Snowflake Symmetry

Students examine properties of snowflakes and use snowflakes to identify and describe symmetry.

Grade Level: 1st

Phenomena:
What makes snowflakes unique?

Objectives:
- Students will identify at least one line of symmetry on a snowflake.
- Students will describe three properties of snowflakes: have six points, are symmetrical, are all unique from one another.

Materials:
- Hexagonal paper
- Scissors
- String (optional)
- Dry-erase markers
- Laminated pictures of snowflakes and symmetrical objects in nature
- Laminated pictures of asymmetrical objects found in nature
- Poster of snowflake riddle

Appendixes:
- Snowflake riddle: Page 6
- Hexagonal pattern: Page 7
- Snowflake images: Pages 8-10
- Symmetrical nature images: Pages 11-13
- Asymmetrical nature images: Pages 14-16

Time Considerations:
Preparations: 15-20 minutes
Lesson Time: 45-60 minutes
Introduction: 5-10 minutes
Activity 1: 10 minutes
Activity 2: 5-10 minutes
Activity 3: 10 minutes
Activity 4: 5-10 minutes
Conclusion: 10 minutes

Related Lesson Plans:
Let it Snow! Let it Melt!, Can You Measure the Wind?, Winter

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Next Generation Science Standards

1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.

Science and Engineering Practices:
Developing and using models.
Planning and carrying out investigations.

Disciplinary Core Ideas:
1-LS1 From Molecules to Organisms: Structures and Processes.

Cross Cutting Concepts:
Scale, proportion, and quantity.
Systems and system models.

Excellence in Environmental Education Guidelines

Strand 1—Questioning, Analysis, and Interpretation Skills

A) Learners are able to develop questions that help them learn about the environment and do simple investigations.

F) Learners understand that relationships, patterns, and processes can be represented by models.

Background

A popular misconception of how snowflakes form is the thought that snowflakes are frozen raindrops. This is false. Frozen raindrops are known as sleet. Snowflakes on the other hand have a process of their own.

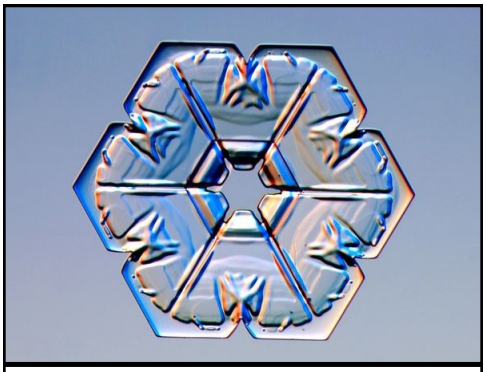
The story begins with water vapor. Water is first evaporated from bodies of water and rises as a gas, known as water vapor. When the vapor cools, the gas condenses on grains of dust to form a minute droplet. These droplets are liquid water, which remain in the cloud. When the air temperature cools, these liquid droplets freeze and become ice crystals. The condensing and freezing however, does not take place at the same time. Instead, droplets will form and freeze independently. As minute droplets condense and freeze to the ice crystals, a snow flake is formed (Libbrecht, K. G.).

On the hand other, “sleet occurs when a snowflake falls from a cloud then enters into a warm layer and melts. The now melted snowflake then continues to fall then it enters

into a cold layer near the surface of the earth and freezes again. When the frozen droplet impacts the earth, it is usually in the form of ice and does not freeze upon impact" (Wiggin, K.). The difference between these two types of precipitation is in their formation and how they reach the surface.

The most basic form of a snow crystal is a hexagonal prism. This structure occurs because certain surfaces of the crystal accumulate material very slowly. When snow crystals are very small, they are mostly in the form of simple hexagonal prisms. But as they grow, branches sprout from the corners to make more complex shapes.

While it grows, the crystal is blown around inside the clouds, so the temperature changes randomly. Crystal growth depends strongly on temperature. The six arms of the snow crystal each change their growth with time. The end result is a complex, branched structure that is also six-fold symmetric.



The six points of a snowflake

If a shape can be folded in half so that both sides are identical, it is said to have a line of symmetry. Snowflakes have multiple lines of symmetry, as do other objects found in nature.

Preparation

Gather all needed materials and practice folding and making a snowflake.

Introduction: The Snowflake Poem

Begin by telling the class you have a poem that describes the topic that will be investigated today.

Read the snowflake poem one time through, and have students identify the topic. (snowflakes)

Explain to the class that parts of the poem are things we already know about snowflakes, and parts of the poem are things we can ask questions about. We'll use our questions to help guide us as we investigate snowflakes today.

Re-read each paragraph of the poem. Have students list things that they know and things they have questions about into two categories.

List the following questions on the board under the heading, "Snowflake Questions": Six points? Same on both sides? All different or the same?

Explain to students that by studying snowflakes and thinking about our questions, we are being scientists. In science, we ask questions about topics, conduct investigations and make observations to attempt to answer questions.

Doing the Activity

Activity 1: Snowflakes!

In order to study the properties of snowflakes, students will create a snowflake model from paper.

Hand out hexagonal paper to each student. Have the students count the number of points of their hexagon. Pose the question to the class: will their snowflakes have the same number of points?

Walk students through the process of making a snowflake.

Begin with students holding their papers at the long flat edges, so the long points are at the top/ bottom. Make sure to demonstrate this to the class before they do it themselves.

Next, fold the paper in half so that the points go together to make a trapezoid.

While holding the shape vertical, fold the top most point to the second lowest point, to make a diamond.

Lastly, have students fold the diamond in half to make a triangle.

Next, have students place their paper on their desks and watch how to draw and cut out their shapes.

Demonstrate how to draw medium size shapes on the flat edges of the paper. Depending on the class, one shape to one side of the snowflake works best.

Remind students to keep their paper folded shut when they begin to cut out their shapes.

Now it's time to open it up and check it out! Have them write their names on the edge.

Activity 2: Six Sides to a Snowflake?

Direct the students' attention to their snowflake questions. Read their first question regarding that snowflakes have six points.

To answer the question, have students lay their snowflakes flat on their desks and count the number of points.

To reach other learning styles, have students identify these points, by numbering their points using a pencil or marker.

Activity 3: Same on Both Sides?

Return to the list of snowflake questions. Direct students' attention to the second question: are snowflakes the same on both sides?

Ask the students to look at their snowflake and see if it is the same on the left as it is on the right.

To better identify this, have students fold their snowflake in half to see if their cut out shapes match up on both sides.

Next have students draw a line using their pencil down the middle fold. And again ask if their snowflakes are the same on the left as it is on the right?

Explain to students that when objects can be divided in half showing each side to be identical, these objects are said to have a line of symmetry or are called symmetrical.

Use the kite prop and objects in the room, to provide examples that many objects in nature have symmetry.

If time is available, have students examine pictures of snowflakes. Have students come up one at a time to draw a line of symmetry on the snowflake in dry erase marker.

Also use the pictures that show objects from nature and have students find the line of symmetry in them.

Activity 4: Blizzard in the Room

Again direct the class to the last snowflake question: are all snowflakes the same or different?

Review what the word identical means: exactly the same.

Explain to the class, that students will move around the classroom observing their classmate's snowflakes. Their goal is to find another snowflake that is identical to their own.

Symmetry found in nature

Set expectations for this activity, such as observe only with your eyes, and begin!

If a student claims to have found an identical snowflake, compare the two and have the class determine if they are identical to each other.

Return to the snowflake questions and ask the class if they feel their questions were answered completely.

Conclusion

Summarize the key points of the lessons and read the poem one last time.

Students may use their snowflakes as you read, to see that each part of the poem is

indeed true.
Evaluate student performance by their ability to complete the paper snowflake activity.

During activities three and four, assess students comprehension of snowflakes having six sides and symmetry, based on how each student labeled their snowflakes.

Assessment

Informally assess students by their contributions to class discussions and their ability to answer teacher questions.
Human Snowflake!
Brainstorm with the class ideas about how snowflakes are made.

Extensions

Explain that during the winter there are little bits of water suspended in the air - water droplets suspended in clouds. Along with these bits of water, there is dust that is blown around outside.

When the temperature is just right, these bits of water freeze to the singe grain of dust to create an ice crystal.
As the ice crystal is blown around, more ice crystals freeze forming a snowflake.

During this description or afterwards, position students in the following way to create a human snowflake.

Choose one student to represent a particle of dust. Choose six other students to branch off the dust and to represent the six points of a snowflake.

The remaining students may attach themselves to the six points.

Snowflake Comparison
Using envelopes with precut snowflakes, have students apply what they have learned about snowflakes to decide if all snowflakes have these properties: six sides, symmetrical, not identical.

Read key points about snowflakes before handing out envelopes to pairs.

Summarize the activities by reviewing each property with students; ex. Ask students to show thumbs up if all the snowflakes have six sides, etc.

How is Snow Made?
You will need the following materials: coffee filter, snow that is as clean as possible, container and warm water.

Tell the students that we just learned how special snowflakes are and how no two snowflakes are alike. But how is snow made?

Brainstorm with the students and have them share their ideas aloud.

Use students to help set-up the experiment. Begin by placing snow inside of a filter with the filter sagging just a little in the container.

Have students share their predictions as to what they will see left in the filter.

Pour warm water over the snow and check out all the dirt filtered out of the snow.

Explain that snowflakes start from a piece of dust. From that dust, small pieces of water begins to freeze on little by little. As the little snowflake is blown around in the air, more and more pieces of water start to freeze on in different ways.

When it is heavy enough it falls to the ground in the form of a flake.

Vocabulary

Line of Symmetry: a line that you can draw through a shape where both sides match or are the same

Bilateral Symmetry: when only one line can be drawn through an object and both sides match

Radial Symmetry: when an object can be rotated and look the same; when one can draw more than one line of symmetry

Symmetrical: having matching points, parts or shape on both sides of a dividing line

Asymmetrical: a shape that is asymmetrical cannot be divided so both pieces match exactly in shape and size

Sources

- Libbrecht, K. G. (1999, Feb. 1). *The Life of a Snowflake: A Snowflake Primer*. Retrieved Jan. 29, 2011, from *Snow Crystals.com:* http://www.its.caltech.edu/~atomic/snowcrystals/primer/primer.htm
- Wiggin, K. (2007, Dec. 7). *Snow, Sleet, and Freezing Rain - They're All the Same, Right?*. Retrieved Jan. 30, 2011, from Ezinearticles.com: http://ezinearticles.com/?Snow,-Sleet,-and-Freezing-Rain---Theyre-All-the-Same,-Right?&id=868391

Images:

- (2008). *African Elephant.* Retrieved Dec. 15, 2011, from African Wildlife Safari: http://www.freewebs.com/lacyrichmond/elephant.htm
- (2010, Jan. 7). *Asian Ladybug.* Retrieved Dec. 16, 2011, from 4us2be: http://www.4us2be.com/health-fitness/ladybug-allergy/
- *Beautiful Butterfly*. Retrieved Jan. 30, 2011, from Mister Teacher: http://www.misterteacher.com/symmetry.html
- Habeeb, L. (2010, July 1). *Antelope Island Echo Ghost Towns.* Retrieved Dec. 16, 2011, from Wikipedia: http://en.wikipedia.org/wiki/File:AntelopeIslandEchoGhosttowns_221.jpg
- Libbrecht, K. (1996-2011). *Dendrite Snowflake Crystal.* Retrieved Dec. 15, 2011, from National Geographic: http://photography.nationalgeographic.com/photography/photos/patterns-snow-ice/#/hexagon-snowflake_9426_600x450.jpg
- Libbrecht, K. (1996-2011). *Plate Snowflake Crystal.* Retrieved Dec. 15, 2011, from National Geographic: http://photography.nationalgeographic.com/photography/photos/patterns-snow-ice/#/hexagon-snowflake_9426_600x450.jpg
- Libbrecht, K. (1996-2011). *Sectored Plate Snowflake.* Retrieved Dec. 15, 2011, from National Geographic: http://photography.nationalgeographic.com/photography/photos/patterns-snow-ice/#/hexagon-snowflake_9426_600x450.jpg
- Lorch, J. (2004, May). *Starfish.* Retrieved Dec. 15, 2011, from Gallery: Jonas Lorch: http://gallery.jlo.ch/barrier_reef/STARFISH
- Nicole, K. (2011, Sept. 30). *Cloud Computing 3.* Retrieved Dec. 16, 2011, from Silicon Angle: http://siliconangle.com/blog/2011/10/01/this-week-in-the-cloud-from-backup-to-mobile/cloud-computing-3-2/
- Poon, W. (2005, Jan. 1). *Joshua Tree in Joshua Tree National Park.* Retrieved Dec. 16, 2011, from Wikipedia: http://en.wikipedia.org/wiki/File:Joshua_Tree_in_Joshua_Tree_National_Park.jpg

What Am I?

A Snowflake Riddle By: Jessica Snaman

When it's winter and cold
I come from up high
Twirling and dancing
As I fall from the sky

I'm light and I'm white
With six points all around
If it's cold enough outside
I'll stick to the ground

I'm the same on the left
As I am on the right
Just like if you folded
A symmetrical kite

No two of my kind
Are ever the same
And I turn back to liquid
If I melt into rain