

What Are Crystals?

A solution is a substance formed by dissolving a solute in a solvent. For example, salt water is a solution of salt (the solute) dissolved in water (the solvent). Water is called the universal solvent because it can dissolve many solutes.

Crystals are structures that are formed from a regular repeated pattern of connected atoms or molecules (very small particles of a substance). Crystals grow by a process called nucleation.

During nucleation, the atoms or molecules that will crystallize are dissolved into their individual units in a solvent. The solute particles contact each other and connect with each other. As they connect, they form an object that is larger than an individual particle, so more particles will contact and connect with it. Eventually, this crystal nucleus becomes large enough that it falls out of solution, creating a crystallized solid. Other solute molecules will continue to attach to the surface of the crystal, causing it to grow until a balance or equilibrium is reached between the solute molecules in the crystal and those that remain in the solution.

The Basic Technique

- Make a saturated solution.
- Start a garden or grow a seed crystal.
- Continue growth.

In order to grow a crystal, you need to make a solution which maximizes the chances for the solute particles to come together and form a nucleus, which will grow into your crystal. This means you will want a concentrated solution with as much solute as you can dissolve (saturated solution). Sometimes nucleation can occur simply through the interactions between the solute particles in the solution (called unassisted nucleation), but sometimes it's better to provide a sort of meeting place for solute particles to aggregate (assisted nucleation). A rough surface tends to be more attractive for nucleation than a smooth surface. As an example, a crystal is more likely to start forming on a rough piece of string than on the smooth side of a glass.

Make a Saturated Solution

It's best to start your crystals with a saturated solution. A more dilute solution will become saturated as the air evaporates some liquid, but evaporation takes time (days, weeks). You will get your crystals more quickly if the solution is saturated to begin with. Also, there may come a time when you need to add more liquid to your crystal solution. If your solution is anything but saturated, then it will undo your work and actually dissolve your crystals! Make a saturated solution by adding your crystal solute (e.g., alum, sugar, salt) to the solvent (usually water,

although some recipes may call for other solvents). Stirring the mix will help to dissolve the solute. Sometimes you may want to apply heat to help the solute dissolve. You can use boiling water (or sometimes you can heat the solution on the stove, over a burner, or in a microwave, but be aware of how your solution will react to this before doing it).

Growing a Crystal Garden

If you just want to grow a mass of crystals or a crystal garden, you can pour your saturated solution over a substrate (rocks, brick, sponge), cover the setup with a paper towel or coffee filter to keep out dust, and allow the liquid to slowly evaporate.

Growing a Seed Crystal

On the other hand, if you are trying to grow a larger single crystal, you will need to obtain a seed crystal. One method of getting a seed crystal is to pour a small amount of your saturated solution onto a plate, let the drop evaporate, and scrape the crystals formed on the bottom to use as seeds. Another method is to pour saturated solution into a very smooth container (like a glass jar) and dangle a rough object (like a piece of string) into the liquid. Small crystals will start to grow on the string, which can be used as seed crystals.

Crystal Growth and Housekeeping

If your seed crystal is on a string, pour the liquid into a clean container (otherwise crystals will eventually grow on the glass and compete with *your* crystal), suspend the string in the liquid, cover the container with a paper towel or coffee filter (don't seal it with a lid!), and continue to grow your crystal. Pour the liquid into a clean container whenever you see crystals growing on the container.

If you selected a seed from a plate, tie it onto a *nylon* fishing line (too smooth to be attractive to crystals, so your seed can grow without competition), suspend the crystal in a clean container with saturated solution, and grow your crystal the same way as with seeds that were originally on a string.

Keeping Your Treasures

Crystals that were made from a water solution will dissolve somewhat in humid air. Keep your crystal beautiful by storing it in a dry, closed container. You may wish to wrap it in paper to keep it dry and prevent dust from accumulating on it. Certain crystals can be protected by being sealed with an acrylic coating (like Future floor polish), although applying the acrylic will dissolve the outermost layer of the crystal.