

Making clouds



The clouds in the sky are so far away but what if we can bring them down to Earth and make them ourselves? This is exactly what we are going to do!

Clouds form when hot air (containing water vapour) cools as it rises into the sky. This might seem strange because it is moving closer to the sun... but as the air ascends into the sky, the pressure drops which means the temperature also drops (we'll explain this a bit more below). This change in temperature causes condensation which forms liquid water droplets. These water droplets sit on bits of dust in the sky and clump together to form clouds.

We are going to create clouds from a water bottle by mimicking the same cooling and condensing process that happens in the atmosphere.

Questions:

1. What do we mean by:
 - (a) Volume
 - (b) Pressure
 - (c) Temperature

2. When we twist a plastic water bottle (like in the picture above)... what happens to the:
 - (a) Volume
 - (b) Pressure
 - (c) Temperature

(compared to before you twisted it)

Hint: take a look at your bottle. Think about how much space is inside it before and after twisting.

Experiment: what you need

- Plastic bottle with a twisty lid (similar to the picture above) and a small volume of water inside
- A bit of space (you don't want the bottle lid to take someone's eye out!)

Methods:

1. Find an empty plastic bottle with the lid on.
2. Keeping the lid on, twist the bottle (like you are twisting a salt or pepper shaker).



3. **Point the bottle away from you** and unscrew the lid (quickly). Watch a **puff of smoke escape from the bottle!**

Answers:

1. (a) Volume is how much space there is (in 3D... so above us, to the side of us and ahead of us/behind us)
(b) Pressure is the force exerted against an object
(c) Temperature is how hot or cold something is
2. (a) Twisting the bottle **decreases** the volume inside the bottle
(b) Twisting the bottle **increases** the pressure inside the bottle because the same amount of air is forced into a smaller space.
(c) Twisting the bottle **increases** the temperature inside the bottle because the air is whizzing around and knocking into each other and the bottle more which increased the temperature.



How did we form clouds from a bottle?

When you decrease the volume, you **increase** the **pressure**.

Imagine you are an angry air particle and someone put you in a small locked room. The room has a small volume. You don't like small spaces so you try to bang on the walls to get out. You are putting pressure against the walls. When you decrease volume, you increase pressure.

Now imagine you are a golfer invited to a big fancy golf resort. The golf course is huge, the volume of your surroundings is large. You walk freely around the course. There are no walls to bang against. The volume is large and the pressure is low. You feel no pressure at all,

there's so much space!

When you decrease volume, you **increase** the **temperature**.

Now imagine you are the angry air particle in the locked room again. You are banging against the walls and you work up a bit of a sweat. Your temperature increases. When you decrease volume, you increase temperature.

So, how is this like clouds?

When we twist the bottle, we are increasing the temperature inside the bottle (because temperature is related to volume and pressure). This is like the hot air rising up into the sky to form clouds

When we open the lid, we are exposing the hot air in the bottle to the cooler air outside. This is just like the hot air in the atmosphere cooling as it rises.

Therefore we cause condensation to happen at the end of the bottle, just like it happens all the way up in the sky to form clouds!

If you want to learn a bit more about why volume, pressure and temperature are related, have a look at Boyle's Law and Charles' Law. They were physicists from hundreds of years ago who worked out a relationship between these!