

Name: _____ Per: _____ Date: _____

Frosted Ornament Lab

Aim: To use ionic properties of salts to make a frosted ornament.

Background: Based on their ionic nature, salts dissolve in water, a polar, molecular compound. Many salts are more soluble at higher temperatures and less soluble at lower temperatures. When a salt is dissolved in warm water and then cooled, the particles slow down and the attractive forces of the ion overcome the repulsive forces of the water and crystals form out of the solution. The ornament serves as a surface upon which the crystals can form.

Vocabulary:

Salt:

Solute:

Solvent:

Crystallization:

Holiday:

Materials:

Pipe cleaners

Thread

Large Beaker

Water

Borax (Sodium Tetraborate ($\text{Na}_2\text{B}_4\text{O}_7$))

50mL Beaker

Scoopula

Stirring Rods

Hot Plate

Procedure:

1. Create an ornament by configuring pipe cleaners into a desired shape (no larger than 7 cm in any dimension).
2. Tie thread to hang ornament, leaving a sufficient amount to create a loop at least 15cm in length. Tag the ornament thread with the name of the artist so that it can later be identified.
3. Fill 600 mL beaker to between 400-500mL with water. Bring to a boil.
4. Add approximately 1 50mL beakerful of Sodium Tetraborate, stirring to dissolve. Stir until all solute is dissolved. Add an additional 50mL beaker of Sodium Tetraborate and stir until it also dissolves.
5. Remove beaker from heat.
6. Hang ornament on thread from stirring rod. Lower rod into beaker so that the ornament does not touch the sides, bottom, nor any other ornament in same beaker (depending on the size of the beaker it may have more than one ornament).
7. Allow solution to cool for 1-2 days. When cool, carefully remove ornament, separating any excess crystals. Let dry and display for all to enjoy.

Questions:

1. Sodium Tetraborate is an ionic compound of a metal ion (Sodium) and a polyatomic ion (Tetraborate). Based on the chemical formula shown in the materials list, what is the formula and charge of the tetraborate ion?
2. Describe the forces of attraction that result in the dissolving of the salt (consider the nature of both the water molecule and the salt crystal).
3. Explain why salts might be more soluble at higher temperatures.
4. Given that the forces of attraction between the salt ions remain the same during the dissolving/recrystallization process, why might the salt reform as the solution cools? HINT: Recall that temperature is a measure of average kinetic energy.
5. Describe the shape of the crystals which formed.
6. Based on your knowledge of ionic compounds, are the crystals likely to be brittle or malleable? _____
How will this influence your handling of your ornament?