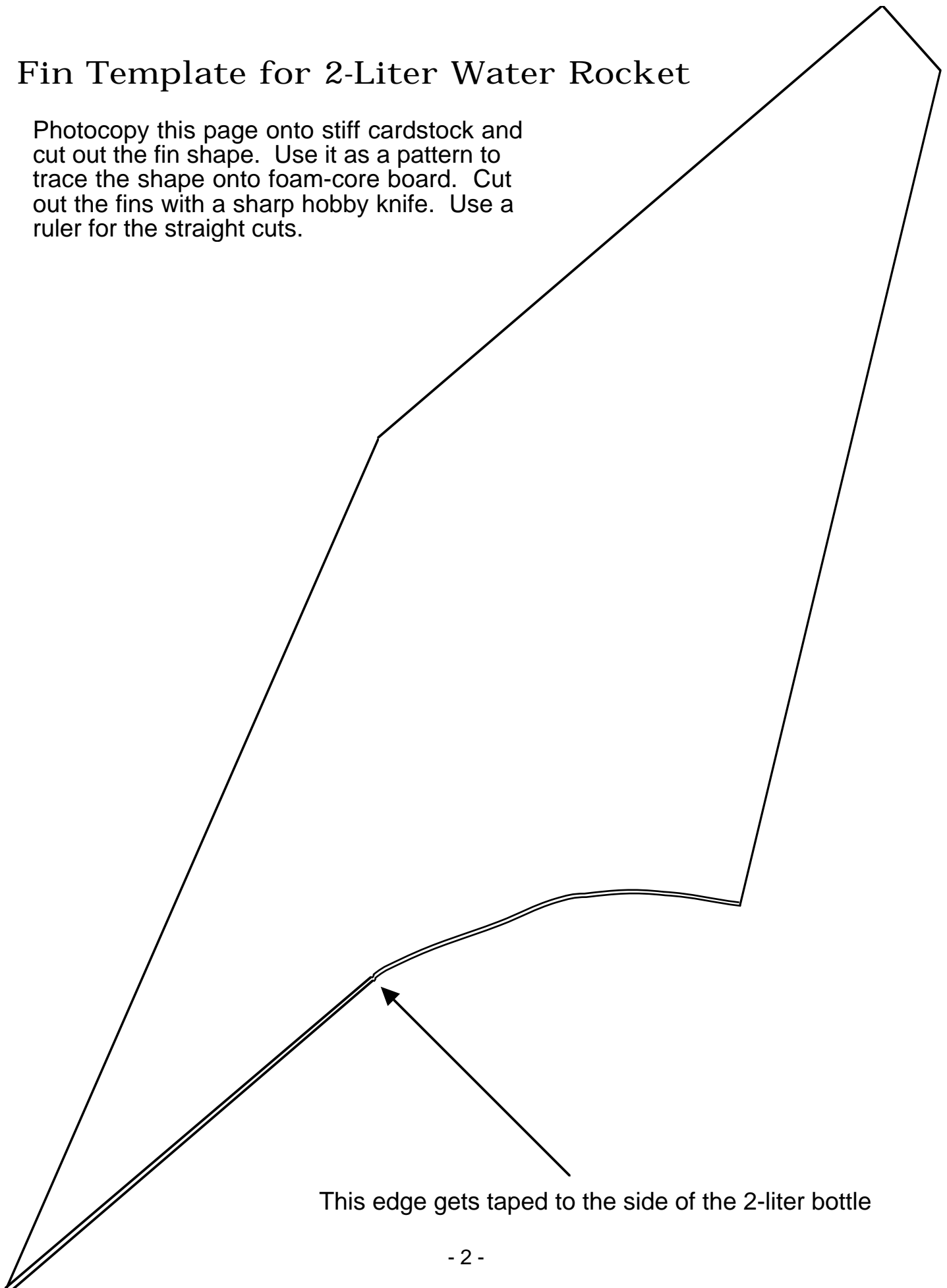
launch, because the higher air pressure will cause the water to come out much faster.

This is Newton's Third Law at work: For every action, there is an equal and opposite reaction. In this case, the action is the rocket pushing the water down and out. The reaction is the water pushing the rocket up. Stress to the students that this is exactly the same principal used to to launch NASA rockets. Thus, your water rocket is very much a "real" rocket.

To increase the stability of your rocket (making it fly straighter), tape two or three quarters to the top of the rocket (which is the bottom of the bottle). This moves the center of mass higher above the center of pressure (which is back where the fins are). Try it! It really works!

Fin Template for 2-Liter Water Rocket

Photocopy this page onto stiff cardstock and cut out the fin shape. Use it as a pattern to trace the shape onto foam-core board. Cut out the fins with a sharp hobby knife. Use a ruler for the straight cuts.



This edge gets taped to the side of the 2-liter bottle