

Dynamics and Statics

Cloud in a bottle

(Ireland)

Background

This model demonstrates a physical change (change of state) through the formation of a cloud inside a sealed bottle. No new substances are formed but squeezing and releasing the bottle causes a cloud to form and dissipate, replicating in a simple way, an aspect of our weather

You will need....

- ✓ 2 litre soft drinks bottle
- ✓ 20 cm³ of tap water
- ✓ Small beaker
- ✓ One match

Follow these steps:

1. Place approximately 20 cm³ of tap water into the bottle, seal and shake vigorously for 1 minute.
2. Empty the bottle of water and reseal.
3. Light a match (or small piece of taper) and allow to burn for half of its length, and then extinguish.
4. Open the bottle and place the extinguished match inside while still emitting some smoke.
5. Seal immediately. Squeeze repeatedly until a cloud appears.

So what happened?

Shaking the water in the sealed bottle creates a vapour with the bottle. When the smoking match is placed in the bottle, this adds smoke particles to the internal atmosphere.

Squeezing increases the internal pressure, causing a heat increase, maintain the water as vapour. Releasing the bottle reduces the pressure and temperature, water droplets form. These cooled droplets attach to smoke particles forming a cloud (nucleation).

The more squeezing that happens the more persistent the cloud will be inside the bottle.

What next?

- This demonstration can be related to the weather effects of pressure at JC Science and JC Geography (barometric pressure)
- On a careers thread it can also be used to help explain why meteorologists are required to have physics degrees as a great many weather phenomena have a heat or pressure aspect.
- If pressure changes were created by a bicycle pump with a pressure gauge, this could be extended into an investigation of vapour pressures and cloud density/cloud cover and fogs.

