Squashing Pop Cans with Atmospheric Pressure

This demonstration is an audience favorite. It is a simple demonstration, but it can generate many questions and really make the students think about the interactions of pressure, volume, and temperature. It can been used simply to demonstrate atmospheric pressure but is also suitable when the ideal gas law is presented.

Chemicals and Equipment Needed

- d-H_2O
- Ice
- 2 regular pop cans – **on top of H**
    - Make sure you aren't using the scored pop cans for Ripping Pop Cans
- Bunsen burner with tripod, or hotplate (burner is generally preferred) - **T/A4**
    - For rooms without methane, use the butane burner and a clay triangle
- Specialized tongs (with wide spread) - **U2**
- Large crystallizing dish – **P3**

Hazards

- Methane and butane are flammable gases, and the burners should only be handled by experienced persons.
- Hot plate surfaces and metal fixture remain hot even after turned off.

Preparation

- Pour ~15 mL d-H_2O into each pop can
- Right before delivery, fill crystallizing dish with water and some ice to make very cold.

Presentation

- Wear goggles for the presentation. A lab coat is recommended as well.
- Heat can over burner or hot plate until steam comes out of top.
    - It will take longer to heat the can on the hotplate.
- Grasp can with tongs and invert quickly into dish of cold water, just enough to immerse the open end of the can.
- The dramatic result is convincing evidence of the force of atmospheric pressure.

Discussion

- Present the Ideal Gas Law:

  $$PV = nRT$$

    - Ask: How do *P*, *V*, *n*, and *T* vary (or remain constant) throughout this demonstration?
    - Solicit explanations from the audience, then repeat the demonstration, if desired.
- The original empty can had air inside as well as outside, so the pressure both inside and outside was equal. The steam produced by boiling water displaced the air from the can. Removing the can from the heat and inverting it in the water did two things very quickly – the steam cooled and changed back to water (so there was no gas and therefore no pressure left inside the can), and the water in the dish sealed the can so that no air could get in. Since there was still air pressing on the outside of the can, it was immediately compressed by the atmospheric pressure.

Cleanup

- Recycle the squashed can, and encourage your students to save aluminum cans for recycling. Recycling aluminum is orders of magnitude cheaper than refining it from the raw ore.

NOTES

- Even with the “good” hotplate, this demo has a 50% fail rate. The butane burner has been much more effective, but you have to use a clay triangle instead of mesh.
- Steggy did this with a small keg on Heineken. It was awesome.