**Model Project - Crystallization**

1. **Purpose** – I chose this model because the concept of crystallization is interesting. I thought doing sugar crystallization would be attention getting because the process results in rock candy and almost anything involving food and/or candy will get a student’s attention. Developing the model with the students is important because it helps to teach the scientific process along the way.
2. **Description** - Crystals consist of matter that is made from an ordered arrangement of atoms, molecules or ions. Crystals are recognizable because there are repeated units. There are seven types of crystal structures or lattices. They include: cubic or isometric, tetragonal, orthorhombic, hexagonal, trigonal, triclinic, and monoclinic. The process of crystallization or solidification of molten rock is very interesting. The solidification process can take place either above ground or below ground. When the magma or molten rock begins to cool, atoms slow down and start to arrange themselves into orderly formations. The formations will continue to grow until they run out of room and all the liquid is transformed into crystals. One of the greatest influences on the size of the crystals is the rate of cooling. A slow rate of cooling will result in large crystal, while a faster rate of cooling produces smaller crystals in a more solid mass. Generally larger crystals form further below the surface then smaller ones.
3. **Materials needed** - One way to teach students about the process of crystallization is to grow them in the classroom using a super saturated solution of sugar and water. Here is what you need to demonstrate crystallization and directions for setting up this experiment.

* Gather your materials. You will need a pot to boil the water, 1 cup of water, 2-3 cups of granulated sugar, two pieces of string or yarn, a metal skewer, a pencil or laundry pin and three tall, drink glasses.
* A seed crystal is not necessary as long as you are using a rough string or yarn. You can also soak the string in the saturated solution and role the string in sugar.
* Tie the string to a pencil or laundry pin. If you have made a seed crystal, tie it to the bottom of the string. Set the pencil or laundry pin across the top of the glass and make sure that the string will hang into the glass without touching its sides or bottom. However, you want the string to hang nearly to the bottom. Adjust the length of the string, if necessary. Set up a second glass the same way. The third glass will have the metal skewer secured to a laundry pin and hanging into the glass.
* Boil 1 cup water. If you boil your water in the microwave, be very careful removing it to avoid getting splashed!
* Stir in the 2 to 3 cups of sugar, a bit at a time. Keep adding sugar until it starts to accumulate at the bottom of the container and won't dissolve even with more stirring. This means your sugar solution is saturated. If you don't use a saturated solution, then your crystals won't grow quickly. On the other hand, if you add too much sugar, new crystals will grow on the un-dissolved sugar and not on your string.
* If you want colored crystals, stir in a few drops of food coloring.
* Pour your solution into the clear glasses. If you have un-dissolved sugar at the bottom of your container, avoid getting it in the glass.
* Place the pencil or laundry pin over the glassed and allow the string to dangle into the liquid and in a third glass place a metal skewer.
* Set the glass somewhere where it can remain undisturbed. Put one of the glasses with a string into the refrigerator. If you like, you can set a coffee filter or paper towel over the glass to prevent dust from falling into the glass.
* Check on your crystals after a day. You should be able to see the beginnings of crystal growth on the string. If crystals are starting to grow on the glass, carefully transfer the sting unit to a clean glass and add the remaining liquid.
* Let the crystals grow until they have reached the desired size or have stopped growing. At this point, you can pull out the string and allow the crystal to dry. You can eat them or keep them. Have fun!
* Which glass will grow the most crystals? Metal or Yarn? What size will the crystals be in the refrigerated glass?

1. **Scale** – There will be about a quadrillion molecules attached to the string when the crystallization is complete. The rock candy will be about 250 times the size of an actual rock candy crystal.
2. **Target age** – This would be a wonderful demonstration/model for upper elementary students. I would use it for 3rd to 5th grade. They have the patience to wait and watch as the crystals grow. They also can handle an experiment not going as planned.
3. **Strengths and weaknesses** – The strengths of this model is that it shows the students in a fairly short amount of time the crystallization processes. I added some different components to the original model of rock candy – different growing mediums and growing temperatures. I felt that adding the diverse growing temperatures to give students a better idea of slow cooling vs. fast cooling crystallization. The weaknesses of this model are that an adult needs to handle the hot liquids and it is fairly easy to misjudge how much sugar should be added to the solution and how long and how hot it should get. This weakness can be used as learning experience about how challenging experiments and models can be to do.
4. **References**-

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