

# Nucleation Activity

## Cloud in a Bottle

### *Purpose*

You will explore the conditions needed to condense water vapor to the liquid.

### *Materials*

basketball pump, hose, rubber stopper, 2-L PETE bottle with LC thermometer strip inside, warm water, matches

### *Overview*

In the vapor phase, water molecules are separated from each other. In the liquid, the molecules are all in close contact. There is a big difference between how the molecules behave and interact in the two phases. How do they make the change? Are there certain conditions that make it easier than others?

### *Procedure*

Because this activity involves gases under pressure and small objects that may fly through the air, *all members* of a group working on this activity **MUST WEAR SAFETY GOGGLES**. True, goggles are neither comfortable nor stylish. But it's all fun and games...until somebody loses an eye.

1. Pour some warm water into the 2-L bottle. Cover the mouth of the bottle. Shake and swirl the bottle for a few seconds. Pour out the water.
2. If it is not already assembled, connect the hose to both the pump and the rubber stopper so that air expelled from the pump comes out through the narrow end of the stopper. Place the stopper securely in the mouth of the bottle. It is best if one person holds the stopper in the mouth of the bottle and another operates the pump.
3. Pump a few strokes of air into the bottle until the bottle becomes hard. Wait 30 seconds for the temperature to equilibrate. *Gently* release the pressure by releasing the stopper. What do you see inside the bottle?
  
4. Light a match. When its phosphor has burned down, blow it out. Drop the smoldering match into the bottle.
5. Connect the pump to the bottle as before. Pump a few strokes of air into the bottle until the bottle becomes hard. Wait 30 seconds for the temperature to equilibrate. *Gently* release the pressure by releasing the stopper. What do you see inside the bottle?

6. Connect the pump to the bottle once again. Pump a few strokes of air into the bottle until the bottle becomes hard. What do you see inside the bottle now?

7. Repeat a few more times until you think you understand what is happening.

Remove the burnt match from the bottle and clean up any water or other debris from your table.