

# Growing Crystals Two Ways Using Supersaturated Solutions

## WHAT IS A SUPERSATURATED SOLUTION?

A supersaturated solution is a mixture that can't hold any more particles. Like with the salt/borax here, we have filled all the space in the water with salt/borax and the rest is left behind.

Water molecules are close together in cold water, but when you heat the water up, the molecules spread away from each other. This is what allows you to dissolve more salt/borax in the water than you normally could. It even appears cloudy.

As the solution cools down there is all of a sudden going to be more particles in the water as the molecules move back together. Some of these particles will start to fall out of the suspended state they were once in, and the particles will start to settle on the pipe cleaners as well as the container and form crystals. Once a tiny seed crystal is started, more of the falling material bonds with it to form bigger crystals.

Crystals are solid with flat sides and symmetrical shape and will always be that way (unless impurities get in the way). They are made up of molecules and have a perfectly arranged and repeating pattern. Some might be bigger or smaller though.

You can try these experiments with cold water to compare the difference in the amount of salt/borax needed to get this mixture, and you can compare the results of the crystals afterward.



### Make a Star with Pipe Cleaner

The simplest way to make it is to cut 4 to 6 same-length pipe cleaners, and then connect them at the middle point of each. Make sure to have a hanging hook if you plan to hang it.

## Grow Salt Crystals

### Supplies

--Pipe cleaners      --Salt      --Hot Water      --Tray OR Paper Plate (needs to be about ¼ inch deep)

### MAKING A SUPER SATURATED SOLUTION FOR GROWING SALT CRYSTALS

1. First you need to start with hot water, so this is an adult only step if needed. I microwaved about 2 cups of water for 2 minutes.
2. Now, it's time to add the salt. I added 1 tbs. at a time, stirring very well until completely dissolved. You can feel the point at which it's not gritty as you stir. {Close to 6 tbs. for me}
3. Do this with each tablespoon until you can't get rid of that gritty feeling. You will see a bit of salt on the bottom of the container. This is your super saturated solution.
4. **BEFORE** you pour the solution, move your plate or tray to a quiet location that won't be disturbed. It's easier than trying to do it after you have added the liquid.
5. Pour your mixture over the pipe cleaners just covering them with a thin layer of the solution.
6. Now you just need to give your pipe cleaners time to form the salt crystals. Plan to allow approximately 2-3 days for this activity so you can let some of the water evaporate. I feel the salt stays on the ornament better if you take it out of water while it is still damp.



### Attleboro Public Library

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# Grow Borax Crystals

## Supplies

--Pipe cleaners    --Borax    --Hot Water    --Glass or Jar    --Popsicle stick OR Pencil    --String

**\*\*note:** Plastic cups are generally not recommended for growing the best crystals.. When you use plastic cups, the saturated solution can cool too quickly leaving impurities to form in the crystals. The crystals will not be as sturdy or perfectly shaped. If you can use a glass or a glass jar, you will have better results

## MAKING A SUPER SATURATED SOLUTION FOR GROWING BORAX CRYSTALS

1. First you need to start with hot water, so this is an adult only step if needed. I microwaved about 2 cups of water for 2 minutes.
2. Now, it's time to add the Borax. The ratio of Borax powder to hot water is 3:1. You want to dissolve 3 tablespoons of borax powder for each cup of boiling water. This will make a saturated solution.
3. Tie the pipe cleaner to the popsicle stick using the string. Balance the popsicle stick across the mouth of the glass/jar. Make sure that it is fully submerged, but not touching the sides of the glass/jar. You can loosely cover the jar to keep the water hot for longer.
4. You want to set the glass/jar in a quiet place where it won't be disturbed. No tugging on the string, stirring the solution, or moving the glass/jar around! It needs to sit still to work.
5. After a couple of hours, you will see some changes. Later on the night you will see crystals growing! You want to leave the solution alone for 24 hours.
6. Make sure to keep checking to see the stage of growth the crystals are in! This is a great opportunity for making observations.

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## The Science Behind The Salt Crystals

The salt is made of Sodium (Na) and Chlorine (Cl) atoms. While in water, the Na and Cl are separated by water molecules (H<sub>2</sub>O). As the water evaporates, the Na and Cl atoms begin to bond together sharing a pair of electrons called ionic bond. While more salt molecules form, they bond together, forming crystals. The crystal shape for salt is cube. This shape is definitely visible on all the ornaments you make.

To make it fun, observe the salt crystals under a magnifying glass. Are they shaped like cubes?

Salt crystal ornaments are fun to make. It is an easy STEAM project combining science and art. If you do like I did, using plates for salt water, and put a little salt as crystal starting seeds, you will get the crystals pretty quickly.

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## The Science Behind The Borax Crystals

Crystal growing is a fun chemistry project involving liquids, solids and soluble solutions. Because there are still solid particles within the liquid mixture, if left untouched, the particles will settle to form crystals.

Water is made up of molecules. When you boil the water, the molecules move away from one another. When you freeze water, they move closer to one another. Boiling hot water allows for more borax powder to dissolve to create the desired saturated solution.

You are making a saturated solution with more powder than the liquid can hold. The hotter the liquid, the more saturated the solution can become. This is because the molecules in the water move farther apart allowing more of the powder to be dissolved. If the water is colder, the molecules in it will be closer together.

As the solution cools down there is all of a sudden going to be more particles in the water as the molecules move back together. Some of these particles will start to fall out of the suspended state they were once in, and the particles will start to settle on the pipe cleaners as well as the container and form crystals. Once a tiny seed crystal is started, more of the falling material bonds with it to form bigger crystals.

Crystals are solid with flat sides and symmetrical shape and will always be that way (unless impurities get in the way). They are made up of molecules and have a perfectly arranged and repeating pattern. Some might be bigger or smaller though.

**You can reuse the Borax solution over and over!** Bring it to boiling in the microwave, and add more water and Borax as needed.