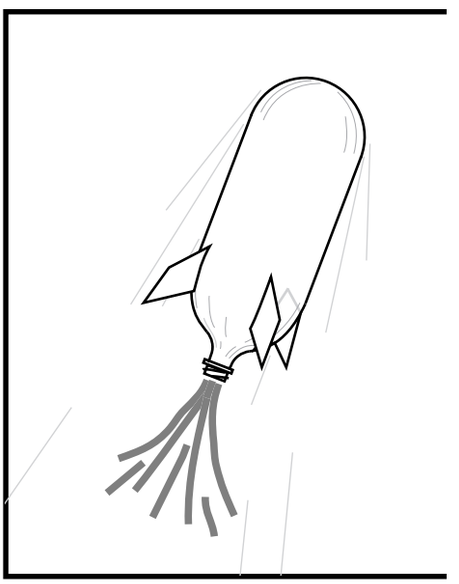
Bottle Rocket Lab



Most of you have blown up a balloon, and instead of tying the open end shut, you let it fly across the room. This is a simple, yet excellent example of Newton's third law of motion at work.

Objective:
To have an empty, 600ml bottle fly as far as possible using nothing more than water and air to make it work. The teacher will pressurize all bottles with the same amount of air using an electric pump. No part of the empty, 600ml bottle can be removed to lessen its mass. You need to make your bottle aerodynamic and stable in flight while keeping any added mass to a minimum.

Variables: By the time you finish this experiment, you will need to identify the different types of variables present in this investigation. Consult your notes for definitions of the types of variables.

Independent Variables:

_____

Dependent Variables:

_____

Controlled Variables:

_____

_____

Materials: empty 600ml bottle of equal size, tape or glue, stiff cardboard, scissors, ruler

Procedures

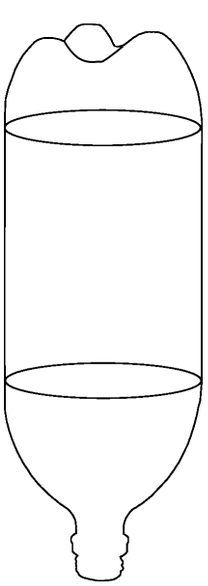
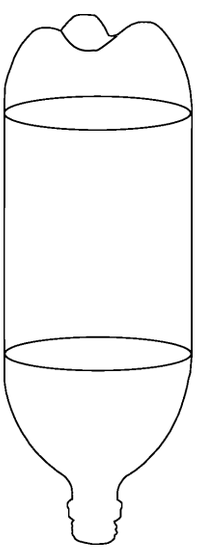
1:Planning

An ordinary plastic bottle would be very unstable in flight so you need to add some fins to it. Your fins should be stiff enough to steer the rocket but not so heavy that it fails to go far enough. This is the reason for the stiff cardboard.

The fins must be securely attached with tape or glue so they don't rip away upon launch. Tape should be applied evenly and without wrinkling it. Fins must be symmetrically placed around the

bottle. You'll need to measure the bottles circumference to do this.
To reduce air resistance a nose cone of some type must be secured onto the top of the rocket. The file folder will be used to make your nose cone. Your design must be symmetrical when viewed from the side and when looking downward at the rockets nose cone.

1. Make a preliminary sketch of what your plan will look like using pencil only. In your sketch, you will need to clearly label what everything is. Show this in the space labeled, "Preliminary Design"
2. Show your completed sketch to your teacher. If necessary, you may have to revise your plan.
3. If it's necessary to make minor changes in your design, show these in the space labeled, "Final Design"

 **Preliminary Design**	 **Final Design**

<u>Procedures</u>

Fin Construction

A. The fins you make for your rocket should all be identical in size and shape. One side must be straight for attaching to the bottle and the edge along this straight side should be perpendicular to the piece of cardboard it is cut from.
B. Once you have cut out one fin, use it as a pattern for drawing the remaining fins.

C. When all fins are cut out, stack them on top of each other and check for any irregularities in them and trim them if needed.

Nose cone Construction

A. Use a CD to draw a circle on some card and then cut it out.

B. Fold this circle exactly in half. Mark the center of the fold line (diameter) using your ruler to measure it. Now cut the circle in half along the fold line (diameter).

C. Curl the two ends toward each other, forming a cone in the process with the mid point of the diameter as the tip of the nose cone.

D. Place this folded cone over the top of the rocket (actually the base of the bottle) and adjust until it's the same diameter as the bottle. Tape the cone closed while holding it against the top of the rocket.

E. Now tape the nose cone to the bottle once you have it centered on the bottle. Be sure to tape it all around to the bottle.

Liftoff

Launch Preparation

A. Your rocket needs to be filled with 100 ml of water. Use the cap you should have saved and screw it onto the bottle to keep it from losing any water on the way to the launch site.

B. When it is time to launch your rocket, replace the cap with the stopper.

C. Place the bottle on the launch pad

D. Put on safety glasses.

E. Pressurize the rocket using the electric pump.

F. Give a countdown and watch it fly!

Question 1-Filling the bottle rocket with water first and then pressurizing it, makes it go higher than with just air. Use Newton's third law of motion to explain why having the water inside makes it go higher.

_____

_____

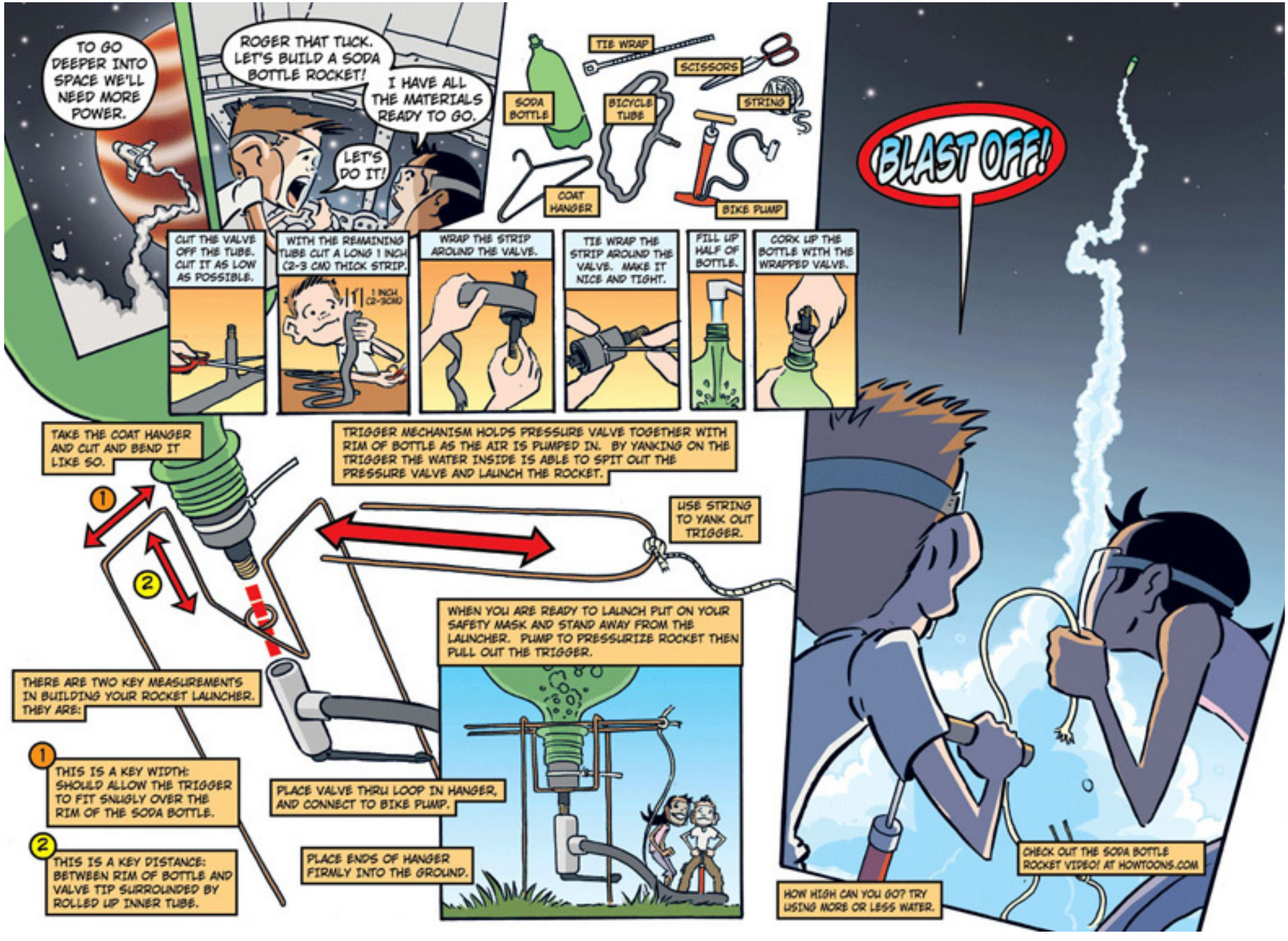
_____

Question 2- What was it about the furtherest bottle design , that made it better than the other bottles? Be specific and logical in your answer. You need to look at what other groups made.

_____

_____

_____


TO GO DEEPER INTO SPACE WE'LL NEED MORE POWER.
ROGER THAT TUCK. LET'S BUILD A SODA BOTTLE ROCKET!
I HAVE ALL THE MATERIALS READY TO GO.
LET'S DO IT!
SODA BOTTLE
TIE WRAP
SCISSORS
BICYCLE TUBE
STRING
COAT HANGER
BIKE PUMP
BLAST OFF!
CUT THE VALVE OFF THE TUBE. CUT IT AS LOW AS POSSIBLE.
WITH THE REMAINING TUBE CUT A LONG 1 INCH (2-3 CM) THICK STRIP.
1 INCH (2-3CM)
WRAP THE STRIP AROUND THE VALVE.
TIE WRAP THE STRIP AROUND THE VALVE. MAKE IT NICE AND TIGHT.
FILL UP HALF OF BOTTLE.
CORK UP THE BOTTLE WITH THE WRAPPED VALVE.
TAKE THE COAT HANGER AND CUT AND BEND IT LIKE SO.
TRIGGER MECHANISM HOLDS PRESSURE VALVE TOGETHER WITH RIM OF BOTTLE AS THE AIR IS PUMPED IN. BY YANKING ON THE TRIGGER THE WATER INSIDE IS ABLE TO SPIT OUT THE PRESSURE VALVE AND LAUNCH THE ROCKET.
USE STRING TO YANK OUT TRIGGER.
1
2
WHEN YOU ARE READY TO LAUNCH PUT ON YOUR SAFETY MASK AND STAND AWAY FROM THE LAUNCHER. PUMP TO PRESSURIZE ROCKET THEN PULL OUT THE TRIGGER.
THERE ARE TWO KEY MEASUREMENTS IN BUILDING YOUR ROCKET LAUNCHER. THEY ARE:
1 THIS IS A KEY WIDTH: SHOULD ALLOW THE TRIGGER TO FIT SNUGLY OVER THE RIM OF THE SODA BOTTLE.
2 THIS IS A KEY DISTANCE: BETWEEN RIM OF BOTTLE AND VALVE TIP SURROUNDED BY ROLLED UP INNER TUBE.
PLACE VALVE THRU LOOP IN HANGER, AND CONNECT TO BIKE PUMP.
PLACE ENDS OF HANGER FIRMLY INTO THE GROUND.
HOW HIGH CAN YOU GO? TRY USING MORE OR LESS WATER.
CHECK OUT THE SODA BOTTLE ROCKET VIDEO! AT HOWTOONS.COM