

Learn About Crystals

You may know that many materials around us are made up of **atoms**. Some materials (for example Iron, Aluminium) are made up of just one type of atom. These materials are called "**elements**". Many other materials are made up of two or more types of atoms combined into something bigger, called "**molecules**". Water is a good example. Vinegar and soap are examples of more complex molecules.

Many of these materials can be in a solid, liquid or gaseous state, depending on the temperature. Water is normally liquid, but becomes solid (ice or snow) when the temperature drops below 0 deg. Celsius and becomes a gas (steam) when heated above 100 deg.C.

When they become solids, if the conditions are right, the molecules come together in complex, repeating patterns, called **crystals**. Snow flakes are an excellent example, but they are hard to see and observe because they melt in your hands!

But we can use a number of other materials and make some quite beautiful crystals to study at leisure.

Crystals may take a few days to grow. So be patient - it will be worth the wait.

Safety First

Adult supervision is required as you will be dealing with hot water. Please take care.

You will also materials such as Epsom Salts, which are not harmful, but do read the instructions on the packet.

1. Let's Start with Small Crystals

You will need a few items that are not in the Starter Kit for this.

- Some Epsom Salts. You can get this at a Chemist or Supermarket, probably with the bath salts.
- A drop of food colouring.
- Pipette or dropper (provided)
- Some aluminium foil.
- A glass tumbler that can hold about 1-2 cups of liquid.

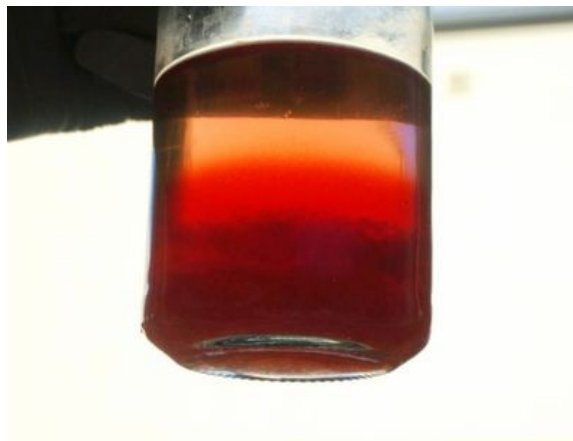
Start by putting 1/2 cup of hot water into the glass container. Add 1/2 cup of Epsom salts and stir for at least a minute.

The Epsom Salts will dissolve as you stir the solution, but there will come a point where nothing more will dissolve and there will be a little left at the bottom. This is called a "saturated" solution.

Now add a couple drops of food colouring using the dropper provided. This is simply to help you see the crystals. They also look beautiful!

Cover the tumbler with aluminium foil place it in the refrigerator.

After several hours you will see crystals deposited on the bottom of the glass. You can pour out the remaining liquid and study the crystals. Make notes of what you see, so that you can compare with other experiments later.



What Happened Here?

By using hot water, we were able to dissolve more of the Epsom Salts (Magnesium Sulphate) than we could with cold water. But when it cools, some of that Salt becomes solid again and form crystals. By cooling it quickly in the refrigerator, the growth happened quicker, but you can try just leaving it to cool naturally as well.

See if it makes a difference to the result.

2. Decorative Crystals from Sugar

In this experiment we will use **white sugar** to grow crystals on chopsticks or something similar. They can be quite attractive and even used as decorations!

You will need a few items that are not in the Starter Kit:

- Some white sugar
- A few drops of food colouring - more than one colour if possible
- A small paper plate.
- Baking paper
- Saucepan
- Stove
- Several small clean glass jars
- Wooden chopsticks, kebab skewers or similar
- Some glue



Safety First

You will be heating some liquids, so **adult supervision** is definitely required. Please take care.

To start your crystals:

- Put a little sugar on a paper plate or saucer
- Apply a little glue on the narrow end of the chopsticks and roll that end in the sugar, tapping it gently to remove any excess.
- Now set the sticks out on some baking paper, to dry.

Next:

- Pour about a cup of water into the saucepan and add about 50 g (about 2 Tablespoons) of sugar and stir it well until the sugar is dissolved.
- Now add more sugar about 50 g at a time and keep stirring until you reach a point when no more sugar will dissolve and some undissolved sugar remains at the bottom of the saucepan.
- This is called a **saturated solution**.

For this next step, you **need an adult** to help you.

- Heat the saturated sugar solution on the stove, until it boils, stirring all the while.

- Turn the heat down to low and keep stirring. You will notice the undissolved sugar now dissolving in the hot liquid. Keep heating gently and stirring until everything is dissolved.
- This is now a **super-saturated** sugar solution.
- Keep cooking the liquid and stirring it until it becomes clear. Turn off the stove as soon as it begins to look clear.
- Now allow the pan to cool until the sugar solution is still slightly warm.
- Pour the sugar solution into the glass jars. Fill each about 2/3 full.
- Add a few drops of food colouring into each jar and stir. You can try as many colours as you like.
- Wait for the solution to cool a little more, then place a couple of the sugar-coated sticks that you prepared earlier, in each jar.
- Keep the jars in safe place where they will not be disturbed, but you can view them easily.
- Check them every day. If you find large crystals forming on the surface, just stir the liquid gently with the sticks to break them up.

You will see crystals begin to grow on the sticks. The little bit of sugar you stuck on with glue helps the crystals get started. After about a week, you will should see a lot of colourful crystals growing on the sticks.

What Happened Here?

Just like the first experiment, you started by making a saturated solution where no more sugar would dissolve. When it was heated up, the water was able to dissolve some more sugar and a **super-saturated** solution was formed.

Then, as the solution cooled, the sugar molecules in the solution began to join the sugar molecules on the sticks. The sugar on the sticks are called “seed” molecules, which the crystals a starting point.

Left for several days, the water in the solution gradually evaporates, leaving only sugar molecules behind. So more sugar molecules gradually join those already on the stick, forming even larger crystals. *Now can you guess why you had to break up any crystals forming on the surface?*

Because there is only one substance (sugar) all the dissolved molecules are the same (they are all sugar). So they all form the same shape of crystals and they all stick together. If you look carefully at the crystals formed on the stick, you may be able to make out the same basic shape being repeated.