

Lesson Plan - Growing Crystals

We need to collect data to measure how effective our lesson is. Here is one way:

1. Distribute the **Knowledge Test** to all participants and emphasize to please not guess at the answers. Emphasize it's OK to mark "I Don't Know" since we are all here to learn more about this topic
2. Gather the completed tests and mark them all with a "1" to indicate they are the first set of tests
3. Go over the **Fun Facts** (see page 2) prior to the video. Mention these **Fun Facts** will also be in the video
4. Play the video and pause on the **Fun Facts** if you want to (repetition is the key to learning!)
5. Distribute the **Knowledge Test** and mark them all with a "2" to indicate they are the second set of tests

Guide to doing the experiment:

1. You will be cooling a hot solution over-night in a Cooling Container. A wide-mouth clear glass is great, but you can also use a 2-Cup Measuring Cup, Styrofoam Cups, Hot Coffee Cups, etc.
2. Know the size of your Cooling Container because you need your Pipe-Cleaner bent shape to fit inside the container with ~1/2" below and ~1/2" space on the sides
3. Start the kids off with each of them bending a pipe-cleaner into whatever shape they want to crystallize
4. They need to keep in mind that a string needs to be attached to a center-point to suspend it
5. If they are skilled, they can eliminate the pencil by attaching 3 stings to the object and bring the strings up and over the lip of the container and tape the stings to the outside (this is how the Snowflake in the video was suspended)
6. We think dental floss is the easiest "string" to find in a home, and it works great
7. The string will be taped down to hold the object in its suspended position. We used gift-wrapping scotch tape. Blue tape or Duct Tape is OK too
8. We recommend mixing 4 Tablespoons of Borax to 1 Cup of hot water. This ratio can go into solution at a lower temperature and is therefore safer, and the results are just as good
9. Two (2) minutes in the microwave is what we needed. The solution will be above 120F, so this is considered "scalding" water and care must be exercised
10. Pour the borax solution into the cooling container until the pipe-cleaner shape is covered. You can always make another batch of solution and top it off
11. Colored pipe cleaners are the best to use. It took more food coloring than expected (+10 drops) to get a tint of color into the crystalized shapes when white pipe cleaners were tested
12. Crystal formation can be seen after a couple of hours, but the experiment needs to sit overnight
13. Clean-Up: Hot sink-water will slowly dissolve the crystals off of your cups

Supplies/Tools Needed:

- Pipe Cleaners
- Measuring Cup
- Measuring Spoons
- Tall Glass Container
- Tape
- Dental Floss
- Pencil or Popsicle Stick

Materials Needed:

- Borax
- Water

Fun Facts about Crystals

- Snow flakes, Diamonds, Borax, and Salt are all examples of crystals
- Naturally made crystals usually have flaws
- Crystals form in a process called crystallization
- Crystals form in recurring, stable patterns
- Crystals can form in Squares, Hexagons, and Rectangles, but not Circles

Knowledge Test: Crystals

1. Snowflakes, Diamonds, Borax and Salt are all examples of crystals.
 - a. True
 - b. False
 - c. I don't know
2. Crystals form in shapes that include: Squares, Hexagons, Rectangles and Circles.
 - a. True
 - b. False
 - c. I don't know
3. Crystallization is the process of crystals forming.
 - a. True
 - b. False
 - c. I don't know
4. Naturally occurring crystals are always clear and flawless.
 - a. True
 - b. False
 - c. I don't know
5. Crystals form in random patterns.
 - a. True
 - b. False
 - c. I don't know

Answer Key: 1A, 2B, 3A, 4B, 5B