

WATER ROCKET

Five ...four ...three ...two ...one ...blastoff! You can make a powerful rocket that shoots up into the air at high speed, without using a drop of rocket fuel! This rocket uses air, water, and muscle power to launch a plastic bottle high into the air. Your rocket won't quite reach the stars, but you'll be impressed at how fast and high it can go. So gather what you need and prepare for liftoff.

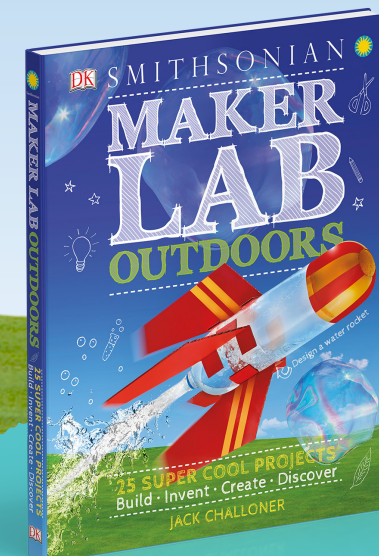
The rocket's fins help it keep stable in the air.

A tennis ball is hidden in here to add weight to the nose of the rocket.

Why not decorate your rocket with stripes or patterns?

BLASTOFF!

To make your rocket work, you have to pump air into the bottle with a bicycle pump. As you pump, the air pressure builds, until eventually the cork blasts out of the bottle's opening and the water is forced out. As the water rushes out, the bottle rises up at high speed.




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HOW TO MAKE A WATER ROCKET

The sky's the limit with this experiment, which uses air pressure to launch your very own water rocket. Two plastic bottles make the rocket—one for the rocket's body and another to make the nose cone at the top of the rocket. This experiment is a bit tricky, but no one said rocket science was easy!



Time
1 hour



Difficulty
Hard

WHAT YOU NEED



1 With the marker, make a mark 4 in (10 cm) down from the cap of one plastic bottle.



2 Wrap the sheet of card stock around the bottle where you marked it, and draw a straight line around the bottle.



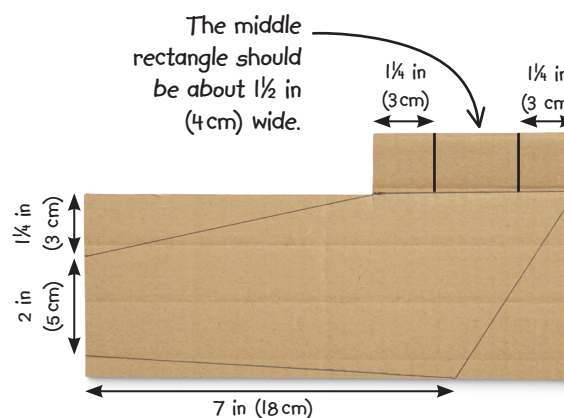
3 Cut all the way along the line you've drawn. Be careful, and if you have any trouble, ask an adult for help.



4 Ask an adult to cut off the very top of the bottle, making sure the hole is smaller than the tennis ball.



6 Paint the tennis ball. Only part of the ball will show, so you only have to paint half of it.



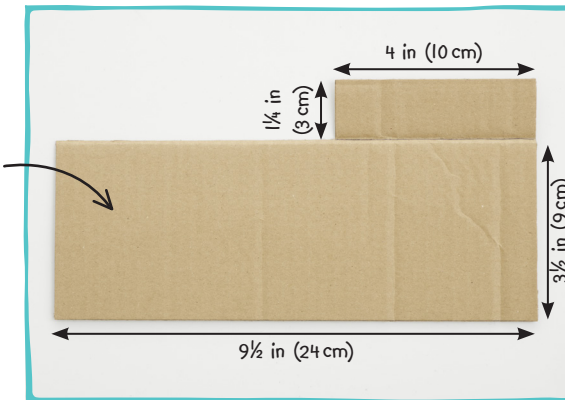
8 Draw the shape of a fin on the large rectangle, like the one shown here. Draw two dotted lines on the small rectangle, 1/4 in (3 cm) in from each side.



Painting the inside of the nose cone creates a shiny effect on the outside.

5 Paint the inside of the round shape you have made. Your nose cone is almost complete.

You can find a template for the fins at the back of the book.



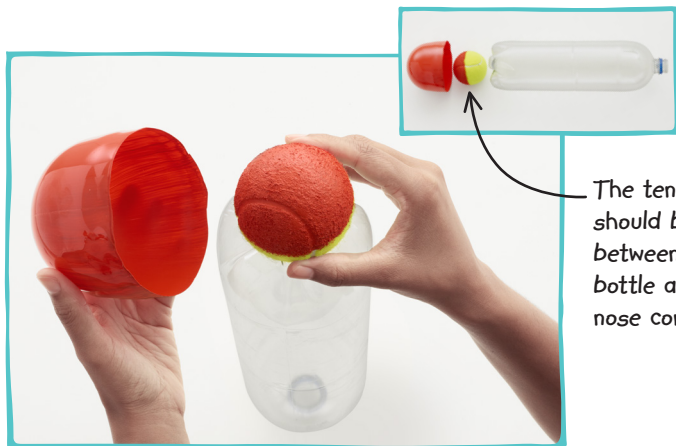
7 Draw two rectangles on cardboard, one on top of the other. Make one 4 in (10 cm) by 1/4 in (3 cm) and the other 9 1/2 in (24 cm) by 3/2 in (9 cm). Cut along the lines so you end up with a shape like this.

9 Cut out the fin and then along the dotted lines to create three separate tabs.



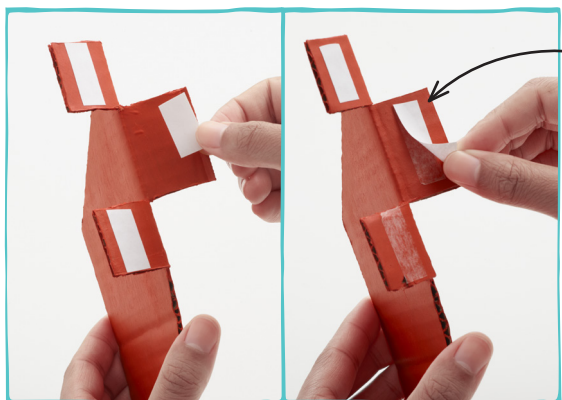


10 Make three more fins. Use the first one as a template to make sure all your fins are the same shape and size.



The tennis ball should be placed between the large bottle and the nose cone.

12 Balance the tennis ball on the flat end of the second large, plastic bottle, and place the painted cone on top, making sure that the ball lines up with the hole in the top of the cone.



Peel away the protective strip.

14 Fold the fins' top and bottom tabs to the left, and the middle tab to the right. Apply double-sided tape to the underside of each tab.



11 Paint all four fins on both sides and let them dry. This design is red, but you could decorate your rocket however you like.



13 Use colored tape to secure the nose cone in place. Make sure you attach it firmly—you don't want it to fall off in midflight!



15 Stick the fins low down on the rocket, so that they extend well beyond the neck of the bottle.

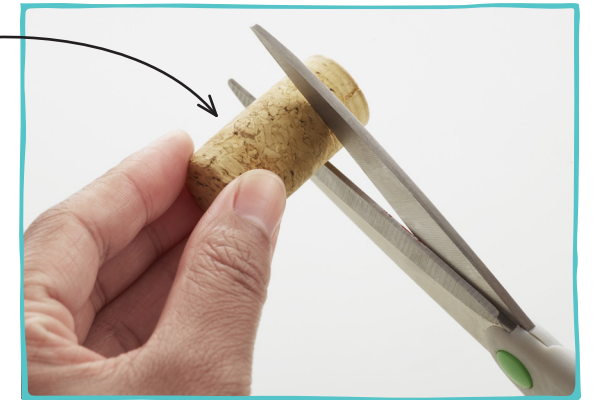
The tennis ball in the nose helps keep the rocket stable in flight.



The fins are really important if you want your rocket to fly straight up, so make sure they are secure.

16 Make sure the bottom of each fin lines up with the others, so that the rocket can stand up straight. Your rocket should now look something like this.

The cork should be cut just slightly shorter than the length of the valve.



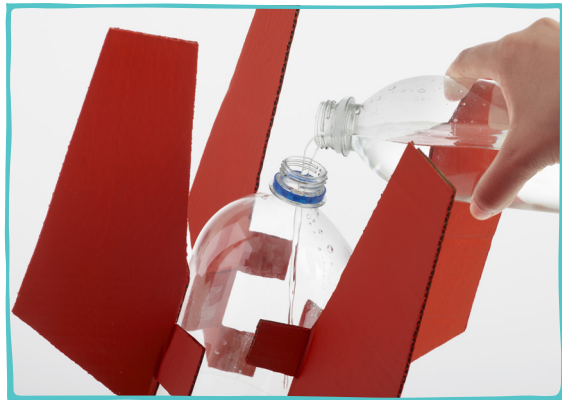
17 Check that your cork fits in the opening of your bottle, and then ask an adult to help you cut a quarter off at the thinner end.



18 Push the valve into the middle of the wide end of the cork until it pokes out the other side. Put a piece of adhesive putty on one end so you don't damage the table.



19 Screw the valve into the foot pump. This is how you'll pump air into the rocket.



20 Turn the rocket upside down and use the small bottle to pour in about 2 cups (500 ml) of water. Your rocket should be about one-quarter full.



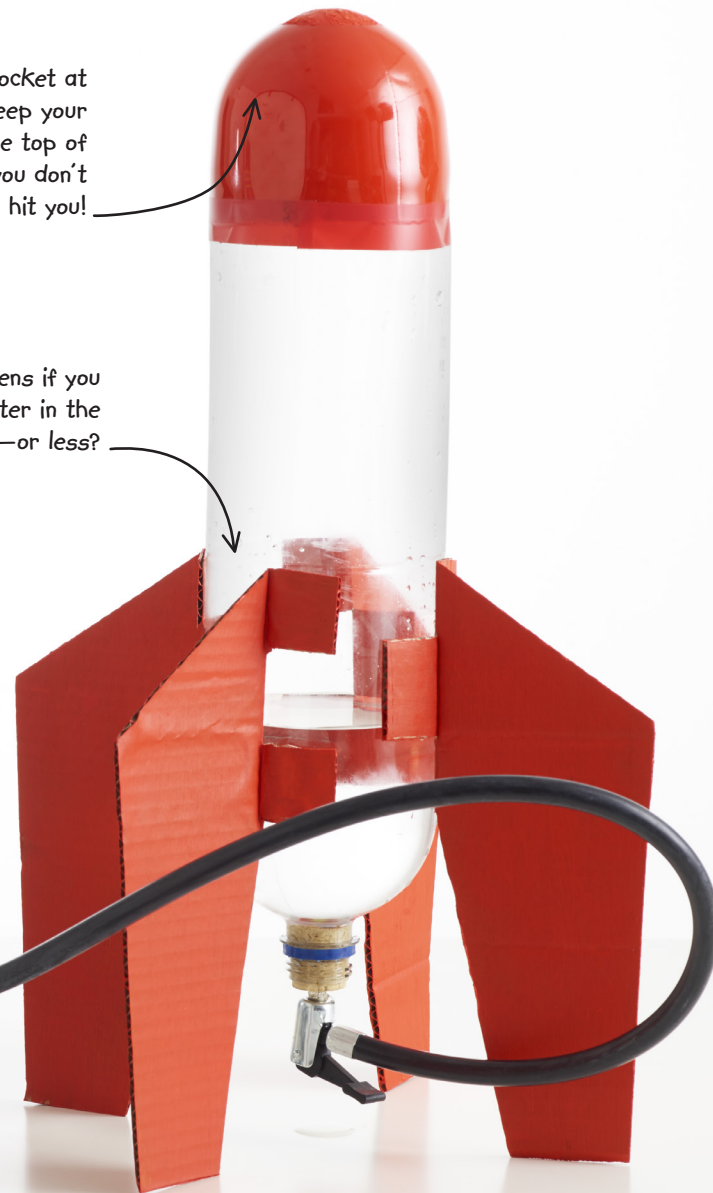
21 Push the cork firmly into the upturned rocket, being careful not to bend the fins. You are almost ready for launch!

22 Stand the rocket on its fins on level ground and, without knocking the bottle over, begin pumping. Keep going until the rocket blasts off.

Don't point your rocket at friends and keep your head clear of the top of the rocket—you don't want it to hit you!

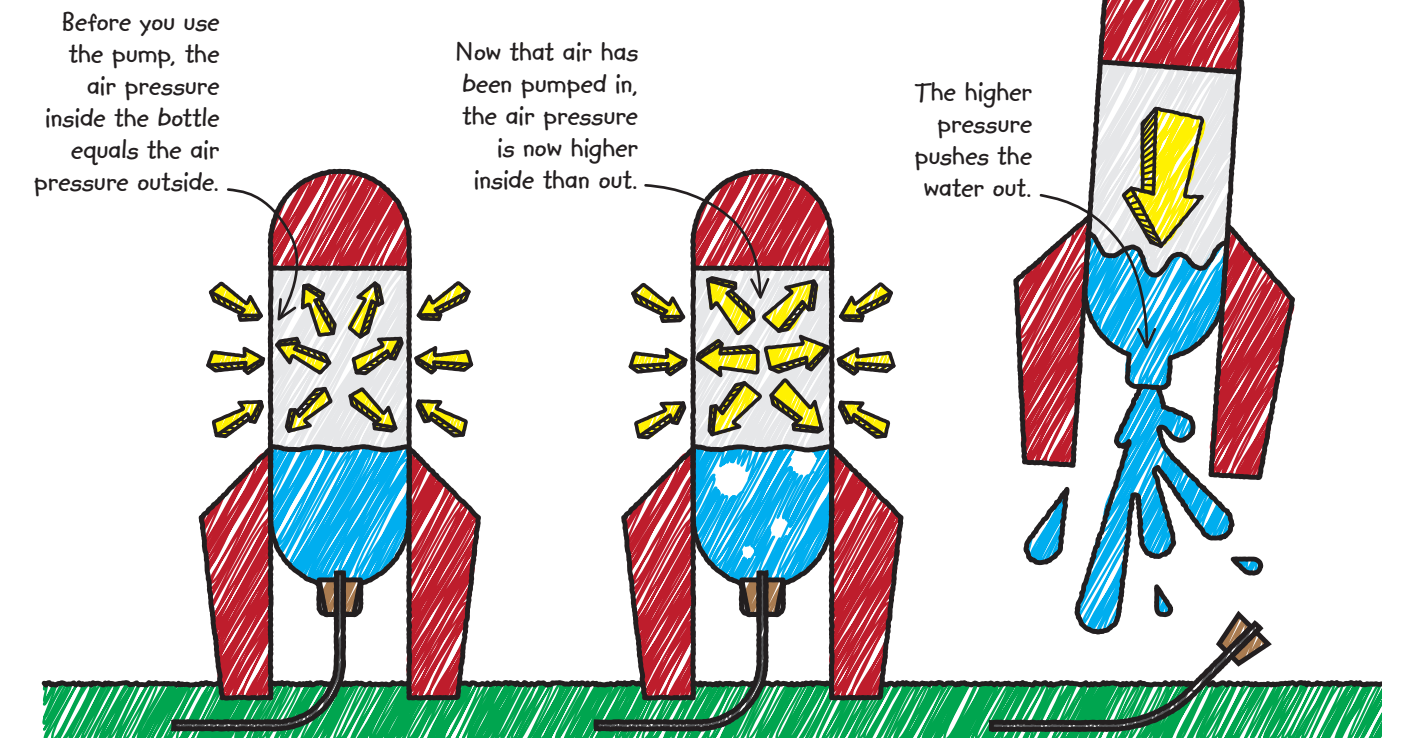
What happens if you put more water in the bottle—or less?

If you don't have a foot pump, a hand pump will work, too.



HOW IT WORKS

Forces always work in pairs. For instance, when you row a boat with a pair of oars, the force of the oars pushing the water creates an opposite force that pushes the oars, and so the boat, forward. This opposite force, called a reaction force, is what makes rockets fly. When you pump air into your rocket, the air pressure inside builds up until it pushes out the cork and then the water with a powerful force. This downward force creates an upward reaction force that launches the rocket. Once all the water has gone and the pressure inside the bottle is back to normal, the forces disappear and your rocket will fall to Earth.



REAL-WORLD SCIENCE ROCKET FUEL

A real space rocket works in the same way as your water rocket—but it's not a bicycle pump that increases the pressure inside the rocket. Instead, rocket fuel burns very quickly, producing huge amounts of exhaust gas. As new gas is produced, it pushes down on the gas already there, and that pushes the rocket upward.

