

Bottle Rocket Construction

Bottle rockets use water and compressed air to propel the rocket upward. They are very safe. There is only one precaution: NEVER PUT ANY PART OF YOUR BODY IN FRONT OF A PRESURIZED BOTTLE ROCKET. Getting hit by a bottle rocket can really hurt.

This article provides some basics on how to construct a bottle rocket.

Materials

All parts of a bottle rocket are optional except the plastic bottle! You can have hours of fun flying nothing but an empty soda bottle. However, if you want to reach higher, loft small payloads, or study the effect of adding fins and a nose cone, you'll want to read on.

Here is a list of materials mentioned in this article for construction of bottle rockets:

- 2 liter soda bottles
- Construction or gift wrapping paper
- Latex interior house paint
- Heavy paper, cardboard, corrugated cardboard, balsa wood, or laminated foam board
- White glue, wood glue, hot glue, or construction adhesive
- Clear plastic packing tape or duct tape
- Modeling clay
- Garbage bags
- String

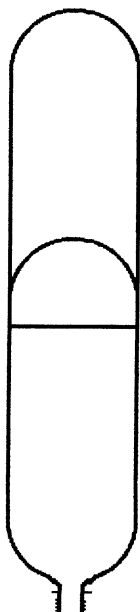


Preparing parts for a bottle rocket is not difficult, but it does require some thought. Parts need to be rugged, light and water resistant. The paints, glues and tapes should similarly be up to the task.

When you think of a "real" rocket, you usually visualize a pointy nose, a long thin body and three or more fins. Other parts that add a realistic touch may be some sort of vents, tapered sections to reduce drag, and various types of mechanisms sticking out to increase stability.

Tools

The only tool you will need for most bottle rocket construction is a sharp pair of scissors.

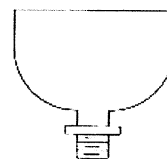


Body

Bottle rocket bodies are built around the plastic "engine chamber". Though it is usually a 2 liter plastic soda bottle, it can be any size bottle that has the same bottle cap and neck. The launcher used to pressurize the rocket forms a tight fit to the neck of the bottle, so the bottle opening must be exactly the same as a 2 liter plastic soda bottle. The bottle should be designed for pressurized liquids - like soda - to assure that the bottle does not burst.

To extend the length of the body, use several bottles. Just cut off the end of a bottle and press it onto the end of another bottle. Although this will increase the weight of the rocket, one or two extra bottles can provide better aerodynamic stability, and increase the height that the rocket can fly.

Multi-stage rockets, and joining several bottles together to increase fuel capacity are possible, but should be attempted by only experienced bottle rocket builders. Preventing leaks is the hardest part of building anything other than a single bottle fuel tank, single stage rocket.



You can use construction or gift wrapping paper for a decorative skin. Use clear plastic packing tape, white glue, wood glue or hot glue (glue gun) to attach the skin to the bottle. Some designers like to leave a slit down the side so they can see how much water is in the bottle before launch. Marks are drawn on the edges of the slit to indicate water capacity for experiments.

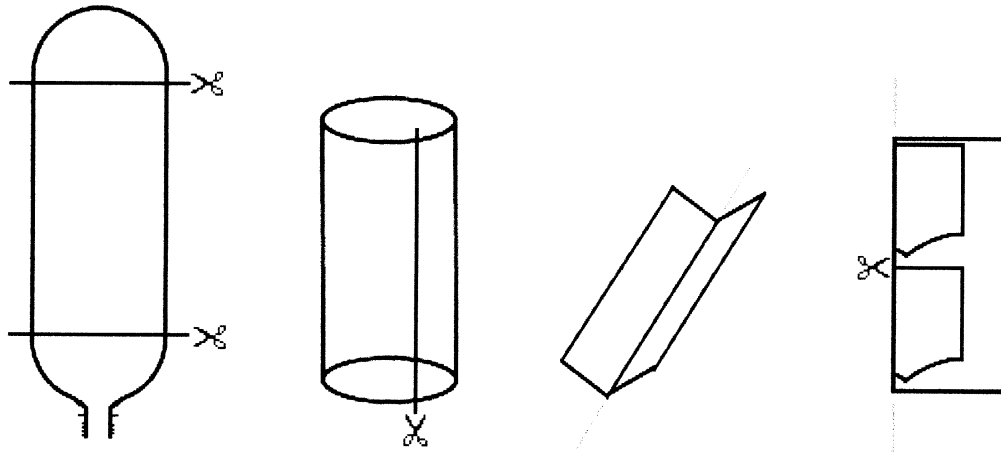
You can also paint the rocket. Paint should be water based to prevent softening the plastic of the bottle, but the paint should be water resistant after drying. Latex interior house paint works well.

Fins

Fins can help the rocket fly straight, or not. Straight flight can make a big difference in how high the rocket flies. But fins can also make a rocket fly wildly. Wings, which can be thought of as very large fins, have even more of an effect. Because wings can lead to very unpredictable flight paths, especially in windy areas, wings should not be used where there are many other people around. Wings can be very difficult to build and attach.

Remember to leave room around the neck of the bottle because the fins can get in the way of placing the rocket on the launcher.

Fin or wing materials range from heavy cardboard, corrugated cardboard, balsa wood, laminated foam board, or the same plastic that the bottles are made from. See the diagram below for using bottles for fin and wing materials.



Use white glue, wood glue, hot glue (glue gun), or construction adhesive to attach the fins or wings. Hot glue or construction adhesive works especially well with plastic and laminated foam fins. You can also use clear plastic packing tape or duct tape. Join the fins directly to the plastic of the soda bottle.

Symmetrical placements of the fins, and alignment with the length of the bottle are important to assure straight flight.

Nose Cone

On bottle rockets, nose cones are primarily for looks. At the low speeds of bottle rockets, rounded noses cause actually less drag than sharply pointed ones.

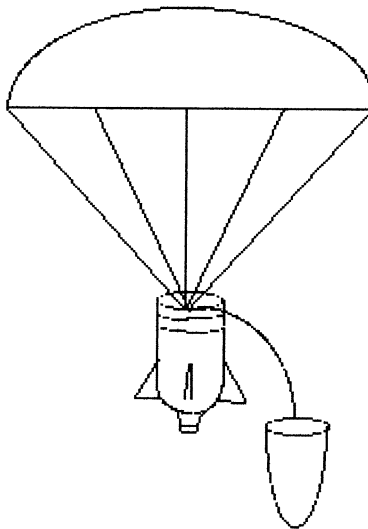
Nose cone materials can be the same as fins. A large sheet of heavy paper can also be used to make a long, tapered nose cone. Bond the nose cone to the body with tape or glue.

The nose cone usually takes most of the impact of landing. If you use a paper or cardboard nose cone, expect it will last for just a few flights.

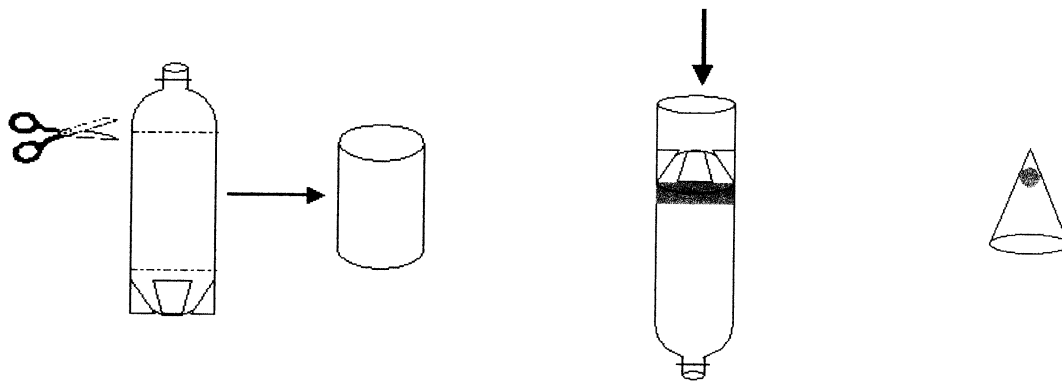
Never make a nose cone both hard and pointed in case the bottle rocket falls on some one and stabs them.

Parachutes

Parachutes can make the flight of a bottle rocket extremely fun to watch, but making a parachute requires lots of experimentation to get the chute to deploy at just the right time. Parachutes are a sign of a master bottle rocket builder.



Use a soda bottle with the top and bottom cut off to make a sleeve to hold the parachute.



Then make a nose cone that slides easily on and off of the sleeve. Put some modeling clay in the top of the nose cone so that it will cause the rocket to flip over when the rocket starts to descend, and the weight also helps the nose cone fall off. Remember to use some string to attach the nose cone to the rocket body.

Cut the parachute out of a plastic garbage bag.

Use string and duct tape to attach the chute to the rocket body.

Rocket Engineering

There are hundreds of ways to construct a bottle rocket. Creative design is really just a matter of thinking hard about what you can do with the materials you have, and experimenting to see what works. Don't be afraid to try something else. Ask yourself, "What's the worse thing that can happen?" Most likely the worse thing that can happen is your rocket does something very weird, and everybody laughs. That's what makes these things fun. People will thank you for giving them a good time. Along the same lines, rockets that look cool are appreciated even if they don't fly very well. If you go beyond what you read in this article, you will truly be a rocket engineer.