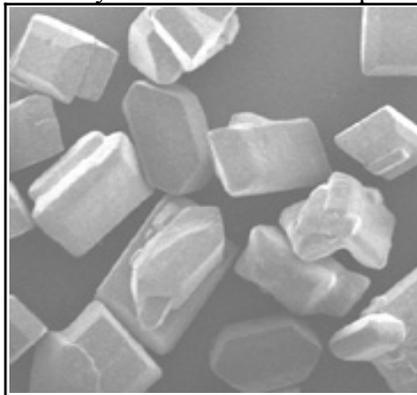




recipe:
Rock Candy

When you make rock candy, you can see the shape of sugar crystals on a giant scale. The key is giving them lots of time (about 7 days) to grow. As the water evaporates, sugar crystals form on the string or stick, and the shapes that they form reflect the shape of individual sugar crystals.



Under a microscope, you can see that sugar crystals aren't cubes, exactly, but oblong and slanted at both ends.

(Image courtesy of Nutrition and Food Management Dept., Oregon State University)

What happens when you heat a sugar solution?

When you add sugar to water, the sugar crystals dissolve and the sugar goes into solution. But you can't dissolve an infinite amount of sugar into a fixed volume of water. When as much sugar has been dissolved into a solution as possible, the solution is said to be saturated.

The saturation point is different at different temperatures. The higher the temperature, the more sugar that can be held in solution.

When you cook up a batch of candy, you cook sugar, water, and various other ingredients to extremely high temperatures. At these high temperatures, the sugar remains in solution, even though much of the water has boiled away. But when the candy is through cooking and begins to cool, there is more sugar in solution than is normally possible. The solution is said to be supersaturated with sugar.

Supersaturation is an unstable state. The sugar molecules will begin to crystallize back into a solid at the least provocation. Stirring or jostling of any kind can cause the sugar to begin crystallizing. (Images courtesy of FEI Co)

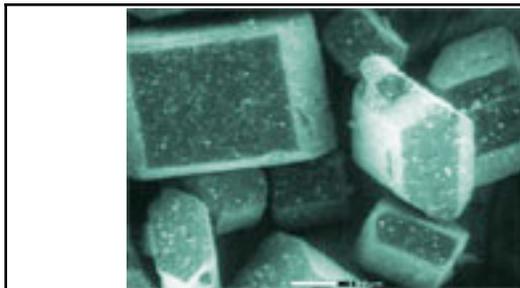
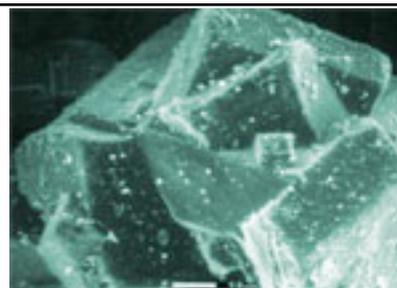


Table sugar crystals, magnified 100 times



Rock candy crystals, magnified 250 times

Notice that the shapes of the rock candy crystals are very similar to those of the sugar crystals. That's because rock candy is made up of many sugar crystals that have grown together.

Did You Know?

Rock candy is one of the oldest and purest forms of candy. It was originally used by pharmacists to make medicines for many kinds of illnesses.

CAUTION: When making candy, the syrup gets **very** hot. Kids, don't try this without the help of an adult!

What Do I Need?

- 4 cups sugar
- 2 cups water
- a small saucepan
- a wooden spoon
- a candy thermometer
- a small, clean glass jar
- a measuring cup
- cotton string
- a weight to hang on the string (such as a screw or galvanized washer)
- waxed paper
- a pencil (to suspend the string in the jar)

What Do I Do?

1. Heat the water in the saucepan over medium-high heat until it comes to a boil.
2. Completely dissolve the sugar in the boiling water, stirring continuously with the wooden spoon until the solution grows clear and it reaches a rolling boil.
3. Remove the solution from the heat, and then carefully pour it into the jar. Cover the jar with a small piece of waxed paper.
4. Tie the weight to one end of the string, and then tie the other end to the middle of the pencil. The string should be about two-thirds as long as the jar is deep. Dip the string into the sugar solution, remove it, lay it on a piece of waxed paper, straighten it out, and let it dry for a few days.

• Why does the string need to be soaked and then dried?

The string will provide the surface on which the crystals will grow. As water evaporates from the string, small crystals of sugar will encrust the string. These tiny *seed crystals* provide starting points for larger crystals. Future growth will be concentrated around these points.

5. Gently suspend the prepared string in the solution and let sit at room temperature, undisturbed, for several days. You can check each day to see how much your crystals have grown. It's tempting, but don't touch the jar until the experiment is finished—it usually takes about seven days.

• What makes the crystals grow?

Two different methods will contribute to the growth of the crystals on the string. You have created a *supersaturated* solution by first heating a *saturated* sugar solution (a solution in which no more sugar can dissolve at a particular temperature) and then allowing it to cool. A supersaturated solution is unstable—it contains more *solute* (in this case, sugar) than can stay in a liquid form—so the sugar will come out of solution, forming what's called a *precipitate*. This method is called **precipitation**.

The other is evaporation—as time passes, the water will evaporate slowly from the solution. As the water evaporates, the solution becomes more saturated and sugar molecules will continue to come out of the solution and collect on the seed crystals on the string. The rock candy crystals grow molecule by molecule. Your finished rock candy will be made up of about a quadrillion (1,000,000,000,000,000) molecules attached to the string.

6. At the end of the week, the crystals on your string should be clearly defined, with sharp right angles and smooth faces of various sizes. In the field of crystallography, these are called *monoclinic* crystals. Their shape is determined by the way the individual sugar molecules fit together, which is similar to the way the shape of a pile of oranges is determined by the shape of the individual oranges and the way they stack together.

What Else Can I Try?• Try adding food coloring or flavoring to your sugar syrup before making the rock candy.