Heading

**How Can You Make a Cloud?**

**Introduction**

**Purpose**

This activity is designed to help students investigate cloud formation and the variables involved.

**Discussion**

Cloud formation is related to Temperature (average kinetic energy of air molecules), pressure (collision of air molecules), condensation nuclei (smoke), and moisture.

Air is most often cooled adiabatically in the atmosphere (*a change in temperature due to a change in pressure and NOT heat*). Adiabatic cooling is a main reason for cloud formation and occurs when air rises. No heat is withdrawn from air. Air pressure decreases with elevation (as air rises) and therefore expands. The expanding air loses kinetic energy as the molecules slow down, decreasing temperature (cooling). Since cold air holds less water vapor (moisture) than warm air, some of the vapor will condense onto tiny clay and salt particles called condensation nuclei.

**Hypothesis**

**Equipment**

Transparent 2-liter bottle with cap Heat Source Thermometer (optional)

Kitchen matches Ice Water

**Procedures**

1. Put a small amount (10-15 ml) of tap water into the 2-liter bottle.

2. Light a match directly above the opening of the bottle and hold it down inside the bottle to make smoke. You can drop the match into the bottle after 2-3 seconds.

3. Put the lid on the bottle tightly.

4. Shake the bottle to add moisture to the air inside the bottle.

5. Squeeze the bottle, then release it quickly and observe what happens inside the bottle.

6. Squeeze the bottle and hold, observing what happens.

7. Release the bottle and observe what happens.

8. Repeat the squeezing and releasing several times, observing what happens inside the bottle.

9. Repeat procedures 1 – 8 but add ice to the bottle instead of water. You may have to crush the ice to get it into the bottle’s opening.

10. Repeat procedures 1 – 8 but add hot water (~50 °C) to the bottle instead of tap water. It does NOT have to be boiling. *Be careful not to get burned*.

11. Repeat procedures 1 – 8 using tap water again. However, this time try to burn the match for at least 6 seconds. You may have to use two matches in succession.

**Calculations and Data**

1. Create a data table for all of your results. You may use a table similar to the following:

|  |
| --- |
| Observations of Making a Cloud |
| Bottle Set Up | When Squeezing the Bottle | After “Releasing” the Bottle |
| 10-15 ml tap water |  |  |
| 10-15 ml ice water |  |  |
| 10-15 ml ~50 °C water |  |  |
| 10-15 ml tap water, more match burning time |  |  |

2. Include two pictures of the experiment: one when the bottle is “squeezed” and another when the bottle is “released” to clearly show the average results obtained.

3. Make observations that are thorough by considering:

* the relative amount of cloud (fog) formed for each condition,
* the location of the cloud (fog),
* the speed at which the cloud (fog) formed for each condition,
* whether the observation changed from the initial squeeze and release compared to after several times.

**Conclusion**

*Be sure to address the following in your conclusion section:*

* *Hypothesis*
* *Analysis*
* *Answer the questions below*
* *Error*

**Questions**

1. What four (4) major variables were used in this experiment to create a cloud? (*HINT: consider the type of water used, your action on the bottle, etc.*) What aspect of the experiment represents each of the variables (e.g. smoke 🡪 match)?

2. Generally speaking, how do clouds form in the atmosphere? Specifically, according to this experiment, how did the cloud form?

3. What happened to pressure and temperature of the air inside the bottle when you squeezed the bottle? How does this affect the amount of moisture held by the air? What happens in terms of cloud formation?

4. What happened to pressure and temperature of the air inside the bottle when you released the bottle? How does this affect the amount of moisture held by the air? What happens in terms of cloud formation?

5. Why were different temperatures of water (tap, ice, hot) used in the bottle? *Hint: consider air moisture and how that relates to cloud formation.*

6. What impact did burning the match longer have on the experiment? How does this relate to cloud formation?

**Error**

**Inquiry**

* Experiment with different temperatures of water and different amounts of smoke in the bottle for this activity.
* Research and learn all you can about how clouds form in the atmosphere. What causes changes in pressure in the atmosphere, and how does this affect temperature? And what do pressure and temperature have to do with cloud formation?

**Bibliography**