

Make your own Smoke Ring Cannon

What you'll need

- One-litre plastic bottle
- Scissors
- Rubber balloon
- Sticky tape
- Incense stick
- Matches

Warning: This experiment involves a naked flame, so should be carried out with adult supervision

What to do

1. Use scissors to cut off the bottom third of the plastic bottle.
2. Cut the balloon at the base of the neck. Discard the neck and keep the main round section.
3. Stretch the balloon over the open bottom of the bottle, so that it forms a tight 'skin'.
4. Secure the balloon to the sides of the bottle with sticky tape.
5. Light an incense stick.
6. Hold the open neck of the bottle directly above the burning incense stick until the bottle is full of smoke.
7. To make smoke rings, tap or poke the balloon skin with your fingers. Varying how hard you tap or poke will give different results.



What's the science?

Tapping or poking the balloon skin exerts a force on the smoky air in the bottle, making a puff of smoke move out of the hole in the neck.

The smoke on the outside of the puff experiences more friction than the smoke in the middle, because it's in contact with the edges of the bottleneck, and the air outside the bottle, as it emerges.

This results in the smoke on the outside moving slower, then it starts spinning as it's simultaneously dragged forwards by the faster smoke in the middle and pulled backwards by the frictional forces.

The spinning smoke forms a doughnut shape, also known as a 'toroidal vortex'.

The smoke in the ring stays together because of the law of the conservation of angular momentum, which means that spinning objects tend to stay spinning unless an external force is applied.

If the smoke wasn't spinning, it would disperse as smoke ordinarily does when it mixes with air.

Investigation taken from: <https://www.sciencefocus.com/science/how-to-make-a-smoke-ring-cannon/>