### Required Training

| UC Lab Safety Fundamentals |

### Required PPE

Lab coat, safety glasses/goggles,
nitrile gloves

### Equipment

Beaker Tongs
Soda cans
Hot plate
DI water squirt bottle
Ice
Ice pan

### Chemicals

### Procedure:

1. Add approximately 100ml of water into the soda can and heat it on a hot plate.
2. Prepare and ice/water bath in an aluminum pan.
3. Once a steady stream of steam is coming out of the can, lift it with the beaker tongs and quickly dunk it upside-down into the ice/water bath.
4. **NOTE:** do not heat the can until all the water has evaporated.
5. In a couple seconds the can will collapse.

### Discussion:

This demonstration shows the power of phase changes. As a gas, the water vapor occupies a volume much larger than it does as a liquid. This follows the equations written below:

At room temperature: $P_{in} = P_{out} = 1$ atm

\[
P_{in} = 1 \text{ atm} = P_{air} + P_{vapor} = 0.972 \text{ atm} + 0.028 \text{ atm}
\]
The vapor pressure of H₂O at room temperature can be found in your textbook.

At boiling point: \( P_{in} = P_{out} = 1 \text{ atm} \)

\[
P_{in} = 1 \text{ atm} = P_{air} + P_{vapor} = 0 \text{ atm} + 1 \text{ atm}
\]

The definition of boiling point

As this low density water vapor condenses on the walls of the cold soda can, a vacuum is created following a similar equation:

\[
P_{in} \neq P_{out}
\]

\[
P_{in} = P_{air} + P_{vapor} = 0 \text{ atm} + 0.028 \text{ atm}
\]

\[
P_{out} = 1 \text{ atm}
\]

\[
P_{out} \gg P_{in}
\]

Even though only a small amount of water vapor is contained in the can when the can is dunked into the ice bath, a number of properties of this demonstration are advantageous in demonstrating a phase change. The aluminum can is highly conductive and quickly cools to a level at which the vapor condenses. The can is weak and crushes easily under pressure. The opening of the can is small enough to not let air rush in while the can is being flipped—the more water vapor in the can (displacing air) the more the pressure change will be when the vapor is condensed.

**Hazards:**

Exercise caution when using a hotplate.

**SOP:**

N/A

**Disposal (by Storeroom)**

Return all materials to the storeroom. No disposal should be needed.