Demo: EGGsperiment

FOR THE TEACHER

Summary
In this demonstration, students will learn how temperature change affects air pressure, while observing an egg getting sucked into a bottle without being touched!

Grade Level
Elementary and Middle School

Objectives
By the end of this demonstration, students should be able to
- Understand the meaning of air pressure
- Determine the relationship between pressure and temperature of a gas.

Chemistry Topics
This demonstration supports students’ understanding of:
- Gases
- Air pressure
- Temperature

Time
Teacher Preparation: 10 minutes
Lesson: 20 minutes

Materials
- 1 boiled egg (peeled)
- 1 glass bottle/flask with a neck that is just a little too small for an egg to fit through (Ex: Snapple bottles)
- 1 lighter or a match
- 1 strip of dry paper
- Pot/container of hot/boiling water (or microwave water until hot- if at school)

Safety
- Students should wear proper safety gear during chemistry demonstrations. Safety goggles and lab apron are required.
- Do not consume lab solutions, even if they’re otherwise edible products.
- Food in the lab should be considered a chemical not for consumption.

Teacher Notes
- Practice this demonstration before conducting it in from of the class.
- Caution: Heat can cause the glass to break or shatter. Use Pyrex or Erlenmeyer glass. Wrapping the glass container with packing tape can help to prevent shattering of glass.
- Air Pressure Explained is a great video to show the class before the demonstration.
- Before class begins, set up a table with the materials in the front of the classroom. Make sure that every student will be able to observe the demonstration from where they are sitting.
- To begin, tell the student that you have a glass bottle and a hardboiled peeled egg. Show them that the egg cannot fit into the bottle by placing the egg at the neck of the bottle. Ask students to brainstorm how the egg can get inside of the bottle without touching the egg?
Procedures:
1. Light the strip of paper on fire and drop the piece of paper into the bottle.
2. Place the egg on top of the bottle (skinny-side down) and have the class observe.
3. The egg will be sucked into the bottle (and not able to be dumped out).

Explanation: The burning paper heated the air inside of the bottle. When air gets hot, it expands. When the burning paper was added to the bottle the air expanded and was pushed out of the bottle. This means that the hot particles in the air moved farther apart from one another. There wasn’t enough room for all of the particles inside the bottle anymore, so the air pressure inside was temporarily higher while the temperature was higher. When the egg was placed on top (sealing the glass bottle) the fire went out due to lack of oxygen and the air started to cool, which means it contracted. The individual particles got closer together. Since there was less air in the bottle then there was before, there is low pressure inside the bottle compared to outside of the bottle, where it is normal. The higher pressure outside the bottle forces/pushes the egg into the bottle.

See the video for a demonstration

How do you get the egg out of the bottle? In the video, I demonstrated this at the end. One way is to turn the bottle upside down, with the egg resting in the neck of the bottle. Pour hot water over the top of the glass bottle. You may need assistance with this so you do not burn yourself. This increases the air pressure inside the bottle.

Differentiation: Instead of dropping a piece of paper on fire into the jar, you could light a candle and stick it in the egg. Turn the egg upside down, candle inside of the jar, and the egg will be sucked right in.

Post-demo real world connection: As stated in the video, when you fly in an airplane or drive high up into the mountains you’ve probably noticed your ears need to “pop”. This “popping” is caused by the same change in air pressure that “pops” the egg into and out of the bottle. Air pressure decreases as altitude increases so as you go higher the air pressure decreases causing the air trapped in your inner ear to push your eardrums outward. Your body tries to regain equilibrium by allowing some of the air in your inner ear to escape through the Eustachian tubes. When the tubes open, the pressure releases and you feel the “pop.”