

MONDAY MORNING SCIENCE BLAST

Let It Snow! - Physical Science - Chemistry

Have you ever looked at a snowflake and wondered how it formed or why it looks different from other snowflakes you might have seen? Snowflakes are a particular form of water ice. Snowflakes form in clouds, which consist of water vapor. When the temperature is 32° F (0° C) or colder, water changes from its liquid form into ice. Several factors affect snowflake formation. Temperature, air currents, and humidity all influence shape and size. Dirt and dust particles can get mixed up in the water and affect crystal weight and durability. The dirt particles make the snowflake heavier, and can cause cracks and breaks in the crystal and make it easier to melt. Snowflake formation is a dynamic process. A snowflake may encounter many different environmental conditions, sometimes melting it, sometimes causing growth, always changing its structure.

The shape a snowflake has depends on the conditions existing when the snowflake forms. Generally, six-sided hexagonal crystals are shaped in high clouds; needles or flat six-sided crystals are shaped in middle height clouds; and a wide variety of six-sided shapes are formed in low clouds. Colder temperatures produce snowflakes with sharper tips on the sides of the crystals and may lead to branching of the snowflake arms (dendrites). Snowflakes that grow under warmer conditions grow more slowly, resulting in smoother, less intricate shapes.

You have probably heard that no two snowflakes are exactly the same. This is both true and false. No two snowflakes are *exactly* identical, down to the precise number of water molecules, spin of electrons, isotope abundance of hydrogen and oxygen, etc. On the other hand, it is possible for two snowflakes to look exactly alike, and any given snowflake probably has had a good match at some point in history. Since so many factors affect the structure of a snowflake and since a snowflake's structure is constantly changing in response to environmental conditions, it is improbable that anyone would see two identical snowflakes. In this lab, your students will be learning the processes involved in the formation of a snowflake.

PLEASE NOTE: It is important that good safety practices be present while doing this activity. This includes the use of safety goggles and having an ADULT pour the boiling water into the jars while using an oven mitt or hot pad.

To begin, instruct your students to cut a pipe stem cleaner into three equal pieces, twisting the sections to form a six-sided snowflake shape as shown in the picture. They will trim their snowflakes to the desired shapes, assuring that the snowflake will fit into the jar without having to bend. Now instruct your students to tie the string to one of the snowflake arms, then tie string around the outer edges to make a snowflake pattern as shown in the picture and tie the other end of the string to the dowel, taping the string so that it does not move on the dowel. Next instruct your students to wind the string on the

dowel so when the dowel is placed across the mouth of the jar, the snowflake will hang in the jar without touching the bottom of the jar.

IMPORTANT: THE FOLLOWING STEP SHOULD BE DONE BY AN ADULT OR WITH ADULT SUPERVISION. Boil 1 pint of water using the hot plate or a stove and a small kettle. Once the water is boiling, **CAREFULLY** remove the kettle and fill the pint jar with the boiling water, then add 1 or 2 drops of blue food coloring to the water. While the water is still hot, have your students add borax 1 tablespoon at a time, stirring to dissolve the borax before adding the next tablespoon of borax; they should be able to dissolve 5 or 6 tablespoons of borax in the boiling water. Now instruct your students to hang their pipe stem cleaner snowflake into the jar so that the dowel rests on top of the jar and the snowflake is completely covered with the liquid and hangs free. The jars should be allowed to sit in an undisturbed location overnight. When your students return to the classroom the next day, have them remove their snowflakes from their jars after they have remained in the borax water for 24 hours.

The final step will be for your students to carefully observe their snowflakes, using magnifying lenses to look closely at the crystals that make up their snowflakes. Students are then to draw detailed pictures of their snowflakes in the Data Section, attempting to show as much detail as possible.

This simple experiment can be modified in a variety of ways. Students can investigate how the mass of the borax crystals varies with the amount of time in the liquid by comparing the dry mass of the snowflake with the final mass of the snowflake after crystallization has been allowed to take place. They can investigate how variations in the concentration of the borax solution affects crystallization. Or they can use additional pipe stem cleaners and string to make more complex snowflakes. Have fun but remember - SAFETY FIRST.

Let It Snow

QUESTION: What processes are involved in forming a snowflake?

MATERIALS:

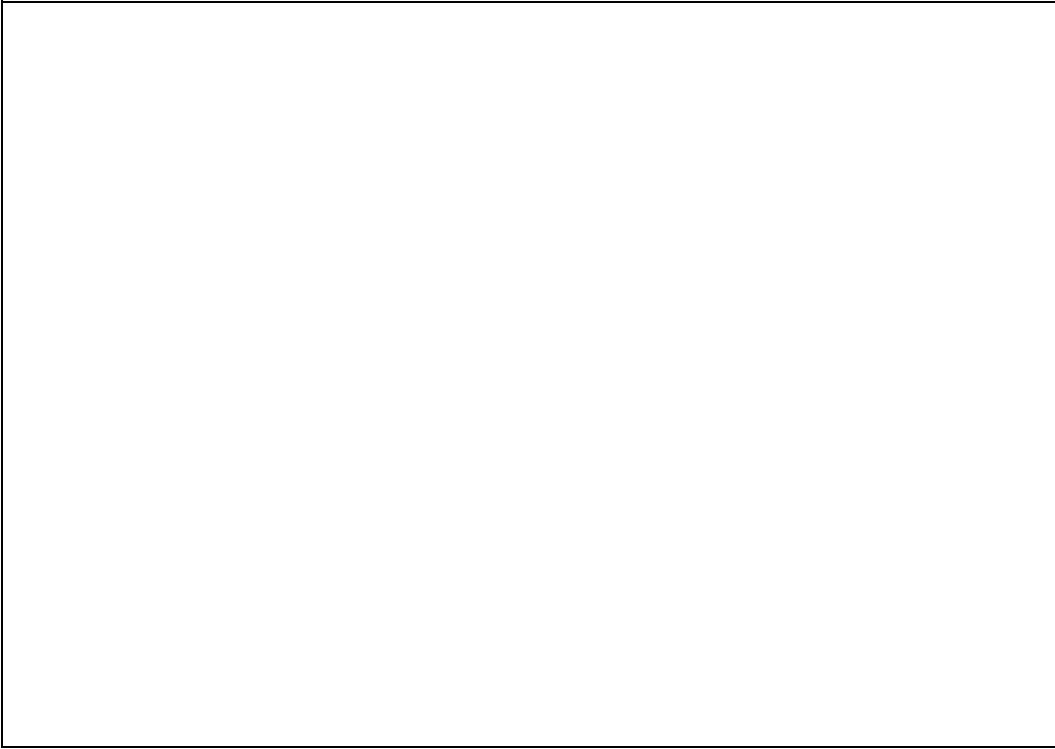
borax (do not use Boraxo soap)	pipe stem cleaner (white)
dowel - 8" (or pencil)	string
food coloring (blue)	tablespoon
hot plate	scissors
pint jar (wide mouth)	water (boiling) - WITH ADULT HELP

CAUTION: This should **ONLY** be done under adult supervision. Safety goggles should be worn throughout the activity. An oven mitt should be used when pouring the boiling water into the jar.

PROCEDURE:

1. Cut the pipe stem cleaner into three equal pieces. Twist the 3 sections together to form a six-sided snowflake shape. See the picture below.
2. Trim your snowflake to the shape you desire. The snowflake should fit into the jar without having to bend. Tie the string to one of the snowflake arms.
3. Now tie string around the outer edges to make a snowflake pattern. See the picture below. Tie the other end of the string to the dowel. Place a piece of tape to tape the string so it does not move on the dowel.
4. Wind the string on the dowel so when you place the dowel across the mouth of the jar the snowflake hangs in the jar without touching the bottom of the jar.
5. Use the hot plate or a stove and a small kettle to boil 1 pint water. Once the water is boiling, **CAREFULLY** remove the kettle and fill the pint jar with the boiling water. **THIS SHOULD BE DONE BY AN ADULT OR WITH ADULT SUPERVISION.** Add 1 or 2 drops of blue food coloring to the water.
6. Add borax 1 tablespoon at a time, stirring to dissolve the borax before adding the next tablespoon of borax. You should be able to dissolve 5 or 6 tablespoons of borax in the boiling water.
7. Hang the pipe stem cleaner snowflake into the jar so that the dowel rests on top of the jar and the snowflake is completely covered with the liquid and hangs free.
8. Allow the jar to sit in an undisturbed location overnight. Remove the snowflake from the jar after it has remained in the borax water for 24 hours.
9. Carefully observe your snowflake. Use a magnifying lens to look closely at the crystals that make up the snowflake. In the Data Section draw a detailed picture of your snowflake. Try to show as much detail as possible.



DATA:**QUESTIONS:**

1. What process caused the crystals to form on the pipe stem snowflake?
2. Why was it necessary to leave the snowflake in the jar undisturbed for 24 hours?
3. Why is it necessary to boil the water before adding the borax?
4. What is the shape of the crystals that formed on the pipe stem cleaner?
5. What do you think would happen if you left the “snowflake” in the borax solution for 2 or 3 days?