



Charles Law: Collapsing Can *Preparer's Version*

Introduction

Boyle's Law states that at a constant temperature, the pressure of a gas is inversely proportional to its volume. This means that as the volume of a gas decreases, its pressure increases, and vice versa, provided the temperature remains constant. This principle is crucial in understanding the 'collapsing can' demonstration, where a small amount of water is boiled inside an aluminum soda can and then rapidly cooled. This relationship between pressure and volume can be expressed as:

$$P_1V_1 = P_2V_2$$

Safety Hazards

- Personal Protective Equipment:
 - Safety glasses/goggles
 - Work gloves
 - Chemical & flame retardant lab coat
- Physical Hazards:
 - Hotplate surfaces get extremely hot and can cause serious skin burns.

Materials

- Aluminum soda cans
- Hotplate
- Power strip
- Metal tongs
- Water
- Crushed ice
- 2000 mL beaker



Procedure

1. Measure ~15 to 20 mL of deionized water.
2. Plug in the power strip and plug the hotplate into the power strip.
3. Place the can on the hotplate. Set the plate to 100% on the heat dial.
 - a. *Optional:* use a blowtorch in place of the hotplate.
4. Prepare an ice bath in the 1L beaker while the water in the can heats.
5. Heat until the water inside boils vigorously and a cloud of condensed water vapor escapes the mouth for about 20 seconds.

Tips & Tricks

- If using a blowtorch in place of a hotplate, bring a ring stand and ring clamp to secure either the can or the blowtorch (depending on the performer's preference).
- The colder the water, the more dramatic the collapse of the can (as long as it's hot enough)!

Clean-Up Procedures

1. Throw away the crumpled can. Be watchful for any sharp/jagged edges.
2. Dump the ice bath into the drain.