

Straw Pressure Popper

Kinetic Molecular Theory and PTV



Introduction

Sometimes, student ideas and tricks can be used to give some insight into everyday chemistry! Use these tricks that your students have probably seen or tried before to explain Boyle's law and the relationship between pressure and volume.

Concepts

- Gas laws
- Boyle's law

Materials

Plastic water bottles, empty

Straws

Safety Precautions

Flicking the compressed straw will cause the straw to split apart. The cap to the water bottle will fly away with force when unscrewed from the compressed bottle. Take care not to aim either demonstration at yourself or students. Wear safety glasses when performing the demonstration.

Procedure

1. Obtain a plastic drinking straw and pinch off the ends to make a closed system.
2. Slowly start twisting and compressing the straw by holding the pinched ends and turning your hands in a circle around the straw.
3. When the straw has been compressed to about 2 or 3 cm, hold the straw at the ends with one hand and flick the straw sharply with your other hand. There should be a loud "pop" as the pressure is released and the straw splits open.
4. Cap an empty plastic water bottle. Slowly start twisting the lower half of the bottle to compress the system.
5. Aiming the mouth of the bottle away from yourself and students, carefully begin to unscrew the bottle cap. The cap will be blown off with quite a bit of force as the pressure is released from the system.

Discussion

Both of these activities demonstrate the concept of Boyle's law and the inverse relationship between volume and pressure in gases. In both demonstrations, the volume of the system is decreased, causing an increase in pressure of the gas as the particles collide more and more with the walls of the container. This movement is not related to the energy of the gas particles, but is rather simply due to the decreased space these particles have to move around in. More collisions between the gas molecules and the walls of the container cause an increase in pressure so dramatic that even the slightest disturbance will drastically alter the system. In the case of the straw, the thwack of your finger against the straw provides sufficient energy to rupture the system, allowing the compressed gas to escape, much like a needle or pin popping a balloon. Similarly, the compression of the gas inside the water bottle is enough that even a small release of the cap will cause the cap to be suddenly and violently ejected from the bottle.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation
Constancy, change, and measurement

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, motions and forces, conservation of energy and increase in disorder, interactions of energy and matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Straw Pressure Popper* activity, presented by Bob Becker, is available in *Kinetic Molecular Theory and PTV*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

The *Straw Pressure Popper* is available from Flinn Scientific, Inc.

Catalog No.	Description
AP6025	Straws, Plastic, Wrapped

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.