



Crystal Growing Science



Children love creating and watching their own crystals grow. This is a great activity where children can practice patience and sharpen their keen observation skills. You will find there are many ways you can grow crystals. Choose the one you already have the supplies for or the one that supplies are easily accessible (amazon, grocery store, etc.). You could try a couple different recipes and have the kids make comparisons.

What are crystals and how do they form? With these crystals growing science experiments, you will grow crystals of your own to find out more about these fascinating and beautiful wonders!

A crystal is a solid material with atoms and molecules that are arranged in a consistent repeating pattern, creating one of seven geometrical shapes. Crystals can be expensive and beautiful, like amethysts or diamonds. But they can also be found right in your kitchen in the form of sugar and salt! You can easily grow crystals by adding a crystal-forming chemical to water and waiting for the water to cool or evaporate.



Quick Crystal Cup

Some crystal growing science projects can take several days. But this super-easy recipe gives you a cup full of needle-like crystals in just a few hours!

Supplies:

- Epsom salt
- Food coloring
- Cup, small bowl or jar



What You Do:

- In the beaker, stir 1/2 cup of Epsom salts with 1/2 cup of very hot tap water for at least one minute. This creates a saturated solution, meaning no more salt can dissolve in the water. (Some undissolved crystals will be at the bottom of the glass.)
- Add a couple drops of food coloring if you want your crystals to be colored.
- Put the beaker in the refrigerator.
- Check on it in a few hours to see a beaker full of crystals! Pour off the remaining solution to examine them.

What Happened:

Epsom salt is another name for the chemical magnesium sulfate. The temperature of the water determines how much magnesium sulfate it can hold; it will dissolve more when it is hotter. Cooling the solution rapidly encourages fast crystal growth, since there is less room for the dissolved salt in the cooler, denser solution. As the solution cools, the magnesium sulfate atoms run into each other and join together in a crystal structure. Crystals grown this way will be small, thin, and numerous. To grow large single crystals, you'll need to follow the evaporation procedure in the next project.



Growing Gems

You can grow single, large crystals that look like gems by using a seed crystal. Here's how to do it:

What You Need:

- Alum (you can often find this in the spice aisle of the grocery store)
- Clean beaker or jar
- Saucer or shallow dish
- Pencil
- Fishing line (or something similar)



What You Do:

1. In one beaker, slowly add alum to 1/4 cup of very hot tap water, stirring to dissolve. Keep adding the alum until no more will dissolve: this is a saturated solution. Pour a little bit of this solution into a shallow dish or saucer and let it sit undisturbed overnight. Make sure you only pour the clear solution, not any of the undissolved material. (You can pour it through a coffee filter if necessary.)
2. The next day you should see small crystals growing in the dish. When they look to be a good size, carefully pour off the solution.
3. Make another saturated alum solution with about 1/2 cup of hot water. Pour the solution into a clean beaker or jar; avoid pouring any undissolved material.
4. Remove the biggest and best-looking of the small crystals from the saucer to use as your seed crystal.
5. Get someone to help you tie the fishing line to the seed crystal. This can be

tricky; a pair of tweezers will help! If you need to, you can score a groove in the crystal to hold the line in place.

6. Tie the other end of the fishing line to a pencil, then set the pencil across the top of the jar so the seed crystal is suspended in the alum solution without touching the sides or bottom of the jar. (You may need to adjust the length of the fishing line: just wrap it around the pencil until it is the right length.)
Note: if your seed crystal starts to dissolve, that means your solution isn't saturated enough. Remove the seed quickly and add more alum to the solution, filtering off any undissolved particles.
7. Cover the jar with a paper towel to keep out the dust and let your crystal grow until you are happy with its size. When you take it out of the solution, set it on some plastic wrap to dry.
8. Note: if you see other crystals growing in the jar, transfer the solution and seed crystal to another clean jar.

What Happened:

The small crystals that formed in the saucer grew because of *nucleation*. A few alum molecules found each other in the solution and joined together in a crystal pattern. Other alum molecules continued to join them until enough molecules gathered to become a visible crystalline solid. (Chemists call that a crystal "falling out of" the solution.) If you left these crystals in the solution they would continue to grow, but they wouldn't get very big because they would all be competing for the remaining alum molecules in the solution. Instead, you took one crystal and used it as the only nucleation site in the solution. It was the primary site for the alum molecules to join together, so the crystal could grow quite large!



Rock Candy Sticks

Get ready to watch some cool crystals grow! And when you're done, you can eat them or give them away.

What You Need:

- 1 1/2 cups of white sugar
- 1 cup of water
- Small plate
- A spoon
- A glass
- Wax paper
- Saucepan
- Stove
- Several small clean jars
- Cake pop sticks or wooden skewers
- Food coloring (optional)
- An adult to help you



Note: You can make Rock Candy without sticks. Use a piece of clean cotton string or thread. Follow steps 2-7 below then dip the string into the solution so that half of the string is coated. Take the string out and let it dry. Once the string has dried, tie the clean end around a pencil and put the dipped end back into the glass of sugar water solution, balancing the pencil across the rim of the glass. Make sure the string does not touch the bottom or the sides of the glass, or your crystals will not form right! When your piece of “rock candy” is as big as you want it to be (about one week), take it out of the glass, let it dry, and enjoy!

What You Do:

1. Fill a glass with water, pour some sugar on a small plate, and lay out a sheet of waxed paper. Dip one end of each stick (cut pointed ends off if you use skewers) into the water and then roll it in the sugar, tapping it gently to remove excess. Set each stick to dry on the waxed paper.
2. Pour the cup of water into the saucepan and add 1/2 cup sugar. Stir it well until no more sugar will dissolve. Add more sugar (1/2 cup at a time) until you can't get any more to dissolve even after stirring for several minutes. You should end up with about 1 1/2 cups sugar dissolved in the saucepan. It's OK if there is some undissolved sugar at the bottom of the pan. (You now have a saturated sugar solution.)
3. Ask an adult to help you heat the sugar mixture on the stove until it boils, stirring the whole time. Turn the heat to medium-low and keep stirring until all the sugar dissolves. (Now you have made a supersaturated solution!)
4. Keep cooking the liquid and stirring it until it becomes clear, but not for more than 5 minutes, or it will get too hot and turn into hard candy! Turn off the stove as soon as it starts to look clear.



5. Move the pan off the heat and allow it to cool down until the pan is no longer hot (the sugar solution will still be slightly warm).
6. Have an adult slowly pour the thick sugar solution into the jars. Fill each about 2/3 full, or enough so that sugar solution will cover several inches of your sugar-coated sticks.

7. Add 5-6 drops of food coloring to each jar and stir.
(Optional: Only do this step if you want to make different colors of rock candy!)



8. Once the solution is cool and the sugar-coated sticks are completely dry, place several sticks into each jar.

9. Carefully move the jars to a place where they won't be disturbed. Check them every other day and gently stir the sticks around in the sugar solution to break up any large crystals forming on the surface.



10. Within a few days, you should start to see crystals growing on the sticks. After about one week, you will probably have a lot of crystals. When your "rock candy" crystals are as big as you want them to be, take them out of the jars and set each color of candy in a clean glass to dry.

11. Once they are dry, you can wrap in cellophane food wrap and tie with ribbon for a sweet gift! Or just have fun eating them.

What Happened:

In step two you made a saturated solution—there was so much sugar in the water that it couldn't dissolve any more sugar and some was left in the bottom of the pan. Once the saturated solution started to heat up, the water was able to dissolve even more sugar and a supersaturated solution was formed in step three. Then, as the solution cooled, the sugar molecules in it started to join with the sugar molecules on the sticks. The sugar on the sticks are called “seed” molecules and the sugar molecules in the solution attached themselves to the seed molecules.

Meanwhile, the water in the solution started to evaporate or dry up into the air, leaving only sugar molecules behind. More sugar molecules gradually joined with the ones already on the stick, forming larger crystals. Because all of the solute molecules are the same (they are all sugar), they all form the same shape of crystals and they all stick together, making a big chunk of sugar crystals that are pretty to look at and tasty to eat!

Note that this is a special science project that is safe to eat because you only used food products, not chemicals. Plus, you used clean dishes from your kitchen. Never eat any experiment unless it is made entirely out of food and you only used clean dishes to prepare it!

Sparkly Pipe Cleaner Hanging Crystal

In this project, you use a chemical called Borax to grow crystals shaped like stars, snowflakes or hearts. Then you can use them as pretty decorations!



What You Need:

- Wide-mouth jar
- Pipe cleaners
- String
- Scissors
- A pencil
- Water
- 1-cup measuring cup
- Tablespoon
- Borax
- Food coloring (optional)
- Glow-in-the-dark paint (optional)
- Ribbon (optional)

What You Do:

1. Twist pipe cleaners into whatever shape you'd like (we chose a simple star). Note: Make sure your pipe cleaner shape will fit easily into your jar with plenty of space around the mouth of the jar as the shape will be slightly wider once crystals have formed on it, making it harder to remove!



2. Tie a piece of string to one point of the shape. Tie the other end around the middle of a pencil.
3. Hang the shape in the jar with the pencil resting across the mouth of the jar. Make sure that it hangs without touching any part of the jar. Take it out of the jar and set it aside.
4. Use a 1-cup measuring cup to count how many cups of water you need to fill your jar about 3/4 full. Then microwave the jar of water for 3-5 minutes or until it begins to boil. Have an adult carefully take the jar out using hot pads (the jar will be very hot!) and set it on a heat-safe surface.
5. For every cup of water you put in the jar, measure three tablespoons of Borax. Stir the Borax solution with a spoon until as much of it dissolves as is possible. If you don't see any tiny pieces of Borax floating around in the jar, add another tablespoon and stir. This will make a saturated solution.
6. Hang your pipe cleaner shape in the jar so that it is completely covered in the solution. Let it sit overnight. Gently remove your now crystal-covered shape in the morning and let it dry by setting it in a dry glass.
7. Optional: To make colored crystals, use colored pipe cleaners and add 5-10 drops of food coloring to the solution in step five. To make your snowflakes glow in the dark, paint the pipe cleaner shape with glow-in-the-dark paint in step one and let it dry completely before continuing. Once the crystals have dried, cut off the string and tie a ribbon to one point of your crystallized shape to make a Christmas tree ornament! These ornaments are fairly sturdy and make lovely Christmas gifts for friends, teachers, or family members.

What Happened:

As in the rock candy project, you made a saturated solution of Borax, which is a chemical that forms crystals when the conditions are right. By mixing it with hot water and letting it cool and having something for the Borax (solute) molecules to attach to (the pipe cleaner shape), you gave the solution the right conditions to grow crystals! Once the crystals started to grow on your shape, more and more crystals formed around them. Ice crystals that real snowflakes are made of are not quite like these Borax crystals, but they do look sort of similar and they both are pretty and sparkle when light shines on them.



Real ice crystals are made only of water. The difference is that they are formed when water vapor in clouds freezes and falls to the ground as snowflakes! Frost is another form of ice crystals that you might see on windows and grass on cold mornings.

Salt vs. Sugar

How can you tell the difference between sugar and salt crystals? They're both crystals and they look very similar—they are both small, white-colored grains. Of course, if you tasted each of them, you would know right away which one was salt and which was sugar because they taste very different. In this project you will find out how to tell sugar and salt apart just by looking at them!

What You Need:

- A teaspoon of table salt
- A teaspoon of white granulated sugar
- Two sheets of black construction paper
- A magnifying glass
- Crystals worksheet (attached)

What You Do:

1. Put a teaspoon of salt on one sheet of black paper and a teaspoon of sugar on the other.
2. Use your fingers to spread the grains apart a little so you can see them better. Now look closely at the grains on each sheet of paper and compare how they look. Do you notice any differences between the two?

3. Now use your magnifying glass to look up close at a few grains of the salt. What shape are they? Are they all about the same shape? Draw their shape in the correct spot on the worksheet.
4. Now take a look up close at a few grains of the sugar. What shape are they? Are they a different shape from the salt crystals? Do you notice anything else that makes them look different from the salt? Draw their shape on the worksheet.

What Happened:

Sugar and salt grains are actually tiny crystals. Can you tell if the picture to the left is salt or sugar? It's sugar!

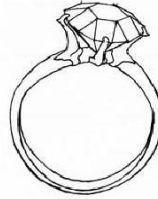
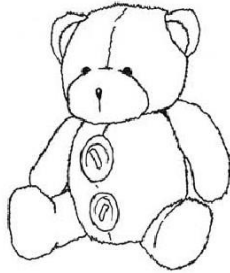
If you were to make a saturated solution of salt and one of sugar, you would be able to see them grow into much larger crystals, but they would always have the same shape as these tiny crystals do! The salt crystals are cube shaped (like dice) and have six sides. The sugar crystals are very rough looking and are shaped more like rectangles with pointed ends.

Most of the crystals are the same shape and size and look very similar to each other, but you probably saw a few crystals on your paper that looked a little different. Those crystals probably had pieces broken off of them, or there might even be more than one crystal stuck together, making them look different from the others. Also, the coloring of the crystals is a little different. Sugar crystals look very clear and sparkly while salt is duller and looks more white-colored or frosted.



Crystals

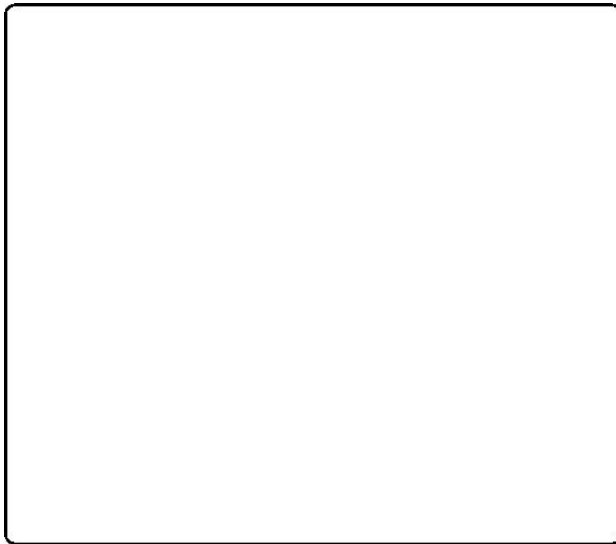
Circle the picture that doesn't have any crystals. Color the pictures



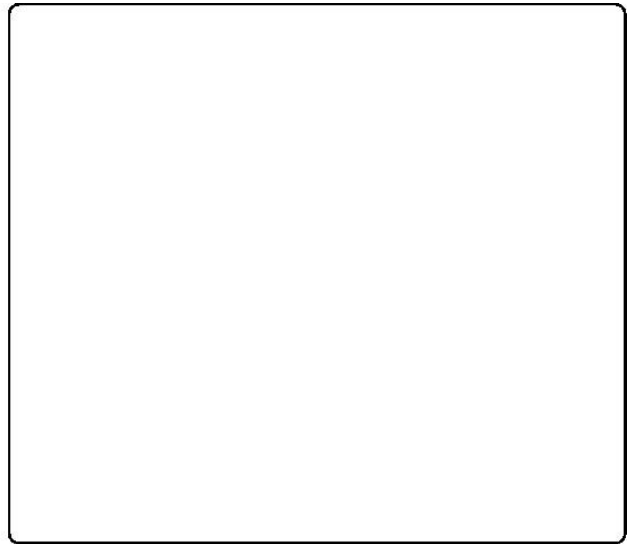
Salt vs Sugar

What to Do:

1. Pour some salt onto a piece of black paper and look at it with a magnifying glass.
2. Draw the shape of the crystals in the correct box below.
3. Do the same thing with the sugar on another sheet of black paper.



salt



sugar

Take what you have learned and experiment and be creative. Try something new!

Crystal Egg Geode Experiment

This is a fun one to try, using those plastic eggs you might have around the house. Or you can use the shells of real eggs (and still eat the eggs – waist nothing).



Forming Borax Geode Crystals:

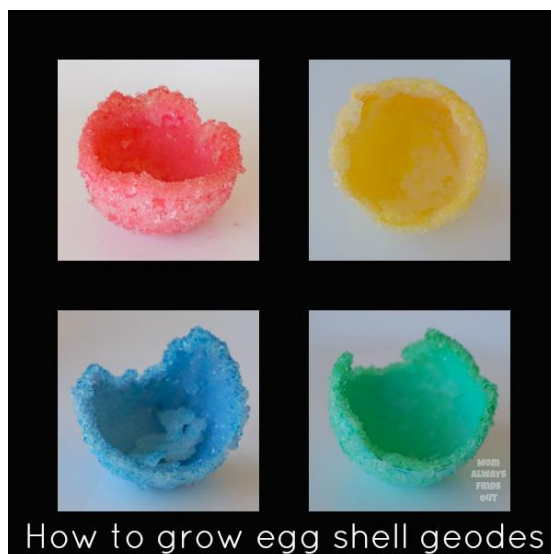
- Eggshells (save them when cooking)
- White glue
- Small paintbrush
- Borax
- Hot Water
- Food Coloring
- One jar per every eggshell



1. **PREP EGGSHELLS AHEAD OF TIME:** You will need to prepare your eggshells by peeling off the inner membrane. Wash and dry the eggshells, then head to step 2.
2. Use a small paintbrush to paint the eggshell inside and out with a layer of white glue. Allow to dry completely overnight.
3. Prepare as much of the hot water/borax solution as needed for your jars. Use 3 Tablespoons of Borax for every 1 cup of boiling water. Stir until Borax is completely dissolved and pour into jars. Use about 1 cup per jar (use enough water to completely cover your eggshell in the following steps). Add a few drops of food coloring to each jar.

4. Carefully place one eggshell per jar. Make sure the shell is submerged in the borax/water solution. Put the jars in a place where they will not be disturbed. Allow them to sit overnight. Crystals will begin forming as the solution cools.
5. Remove eggshells from jars and allow to dry.

It will take about an hour for you to be able to see the crystals beginning to form on the eggshells. The eggshells in the photos show crystal formation after 8 hours in the solution.



Forming Alum Geode Crystals:

- Eggshells (save them when cooking)
- White glue
- Small paintbrush
- Alum powder (They are NOT all the same! More on this in a moment.)
- Hot Water
- Food Coloring
- One jar per every eggshell



1. Prepping the eggshells: follow the same steps as above, if using real eggshells.
2. **Adding the seeding agent ...**

To help seed your crystals you need to add some alum powder to the shells. To do this simply paint the insides of the shells (recommend a little on the outside edge too so your crystals “spill” over the sides), with a generous amount of standard white glue. Ensure you cover the whole area.

3. Then sprinkle a tablespoon of alum powder over all the glue. Shaking it around to ensure you have coated the entire thing. Let sit overnight to dry completely.

4. Making the saturated solution

The next step is to create your super saturated solution so your crystals will form. To do this bring 2 cups of water just to boiling. Remove from heat, but before it can cool, add 3/4 cup of alum powder and stir until it dissolves.

5. Coloring the solution

Divide the solution evenly into two mason jars. Add a generous amount of food coloring, about 20 drops, to each mason jar. Stir. Let the solution cool for about 30 minutes.

6. Add the egg

Carefully place one egg in each jar. Use a spoon to gently push it down, so it falls to the bottom of the jar. Leave it to sit for at least 12 hours. I left some for up to 24 hours.

7. Reveal your egg geode

Once it is finished, use a spoon to gently lift the egg geode from the solution. Let dry.

Failure to Success – The Importance of Alum Ingredients

Seems easy right? And really this experiment is SUPER easy. Until it isn't and you have a massive experiment fail. We had that happen. That's when we learned that not all alum powders are the same. Some alum powders have additives that you may not realize without careful ingredient list analysis.

We had two types of alum powder - some from the bakery section of the grocery store and cheaper alum powder from online.

The alum powder from the grocery store worked perfectly. The online alum powder failed miserably. You will see crystals starting to form in the first few hours, so you'll know if something isn't right.

Salt Crystal Feathers Science Experiment



Supplies:

- Faux feathers
- Salt (1 regular size box of salt makes enough for 3 feathers)
- Mason jars
- Clothespins



1. Make your salt crystal water. Fill your mason jars with water. Then, pour that water into a pot and add salt. Boil the water until the salt dissolves.
2. Keep adding salt until the pot forms a layer of crystallized salt on top of the boiling water. It looks a bit like ice. When you have that much salt in the water, you know it will work. In fact, it works quite quickly.
3. Pour the salty water into the mason jars. At this point, you'll have a layer of salt in the bottom of the pot. You can leave that out of your containers. They will crystallize just fine without it.
4. Grab the end of your feather with a clothespin so you can suspend it over the center of the jar.
5. Dip the feather into the jar and set it in a sunny window.

Make Borax Crystal Flowers



Supplies:

- Borax
- Water
- Fake flowers
- Pencils
- String
- Tape
- Spoons
- Containers
- Paper Towels

Directions:

1. Remove any leaves from your fake flowers.
2. Tie the flower stems to your pencils using string. Dangle your flower heads into your containers. Make sure that the flower heads don't touch anything else (like the container's bottom or side, or other flowers.) Adjust the placement of your flowers and string lengths as necessary. Then, remove the flowers from the plastic containers. (You don't want them to touch anything else because you don't want your crystal flowers attaching to other things.)
3. Boil your water. Pour it into your empty container. Then, dissolve spoonfuls of Borax one at a time until the Borax no longer dissolves. Then, place your flowers into your container and let them sit there for a couple of hours.

Note:

- If your pencils keep rolling, use tape to keep them still.
- You may have some undissolved Borax on the bottom of your container. That's totally fine.

4. After a couple of hours, pull the flowers out and see how crystallized they've become. When you have enough crystals to your liking, set the flowers to dry standing up.

Note: If you're having trouble removing the crystal growth from the bottom or sides of the container, simply pour boiling water into the container again to dissolve the crystals.

Walking Crystals



Supplies:

- 2 x jars or glasses
- String or wool (as long as your arm)
- 2 x paper clips
- Very warm water
- Bi-Carb soda or baking soda
- Spoon

1. Begin by filling the glasses with warm water and stirring a teaspoon of Bi-Carb soda into each. Continue to add teaspoons of Bi-Carb soda until it will not dissolve any more.
2. Slide a paper clip onto each end of the piece of wool or string. Don't wrap it around the paper clip (as shown) as it will struggle to sink. Just slide it on so that it acts as a weight and keeps it in place.



3. Set everything up as shown above. Be sure to have the string sag in the middle and a tray of some kind ready to catch any drips. The string will soak up the liquid and begin making crystals over a period of a week.



This is what it will look like after a week!

If you follow this method of making crystals you will possibly find that the glasses themselves develop crystals. Don't worry, Bi-Carb soda will not cause any damage. These glasses washed up bright and sparkling from the Bi-Carb soda.

Why does this happen?

The wool soaks up the liquid and once the water evaporates all that is left is the crystals from the Bi-Carb soda. I think it's pretty cool and a great way to make daily observations.

Sources:

<https://babbledabbledo.com/>

<https://learning-center.homesciencetools.com/>

<https://littlebinsforlittlehands.com/>

<http://www.pinkstripeysocks.com/>

<https://www.steamsational.com/>

<https://www.steampoweredfamily.com/>

<http://www.momalwaysfindsout.com/>

<https://www.instructables.com/>

<https://laughingkidslearn.com/>