

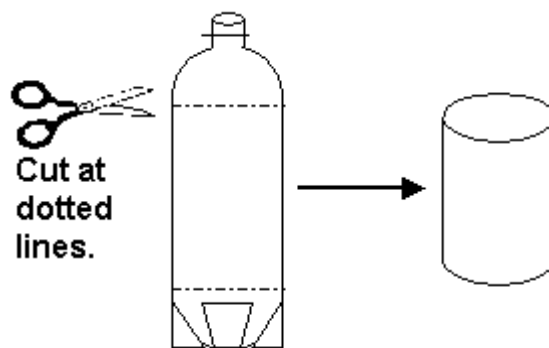
Create one bottle rocket that will fly straight and remain aloft for a maximum amount of time.

Materials

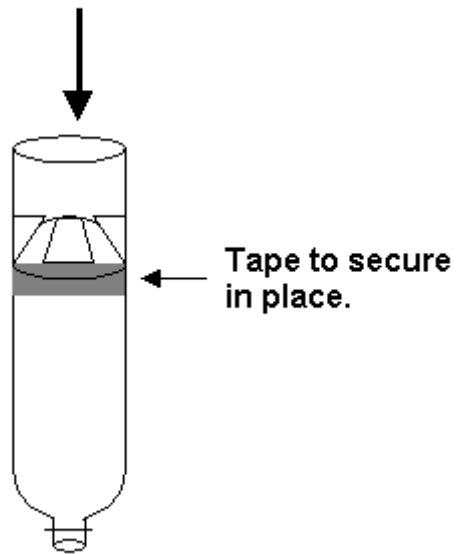
Two 2-liter bottles
One small plastic cone (athletic)
Duct Tape
Scissors
String
Manila Folder
Large Plastic Trash Bag
Masking Tape or Avery Paper reinforcement labels (you'll need 32/chute.)
Hole punch

Procedure

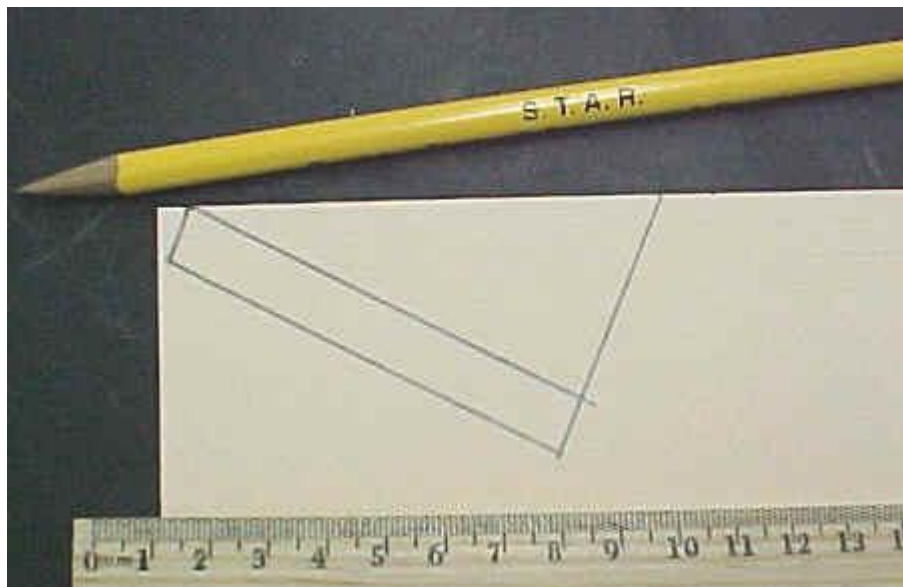
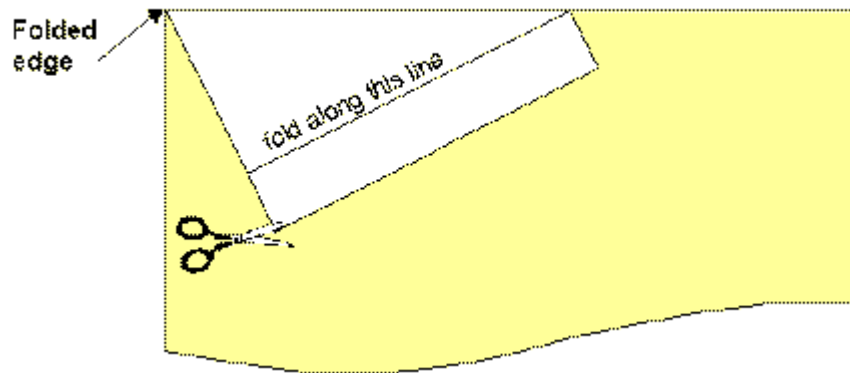
Cut the top and the bottom off of one bottle, so that the center portion or a cylinder remains.

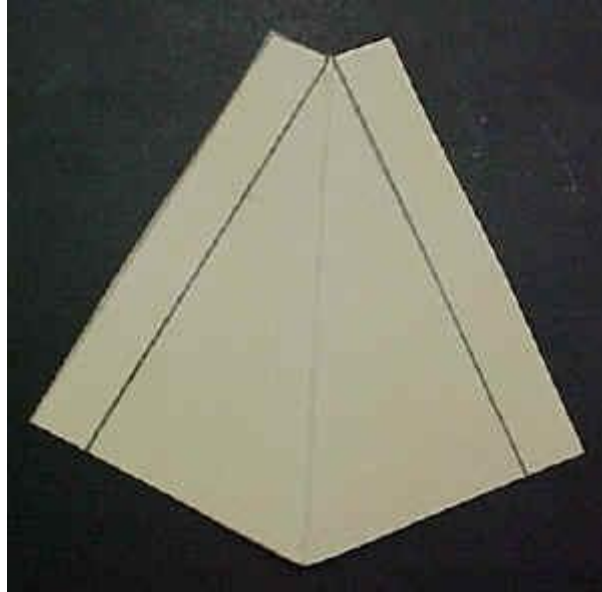


Tape the cylinder to another bottle to create a fuselage (a place to store the parachute).



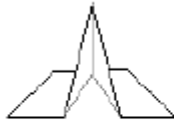
Get the manila folder; fins will be made from it. Cut three shapes out of the folded bottom in the shape that the diagram shows. Your fins will be triangular.



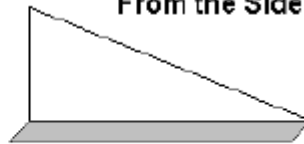


The next drawing indicates how the fin should look once folded.

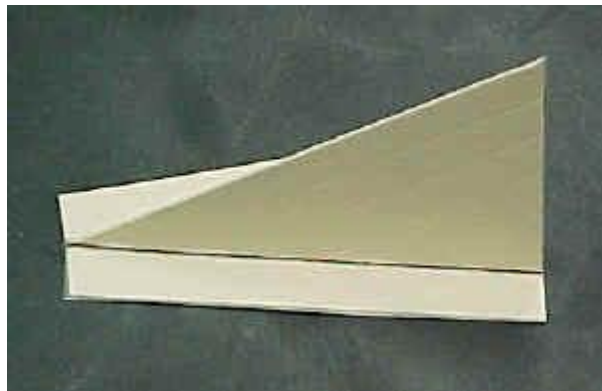
From Bottom



From the Side



Be sure that the sides are together before you secure it to the rocket.

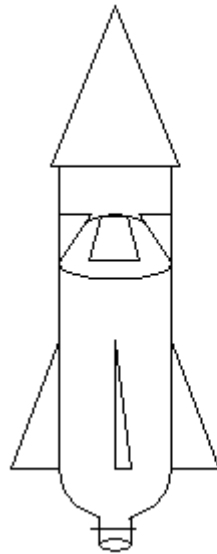


Mark straight lines on the bottle by putting the bottle in the door frame or a right angle and trace a line on the bottle with a marker. Use these lines as guides to place the fins on the bottles.



Make three fins and tape them on the rocket. Be sure that the fins are spaced equally around the rocket body. This can be achieved by using a piece of string

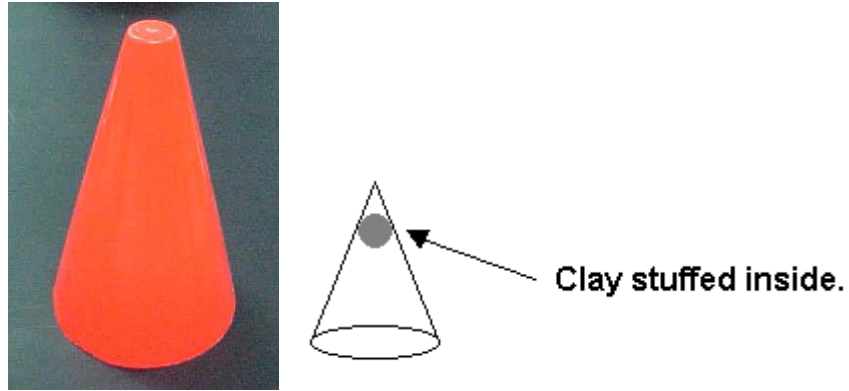
and wrapping it around the bottle and marking the string where it meets the end. Mark the string and lay it flat on a meter-stick or ruler. Find the circumference of the bottle by measuring the length of the string to the mark. Once you know the circumference, then you can divide it by three to find the distances the fins should be separated.



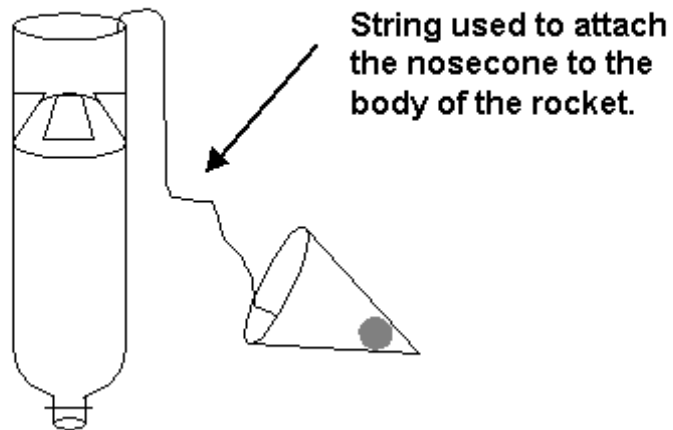
Secure fins with duct tape.



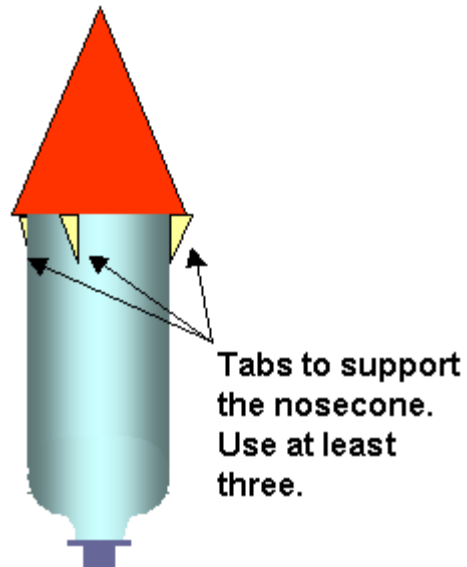
Use the athletic cone to make your nose cone. Use fairly rigid scissors and cut the bottom square off of the cone. Depending upon your project's mass limitations, place a golf ball sized piece of clay in the tip of the cone. This will add mass to the cone and give the rocket/cone more inertia. Then, using scissors, trim the cone to make it symmetrical. (Hint: the diameter of the bottom of the cone should be a little wider than the diameter of a 2-liter bottle.)



Attach the cone with string to the top of the other two-liter bottles so that it looks like the diagram. Tie a knot in the end of each piece of string to give it more friction and tape it using a piece of duct tape to the inside of the cone and to the inside of the rocket body.



Many students have trouble with their nosecone getting stuck on the top of the rocket and not coming off. This can be prevented by making a pedestal for the cone to sit on. It should be high enough up so that there is space between the cone and the top of the parachute compartment. You can make a pedestal out of the same material you will make the fins, the manila folder. Make three mini-fins, invert them and tape them on the rocket where the cone should sit.



Making the Parachute

Don't forget a good parachute has shroud lines that are at least as long as the diameter of the canopy.

Lay your garbage bag out flat. Cut off the closed end. It should look like a large rectangle and be open at both ends. Lay down the bag on a flat surface and smooth it out.



The bag has a long side and a short side and is open at both ends. Fold it in two so that the short side is half as long as it was originally.



Make sure the edges are perfectly lined up during each fold. Now fold it in half along the long axis.



Make a triangle with the base of the triangle being the closed end of the previous fold.



Now fold it again. Fold the hypotenuse so that it lines up with the right side of the triangle in the above drawing.



Examine the base of the triangle and find the shortest length from the tip to the base. This is the limiting factor for chute size. The most pointed end will end up being the middle of the canopy.

For an example; if you want the diameter of the chute to be 34 inches then measure 17 inches from the center of the canopy (the most pointed side of the



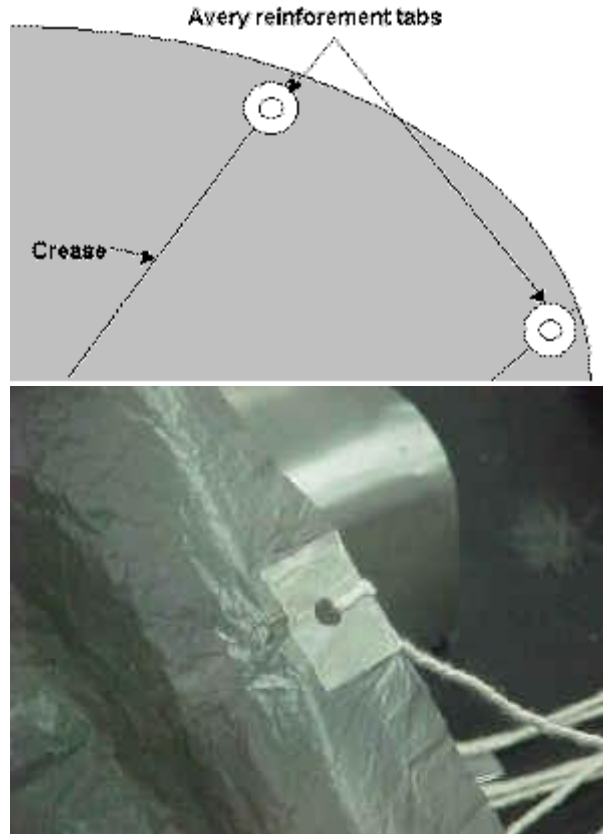
parachute) along each side, mark it and then cut it.



After cutting it, unfold it. If you have been successful there should be two canopies.

Fold the canopy in half, then into quarters, then into eighths. Carefully crease the folds each time. Crease it well and fold it again. Now the canopy is divided into 16ths. Unfold the parachute. Notice the crease marks. Get masking tape and put a piece around the edge at each fold mark. You may also use Avery reinforcement tabs. Place one on both the inside and outside of every crease, making sure that they are overlaid on top of each other.

Punch holes through every piece of masking tape or Avery tab pairs and use these to attach the kite-string shroud lines.



As mentioned earlier the minimum length of the shroud line should be the same length as the diameter of the canopy.

After punching the holes fold the canopy in half. Pick four holes and tie the shroud lines to the holes. After doing this tie the four lines together at the end most distant from the canopy.

Repeat this four times until the chute is completed.

Once you have it complete attach it inside the fuselage. Generally a couple of pieces of duct tape will hold the parachute to the rocket. Pack the parachute loosely and put the nosecone on the rocket.

You are now ready to launch your rocket.



Carefully read the safety instructions. Fill the rocket half full of water, place on the launch pad, pressurize, and launch.



Be safe, and have fun!