

ATMOSPHERIC PRESSURE

Concepts Illustrated:

(1) The impressive force that may be exerted by everyday atmospheric pressure.

Time Requirements: 10 minutes

Grade Level of Audience: This qualitative demonstration is suited for students of all ages.

I. Materials and Equipment Utilized

1. empty aluminum pop can
2. short tray of ice water
3. source of heat to boil water
4. Hot Hands™ or oven mitt
5. A small(12" x 12"), smooth, rubber mat
6. A 6" long, 1/4" diameter wooden dowel
7. A small finishing nail.

II. Description of Set-up and/or Construction of Apparatus

Atmospheric Pressure Mat

1. Carefully pound the finishing nail into one end of the dowel.
2. Using a pliers, bend the end of nail so it is in the shape of an L.
3. Poke a small hole in the center of the smooth rubber mat. Feed the "L" shaped nail through the hole, such that the dowel behaves like a handle to lift the mat. You can secure the nail with duct tape, if necessary.



Collapsing Can

4. Pour a small amount (2-3 ounces) of water into the empty aluminum can. Carefully heat the water in the aluminum can to a boil.



III. Details of Student Implementation

Atmospheric Pressure Mat

1. Place the rubber mat on a smooth surface. A small piece of white board (melamine bathroom board) is very smooth. Press the mat as smooth as possible to force out much of the air beneath the mat.
2. You should be able to lift a stool and/or find it somewhat difficult to lift the mat.
3. After squeezing out much of the air from beneath the mat, the atmospheric pressure above the mat is greater than the atmospheric pressure beneath the mat, resulting in a greater force down, making it difficult to lift up the mat.



Collapsing Can

4. Once the water in the can is boiling, quickly (and carefully) invert the can in the ice water bath.



5. The aluminum can very quickly collapses as a result of the atmospheric pressure outside of the can and lower than atmospheric pressure inside of the can.

6. The idea here is that when the water was boiling with the lid open, the pressure inside of the can was equal to atmospheric pressure outside of the can. However, the pressure inside of the can was due in large part to water vapor (water in gaseous form). When the can is quickly inverted in an ice water bath, the water vapor condenses, which removes gas (and therefore much pressure) from inside of the can. With the pressure outside of the can so much greater than inside of the can, the can collapses.

7. Careful observation of the collapsed can will reveal that even some water was drawn up into the can from the water bath.