Demo: Balloon and Flask

FOR THE TEACHER

Summary
In this demo, students will witness the relationship between temperature and volume as well as temperature and pressure. This is a great substitute for the imploding soda can demonstration that doesn’t always work.

Grade Level
High or middle school

Objectives
By the end of this lesson, students should be able to
- Understand that temperature and volume are directly related.
- Understand that temperature and pressure are directly related.

Chemistry Topics
This lesson supports students’ understanding of
- Gas laws

Time
Teacher Preparation: 15 minutes
Lesson: 30 minutes

Materials
- 200-mL Erlenmeyer flask
- 12-inch balloon
- Water
- Hot plate
- Tongs
- Sink

Safety
- Always wear goggles when working in a lab setting.
- Exercise caution when using a heat source. Hot plates should be turned off and unplugged as soon as they are no longer needed.

Teacher Notes
- I discuss the procedure with the class and ask them to predict what will happen to the balloon and support their answer with a reason. This usually leads to an interesting discussion, which exposes students to misconceptions. The prediction and discussion result in the students being more interested in the final result.
- Oftentimes, students will say a vacuum is created inside the flask as an explanation for why the balloon is sucked inside. This is a good opportunity to discuss what a vacuum is.
- This is a much more reliable way to demonstrate temperature and pressure relationships than a soda can in water.
- This could be done by students in groups or two or as a full class demonstration.
FOR THE STUDENT

Student Activity Sheet: Balloon and Flask

Lesson

Prelab question
Read the procedure and predict what will happen. Justify your prediction.

Procedure
1. Pour about 25 mL of water into the flask.
2. Heat the water on a hot plate until it boils. Allow it to boil for about two more minutes. Turn off the hot plate. There should still be water in the flask.
3. Using tongs or something to protect your hands, remove the flask from the hot plate and pour the water out.
4. Immediately place a balloon over the mouth of the flask.
5. Place the flask on the table and record observations.

Observations

Analysis
Using arrows, sketch the molecules inside and outside of the flask that make up the air during four points in this experiment (see below). Add the balloon and what it looks like, when appropriate. Use arrows to indicate particles, and longer arrows to indicate faster moving molecules.

Room temperature  Boiling water  With balloon, after heating  With balloon, cooled

Conclusion
What did you learn from this experiment about temperature, pressure, and volume of gases?