

611-2335 (35-100) Collapsing Can

Additional Materials Required

- Vacuum Pump
- Water
- Hot plate

Introduction:

The purpose of this device is to demonstrate the effects of air pressure on objects.

This collapsing metal can makes a good introduction to air pressure for any age student. The can, when evacuated by a hand pump, will crumple right before your eyes. You can also boil a small amount of water inside until a cloud of condensed water vapor escapes from the mouth of the can, then cap it (using tongs) and let it cool.

How to use:

The collapsing can demo may be used in one of two ways. Either by pumping out the air with a vacuum pump, or by boiling a small amount of water into steam, and allowing the can to be sealed and cooled. This device is single use only, it is suggested that you read through both sets of instructions before deciding which meets your needs.

1. Pumping out the air:

1. Remove the metal cap from the can, and note that the air pressure inside the can is now equal to the air pressure outside the can.
2. Fit the rubber stopper into the mouth of the can
3. Connect a vacuum pump to the nipple on the top of the rubber stopper.
4. Begin to pump the air from the can. If a hand pump is being used, it may take some time for the air to be pumped out and for the can to collapse.

Discussion:

How is it that removing a gas from the can will cause such a sturdy can to crumple? Air pressure! It is important to note that the air pressure surrounding the can is what makes it collapse. Air pressure at sea level is about 15 lbs per square inch. For this can which measures about 9 x 4 x 6.5 inches, the force of air pressure exerted on the can is enormous. The surface area of the can is about 241 square inches. If all of the air is able to be removed from the can the force of the surrounding air approaches 3600 lbs of pressure on the can.

Extra experiment:

Additionally if a valve is placed between the pump and the can, and the vacuum can be maintained in the can, it can be used to show that air has weight. Weigh the can with the stopper and the connected valve before performing the above experiment. Then weigh the same can and attachments after a vacuum is achieved in the can. If you use an accurate enough scale, you will see a slight difference in the measurements in the range of .5 to 1 gram.

2. Collapsing with steam:

1. Put a small amount of water (75ml) inside the can and heat it over a Bunsen burner or hot plate.
2. When steam begins to rise out of the can at a steady rate, remove the can from the heat.
3. Using gloves and tongs, screw the metal cap onto the can. You may have to wait for the escap-



ing steam to slow before the cap will go on, but the sooner it is on, the more impressive the demonstration will be.

4. Allow the can to cool off. The faster the can cools, the more impressive the demonstration will be.

Discussion:

As the water in the can turns to steam, the steam forces out the air inside the can. Steam is expanded water vapor and greatly expands when heated. When the cap is tightened onto the can, the expanded steam is trapped inside, and the surrounding air is trapped outside.

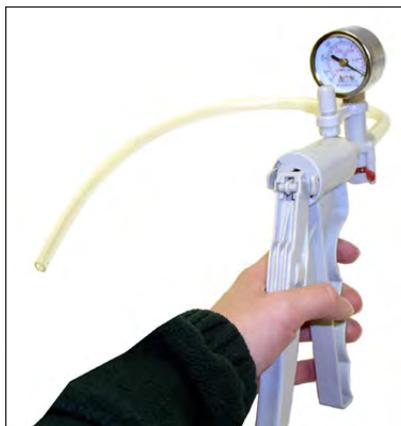
As the can cools, the water vapor contracts, condenses, and returns to a liquid state. The resulting pressure in the can is much less than the air pressure outside the can. The outside air pressure presses on the can and crushes it until the pressures are equalized.

Caution:

Be very careful when working with Bunsen burners and hotplates. Steam can cause serious burns, use gloves, goggles, and appropriate safety measures

May we suggest:

611-2360 Motor Driven Vacuum Pump: Direct drive motor-driven pump comes with built-in gauge. It works from 0 to -30 inches Hg. 1 atmosphere ultimate pressure, 1-stage rotary vane construction. Includes oil level indicator on the side; 11 x 10 x 5". Can be used with Guinea and Feather and Bell in Vacuum.



A hand pump is recommended to demonstrate how much air is really being removed.

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