Western Engineering Outreach

Crystal Suncatchers
Grade 3-5

Meet Today's ENG HERO!

Sohrab Rohani - **Professor with Western Engineering**

Ray is a professor with the Chemical and Biomedical Engineering Department at Western University. He has PhD from the University of Wales in Process Control. He has research interests in crystallization. He also received an Engineering Medal in Research and Development from the Professional Engineers, Ontario, in 2008.

To learn more about Dr. Ray visit:

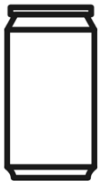
https://www.eng.uwo.ca/chemical/faculty/rohani_s/index.html

Learning Goal:

- Students be introduced to chemical engineering through crystal growth.
- Students will apply mathematical symmetry concepts.
- Curriculum Connections: Grade 3 - Strong and Stable Structures; Grade 5 - Properties of and Changes in Matter

Materials Needed:

- Clear plastic lids (such as the ones found on snack canisters, take out boxes or deli containers)
- Push pin
- Permanent markers
- Ornament hooks
- Measuring cup
- Hot water
- Epsom salts
- Spoon
- Cookie sheet



Engineering and Science Connections:

Today, we will learn about the formation of crystals. A crystal is made up of several highly ordered microscopic structures that form a crystal lattice that extends in all directions.

What's a Crystal?

A crystal is a solid material with atoms and molecules that are arranged in a consistent repeating pattern, creating one of seven geometrical shapes. Crystals can be expensive and beautiful, like amethysts or diamonds. But they can also be found right in your kitchen in the form of sugar and salt! You can easily grow crystals by adding a crystal-forming chemical to water and waiting for the water to cool or evaporate.

It is becoming more and more popular for engineers to grow certain crystals like sapphires and diamonds in labs instead of mining them. Lab diamonds are grown in highly controlled laboratory environments using advanced technological processes that duplicate the conditions under which diamonds naturally develop when they form in the mantle, beneath the Earth's crust. These man-made diamonds consist of actual carbon atoms arranged in the characteristic diamond crystal structure. Since they are made of the same material as natural diamonds, they exhibit the same optical and chemical properties.

There are many reasons engineers are working so hard to create diamonds in labs. Some reasons include that it is a more socially conscious option, but also because it is actually better for the environment. Environmental and green process engineers were searching for ways for mining to have less of an impact on the environment. There are many different methods of mining that can harm the environment, whether it's the direct destruction of an ecosystem or the pollution created in the process of mining different crystals.

What is symmetry?

The quality of being made up of exactly similar parts facing each other or around an axis. In other words, no matter how you look at a shape, it looks exactly the same on both sides!

Today we will be seeing how crystals grow, as well as creating our own patterns for what we want our crystal suncatchers to look like. One reason that people consider diamonds to be so beautiful is because of the cut they have. No matter what shape a diamond is cut into, it always uses symmetry, because humans are hardwired to find symmetrical things beautiful.

Video Recommendation: *Symmetry*

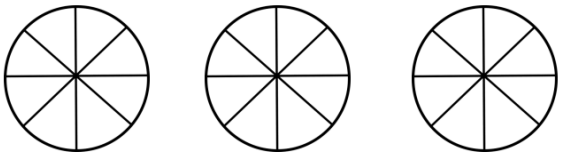
https://www.youtube.com/watch?v=YFzktJNmnPU

CRYSTAL SUNCATCHERS

Activity:

Before beginning, think about the following questions:

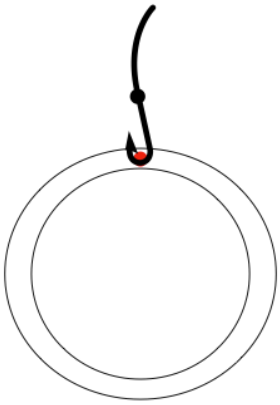
- **How many lines of symmetry does your design have?**
- **How much time do you think it will take for the crystal to grow?**
- **What do you think will happen?**



Part 1: Creating the Suncatcher Design

1. **Plan out what your suncatcher pattern is going to look like. Print out circle templates and draw a rough plan of what they will look like before creating your design on your suncatcher.**
2. **Make sure you are applying symmetry concepts to your design; the design should look the same in each quadrant of the circle.**
3. **Try and create 3 drafts for different designs and choose your favourite. Try to keep the designs fairly simple as the space you will have to work with on their suncatcher is not extremely large. Aim for at most 8 sections of symmetry but if you would like to use less than that you can.**

Part 2: Creating the Suncatcher



1. **Prep the project for hanging. Use the push pin to carefully poke a hole in the upper edge of the rim on the plastic lid (this is where it will hang from). It must be above the water line or in a section that will not have water poured into it or the project will leak. Repeat with remaining lids (if you plan on doing more than one suncatcher).**
2. **Once you have made the holes, thread an ornament hook through each of them.**
3. **Turn your plastic lids base up and have drawn your selected draft design with permanent markers on the undersides of the lids.**
4. **Let the hot water run for a moment before collecting about ¼ cup of water in the measuring cup.**
5. **Add approximately 4 tablespoons of Epsom salts (you want a 1:1 ratio between water and Epsom salts).**
6. **Stir the solution until the Epsom salts dissolve.**
7. **Line up the lids on your cookie sheet.**
8. **Pour Epsom salt solution into each lid.**
9. **Place the cookie sheet in a safe place. In about an hour, you will be able to see some crystals. As the water evaporates, it leaves behind the Epsom salts. The salts cluster together to form regular shapes called crystals. A similar process occurs in nature when minerals in cave water interact, creating stalactites.**
10. **It may take a day or two for the water to evaporate completely. Once the water has evaporated, carefully hang the suncatchers in a sunny window. The crystals will not form directly on the lines, they are just to show symmetry.**

What Did You Learn?

- What are the three states of matter?
- How crystals grow!
- What is a line of symmetry?

Future Learning

- Turn this activity into an experiment! Try to create crystals for different purposes! Try and change the mixture! Try to see how big of a crystal you can make. Will adding more Epsom salts make a bigger or smaller crystal? Will different salts work? Can you make crystals with other materials?

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
Facebook: @westernueng

Thanks for discovering with us!