

# Cloud in a Bottle

*This project demonstrates the formation of Clouds. Participants will be able to explain the interaction of dust particles and water vapor.*

**Number of Participants:** 1

**Audience:** Elementary (ages 5-10) and older

**Duration:** 10 minutes

**Difficulty:** Level 3

**Materials Required:**

- Rubber Stopper
- Foot or Hand Air Pump
- 70% Isopropyl Alcohol
- 2 Liter Bottle



**Setup:**

1. If your rubber stopper does not have a whole in the middle, use a small hand drill to drill a hole.
2. Place the pump needle through the hole of the rubber stopper. It is important for this to be a tight fit to avoid any air escaping.
3. Pour 2-3 tablespoons of Isopropyl Alcohol in the 2 Liter bottle.
4. Coat the bottle evenly by spinning it around multiple times.
5. Place the rubber stopper into the opening of the bottle and ensure that it is a tight fit.
6. Pump air into the bottle about 8-10 times with your hand on top of the rubber stopper.  
*Smaller bottles will require less pumps of air.*
7. While still holding the stopper, quickly pull off the rubber stopper. A cloud should have formed inside the bottle.

***Warning: Building too much pressure in this bottle can be dangerous. Hold on to the stopper while pumping air or the stopper will pop out. Do not put too much air in risk of the bottle exploding.***

**Presenter Brief:**


The presenter should have a basic understanding of meteorology. The alcohol acts as dust, making it something that water vapor can cling on to. The air that is pumped in causes an immense pressure that warms the bottle, making the molecules interact with one another. When releasing the rubber stopper (thus the pressure), the water vapor condenses quickly onto the alcohol droplets, which forms a cloud.

**Vocabulary:**


- Evaporation: The process when liquid turns to vapor.
- Vapor: A substance in a gas phase that has a lower temperature than its critical temperature.
- Condensation: The process when vapor turns into a liquid or gas.
- Precipitation: When any product of condensation falls to a surface.
- Pressure: Physical force exerted on or against an object.

## Physics & Explanation:

### Elementary (ages 5-10):

 *Water vapor clings on to dust particles in the air.*


In the air there are very tiny water droplets, so small that they are difficult to see. The water vapor is created from a process called evaporation. Evaporation is when water from a surface level is heated and the water turns into an invisible gas known as *vapor*. An example of evaporation is when the water from a small puddle dries up!

 *Clouds form when water vapor condenses.*


Water vapor droplets jump on to particles like volcanic ash, dust, soil particles, etc. As soon as these droplets reach a cooler temperature, the water vapor cools down so much it transforms into small water droplets that form a cloud. This is known as condensation.

In our experiment, the Isopropyl Alcohol acts as the dust and pumping air into the bottle makes it warm. When we suddenly release the rubber stopper, the temperature changes very quickly. This is what makes the cloud.

### Middle (ages 11-13) and general public:

 *Water vapor clings on to dust particles in the air.*


In the air there are very tiny water droplets, so small that they are difficult to see. Oceans and smaller pools of water help provide these droplets through a process known as Evaporation. Evaporation is when water from a surface level is heated enough to turn the water into an invisible gas known as *vapor*. Evaporation can occur to any wet object, like a beach towel!

 *Clouds form when water vapor condenses.*


Water vapor droplets become attached to particles like volcanic ash, dust, soil particles, etc. The heat that causes the vapor to rise eventually drops in temperature and the pressure changes dramatically, making it difficult for the air to hold all of the water it once did before. As these droplets cold down, the water vapor transforms into small water droplets that form a cloud. This is known as condensation. Condensation is one of the beginning processes of the water cycle, and contributes to rain clouds, snow, and other weather storms.

In our experiment, the Isopropyl Alcohol acts as the dust and pumping air into the bottle changes the pressure and the temperature. When we suddenly release the rubber stopper, there is a drastic change in pressure and temperature, forming a cloud.

### **Highschool (ages 14+):**

 *Water vapor clings on to dust particles in the air.*

In the air there are very tiny water droplets, so small that they are difficult to see. Oceans and smaller pools of water help provide these droplets through a process known as *evaporation*. Evaporation is when water from a surface level is heated enough to turn the water into an invisible gas known as *vapor*. Heat is known to have the ability to cause objects to expand/rise, making it an influential part of the evaporation process. Evaporation can occur to any wet object that is heated enough.

 *Clouds form when water vapor condenses.*

Water vapor droplets become attached to particles like volcanic ash, dust, soil particles, etc. The heat that causes the vapor to rise eventually drops in temperature and the pressure changes dramatically, making it difficult for the air to hold all of the water it once did before. The release in pressure makes the area cool and the water vapor transforms into small water droplets that form a cloud. This is known as condensation. Condensation is one of the beginning processes of the water cycle, and contributes to rain clouds, snow, and other weather storms.

In our experiment, the Isopropyl Alcohol acts as the dust and pumping air into the bottle changes the pressure and the temperature. When we suddenly release the rubber stopper, the pressure drops dramatically which cools the air inside the bottle, forming a cloud.