



Science Unit: *Weather and Seasons*

Lesson 7: *Crystals*

School Year: 2010/2011

Developed for: McBride Elementary School, Vancouver School District

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Grade level: Presented to grades K and 1; appropriate for grades K – 7 with age appropriate modifications

Duration of lesson: 1 hour and 20 minutes

Notes: One adult is required for each of the stations that are run simultaneously (we had 3).

Objectives

1. Learn that snow is made up of water crystals, each a regular 6-sided shape.
2. Observe familiar items such as salt and sugar close-up, to discover they are crystals, each with their own regular square and oblong shapes.
3. Discover that making your own crystals is relatively simple, and use this process to merge science with art.

Background Information

This lesson was done when the students were likely to have seen snow this season. Snow is used as a jumping off point for further exploration of crystals and symmetry.

Vocabulary

crystal A solid of a repeatable, regular shape. The shape is always the same because of how the molecules pack together.

symmetrical (As in mirror symmetry) Identical on each side, so that a mirror placed along the centre will show the same whole shape.

Materials

- salt in a shaker
- two white pipe cleaners per student
- hinged pair of mirrors per student
- sugar in a shaker
- scissors to cut pipe cleaners
- triangles of paper and colored markers
- epsom salt crystals (they form in the crystal painting solution)
- a plastic cup per student
- black sheet of paper per student



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- white squares of paper to observe crystals on
- 10X magnifier loupes
- 3 tablespoons of borax in each cup
- a kettle of boiling water
- epsom salt solution (1:1 epsom salts:hot water). Use immediately.
- pencil and paint brush

In the Classroom

Introductory Discussion

a) Introduce crystals:

- Ask students if they have seen snow this year. Ask them what it is made from. Ask if they have looked at it closely. Show a photograph of snow close up, so that they can see the pointy shapes.
- Show images of individual snow crystals (ref 1). Count together how many points on these crystals (six), and show that they all have the same number of points. Point out that the snow crystals are the same on each side: they are symmetrical.
- Explain that the shape of the snow crystal is made because of the way water molecules (the tiny parts of water) pack together. Water can only pack in one pattern, and this pattern makes 6-sided crystals. Other crystals are different shapes because their molecules pack in a different pattern.

b) Introduce what we will do today:

- There are four activities, all about crystals and symmetrical shapes. Students do three activity stations in rotation, then the fourth activity altogether.

Brief description of science activities:

- Examination of salt, sugar and epsom salt crystals with a magnifier to see their shapes.
- Make a borax crystal ornament.
- Make symmetrical star shapes with mirrors.
- Epsom salt crystal painting.

The processes of science that the students will focus on: careful observation, technical manipulation.

Safety guidelines: Borax should not be eaten. Teachers should handle the borax solution, and all should wash their hands after these activities.

Science Activities

(1) Activity Title: Crystals close up

Purpose of Activity: Observe familiar materials closely to see that they have defined shapes, and that these shapes are called crystals.

Methods and Instructions:

Students work individually.

1. Students shake a small amount of sugar and salt onto pieces of white paper, then observe them with a 10X eye loupe to see the individual crystal shapes.



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2. Teachers may assist in seeing the cube-shaped salt crystals and the cube and oblong-shaped sugar crystals. The key is to notice that the grains are not round, as may be expected, but have sharp corners and form a distinctive shape.
3. Students observe previously prepared epsom salt crystals, and observe their long, pointed shape.

(2) Activity Title: Borax crystal ornament

Purpose of Activity: Grow crystals, and make a decorative ornament from them.

Methods and Instructions:

Set-up prior to experiment: a kettle set to boil water; plastic cup for each student containing 3 tablespoons of borax each.

Students work individually.

1. Students make a shape from a white pipe cleaner, small enough to fit in their plastic cup.
2. An adult adds very hot water to each student's cup containing 3 tablespoons of borax powder. Hang the student's pipe cleaner shape on a pipe cleaner laid across the top of the cup so that the shape is immersed in the borax solution.
3. The cups are left undisturbed for 2 days. Many crystals will form on the pipe cleaner overnight as the borax solution cools.
4. After 2 days, briefly rinse off the borax crystals with cold water, then hang to dry, out of reach of the students. The crystals, sometimes large enough to see the flat faces, sparkle in bright light such as fairy lights.

(3) Activity Title: Mirror symmetry art

Purpose of Activity: Make symmetrical shapes using mirrors.

Methods and Instructions:

Students work individually.

1. Students make a design on a triangle of paper with coloured markers.
2. Students place their design between a pair of hinged mirrors to make a pointed star.
3. By moving the mirrors closer and further apart, students experiment with making stars with different numbers of points, but always symmetrical. They are challenged to make a 6-pointed star, the same shape as a snow flake.

(4) Activity Title: Epsom salt painting

Purpose of Activity: Make a snow scene painting with crystals

Methods and Instructions:

Students work individually.

1. Students make a simple design on black paper with a pencil.



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2. Students paint over their design with newly-made epsom salt solution. They must work fast so that the solution is laid down quickly, then the paper should be left alone for crystals to form.
3. Leave the paintings to dry. As the water evaporates, long spiky epsom salt crystals will form.

Closure Discussion

Review what the students found and noticed at each station.

References

<<http://www.its.caltech.edu/~atomic/snowcrystals/photos3/photos3.htm>> "Online guide to snow flakes, snow crystals and other ice phenomena" from Caltech. Accessed May 24, 2011.

Extension of Lesson Plan

Crystals and symmetry link easily to mathematical shapes and patterns.