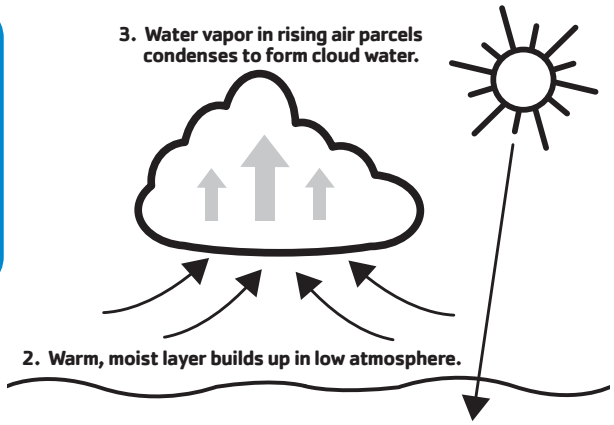
CLOUD IN A BOTTLE

Cloud formation is part of the water cycle, but one we usually cannot see up close. In this demonstration, students directly observe a cloud form right before their eyes.

A cloud is a large collection of very tiny water droplets or ice crystals. The droplets are so small and light that they can float in the air. When warm air rises, it expands and cools. Cool air cannot hold as much water vapor as warm air, so some of the vapor condenses onto tiny pieces of dust that are floating in the air and forms a tiny droplet around each dust particle. When billions of these droplets come together they become a visible cloud.



OBJECTIVES:

- Describe and illustrate the water cycle and associate parts of the cycle with weather conditions.
- Observe and describe changes to the properties of water when it is heated or cooled and associate these changes with weather conditions.

MATERIALS:

- **clean, clear 2L plastic bottle**
- **cork or #3 black rubber stopper**
- **bicycle pump with ball inflating needle**
- **toothpick**
- **rubbing alcohol**
- **safety goggles**

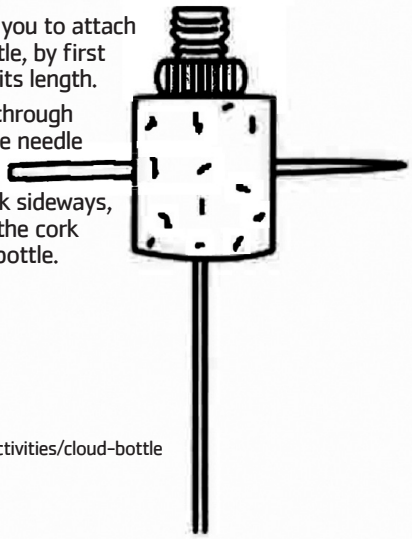
KEY QUESTIONS:

- **What is a cloud made of?**
- **In what conditions does a cloud form?**
- **What happens when we pump air into the bottle? What is happening to the molecules?**
- **What happens to the gas molecules when we open up the bottle?**
- **How does the cloud in the bottle differ from clouds in the sky?**

WHAT TO DO:

PREPARATION

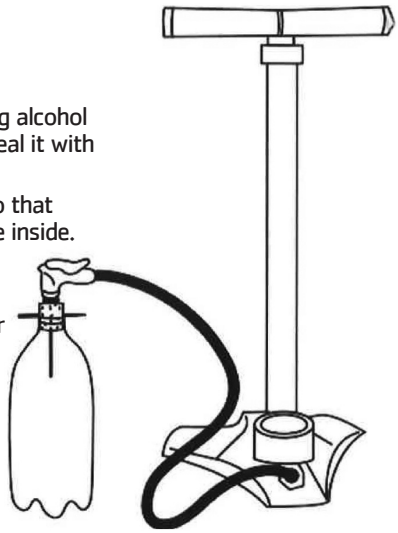
1. Create the plug that will allow you to attach a bicycle pump to the pop bottle, by first cutting the cork to about half its length.
2. Push the ball inflating needle through the cork, so that the end of the needle pokes out of the end.
3. Insert a toothpick into the cork sideways, to create a barrier that stops the cork from being pushed inside the bottle.



https://www.scienceworld.ca/resources/activities/cloud-bottle

DEMONSTRATION

1. Pour about 60ml of rubbing alcohol into an empty bottle and seal it with the prepared stopper.
2. Tilt and shake the bottle so that the alcohol coats the entire inside.
3. Attach the bike pump and add four pumps of air.
4. Quickly remove the stopper and watch the cloud form.
5. To repeat the effect, reattach the stopper and add more air.



SAFETY TIPS

- Use only a small amount of rubbing alcohol. Pour back the excess.
- Everyone near the demonstration must wear goggles. Over pressurization of the bottle may cause it to rupture or explode.

EXPLANATION

This demonstration shows how water in the atmosphere can be made visible by changes in : pressure. Pumping air inside the bottle compresses the molecules and heats them up, causing them to evaporate into gas. When you pull the cork out, you lower the air pressure letting the gas molecules expand and cool. Warmer air rushes out and cooler air rushes in. As it cools the gaseous vapor condenses into liquid particles forming tiny suspended droplets. A "cloud" or fog forms. Although real clouds are formed from water droplets we use rubbing alcohol in this demonstration because it evaporates more readily than water and creates a more dramatic example of what happens in the water cycle.

EXTENSIONS:

- Describe the three main types of clouds and learn how they form
- Make a cloud journal, sketching and labeling the clouds they observe over the course of the day or days.

EXTENSIONS:

Science World Resources I Full Unit I Weather
Science World at TELUS World of Science I School Programs I Whether the Weather
Gordon R. Gore I Catalyst for Science I Clouds (Lesson 5)