

# RAFT IDEAS

**Topics:** Air Pressure, Gas Pressure

## Materials List

- ✓ Empty sturdy plastic bottle, clear (best) or translucent, with an opening no bigger than 3 cm (1¼"), (small water bottles may not work)
- ✓ Balloon
- ✓ Nail, drill, or other tool for cutting a hole in the bottle

This activity can be used to teach:

- Structure of matter (Next Generation Science Standards: Grade 5, Physical Science 1-1; Middle School, Physical Science 1-1)
- Atmosphere (Next Generation Science Standards: Grade 5, Earth and Space Science 2-1)



## Balloon in a Bottle



This neat trick serves as a great introduction to a discussion about air pressure.

### Assembly

1. Drill or poke a small, hard-to-notice hole somewhere near the base of the bottle.
2. Place the balloon into the bottle with the mouth of the balloon sticking out of the mouth of the bottle.
3. Stretch the balloon's opening over the mouth of the bottle and down around the neck such that the balloon stays in place.

### To Do and Notice

1. Blow up the balloon, leaving the hole in bottle uncovered.
2. Once the balloon is inflated, place a finger over the hole at the base of the bottle. The balloon should stay inflated even when its mouth is open. The balloon will deflate when the hole in the bottle is uncovered.
3. Can the balloon be blown up when the hole is covered?

### The Science Behind the Activity

Initially, the air in the balloon is at the same pressure as outside air and the air in the bottle. As blown air moves into the balloon (air pressure in the lungs is greater than the air pressure in the balloon) the balloon expands.

If the hole is uncovered, air flows out of the bottom of the bottle, so the pressure in the lungs exceeds the pressure of the air in the bottle which allows air to continue to flow into and inflate the balloon. When the balloon is inflated, the small amount of air in the rest of the bottle is at the same pressure as the outside air. If the hole is covered at this point, this air may not enter or leave the bottle, so the air pressure in the bottle does not change. In order for the balloon to deflate, it would require the volume of air in the bottle to increase, so the balloon remains inflated. The pressure balance stays intact and keeps the balloon from deflating.

If the hole is covered, the expansion of the balloon decreases the volume of air in the bottle and increases its pressure. Very quickly, the pressure in the bottle builds up until it matches the pressure of the air in the lungs, making it impossible to inflate the balloon any further.

### Taking it Further

This activity is a good way to provoke inquiry on the part of the students. Hand out balloons with bottles (some with no holes and some with holes) and instruct the students to blow up the balloons inside the bottles. Ask them to investigate why they have mixed results.

Without telling them the technique, ask them to fill up the balloon pass it to another person without either sealing the end or letting the air out of the balloon.

**Web Resources** - (Visit [www.raft.net/raft-idea?isid=292](http://www.raft.net/raft-idea?isid=292) for more resources!)