

Make your own Cloud in a Bottle

To see how clouds form

Equipment

- ◇ A large, clean, plastic, fizzy drink bottle. Make sure it isn't cracked or damaged.
- ◇ Warm water
- ◇ Matches
- ◇ Optional thermometer
- ◇ Bike pump
- ◇ Bike pump attachment, eg rubber bung with inner tube valve



Method

1. Pour a few cm of warm water into the bottle, and swill it round to wet as much of the surface as possible.
2. Firmly push the pump attachment into the neck of the bottle, and pump air into the bottle. If you have a thermometer, you can watch the temperature rise a couple of degrees as the pressure increases. This encourages the water to evaporate.
3. Release the bottle suddenly. You may see a faint cloud appear.

When you release the bottle, the pressure, and temperature in the bottle drop suddenly. However, you will not see many cloud droplets forming despite the fact that the air in the bottle is almost certainly saturated with water vapour (if you do, it probably because your bottle wasn't very clean!).

4. Now open the bottle, and light a match (get an adult to help with this step). Hold the match near the mouth of the bottle, then blow it out, gently blowing some smoke into the bottle for a few seconds before quickly attaching the bike pump.
5. Now pump air into the bottle again and release it suddenly. You should see a much clearer cloud forming in the bottle when you release it, as the water vapour now has small particles (smoke, soot, ash), known as Cloud Condensation Nuclei, to condense onto.

N.B., you can repeat this experiment using ethanol (or surgical spirit, or alcohol based hand cleansing gels) rather than warm water. In this case, no smoke is required. Ethanol has a substantially greater vapour pressure than water, and such high levels of supersaturation can be achieved as to make nucleation possible without any CCN present.

How does this relate to the atmosphere?



Clouds can only form when the air is saturated with water vapour (this means that there is more condensation than evaporation going on) and when there are condensation nuclei present. Cloud seeding experiments, and some climate engineering proposals, introduce extra Cloud Condensation Nuclei to the atmosphere, to influence the number and size of raindrops in a cloud.

Where can I find more information?

<http://www.metlink.org/weather-climate-resources-teachers/useful-links.html#clouds>

<http://www.sciencemuseum.org.uk/ClimateChanging/ClimateScienceInfoZone/Exploringourfuturechoices/3point7/3point7point2.aspx>

http://www.usatoday.com/news/world/2006-06-29-china-rain_x.htm

www.rmets.org/experiments