5E Arts Integrated STEM Lesson Plan

Lesson Title: *Snowflakes*

Author: *Melany Dunivan*

Topic:

NASA studies and monitors snow data to help improve snowfall and weather predictions.

A protractor is used to measure angles, and the angle sum of a triangle is always 180 degrees.

The relationship between scale factor and area of a scaled drawing is that the area of the new figure is (scale factor squared) times bigger than the original figure.

Visual arts can be used to communicate understanding of how to use a protractor as well as the characteristics of snowflakes (having 6 sides, 6 lines of symmetry, and 60 degrees angle of rotation).

Targeted Grade Level: *7^{th} grade*

Time Needed: *4 days (50 min each day).*

Subject Integration:

Science: Students learn how snowflakes are formed and NASA's reason for studying and monitoring snowflakes. Students learn that snowflakes formed different shapes at different temperatures and humidity, but they all have 6 sides due to the bond of 2 hydrogen atoms and 1 oxygen atom.

Math: Students use a protractor to measure angles of hexagonal shapes of paper snowflakes and measure angles inside the triangles to learn about the triangle angle sum property. Students find scale factor of hexagonal snowflakes and find the areas of scaled drawings. They find the relationship between scale factor and area of scale drawing which is that the area of the new figure is (scale factor squared) times bigger than the original figure.

Art: Students create their own unique paper snowflakes that meet the properties of a snowflake such as having 6 sides, 6 lines of symmetry and 60 degrees angle of rotation.

Justification:

This lesson about snowflakes is related to these 7th grade math standards: scale factor, angle measures, triangle angle sum property, area of a composite figure, and area of scaled drawings. In this lesson, students will learn about the science of snowflakes, how a snowflake forms a hexagonal shape and grows before forming dendrites, and how the Global Precipitation Measurement satellite helps NASA scientists measure the size and shape distribution of snow particles in a storm to help improve weather predictions of snowfall. The students will learn that a snowflake forms a hexagonal shape first because of the bond between 2 hydrogen atoms and 1 oxygen atom, before growing the dendrites. They will create hexagonal snowflakes and they will find areas of scaled drawings of snowflakes with side lengths that are 2 and 3 times longer than their original shape. The students will determine each area of a hexagonal shape of a snowflake that is composed of 6 triangles. The students will learn the relationships between scale factors and areas of scaled drawings, which is that the area of the new figure is (scale factor squared) times bigger than the original figure. The students will demonstrate their understanding of snowflakes and angle measures by creating visual arts of their own unique paper snowflakes that meet the criteria of having 6 sides, 6 lines of symmetry and 60 degrees angle of rotation. They will use a protractor to measure the angle of rotation as well as the three angles inside each triangle then find the angle sum inside each triangle which is always equivalent to 180 degrees.

Standards:

NGSS Performance Expectations

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and use a model to describe phenomena. (MS-ESS2-1), (MS-ESS2-6)	ESS2.C: The Roles of Water in Earth's Surface Processes • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)	Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings.	PS1.B: Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.	Patterns • Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
Common Core State Standards: Math: Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. (CCSS: 7.G.A.2) Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (CCSS: 7.G.B.6) Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. (CCSS: 7.G.A.1)		

National Art Standards

7th VA: Cr2.3.7a Apply visual organizational strategies to design and produce a work of art, design, or media that clearly communicates information or ideas.

Measurable Student Learning Objectives:

Students will be able to explain the reason for NASA to study and monitor snow data.

Students will be able to use a protractor to measure angles and determine that they can create more than one triangle when the angle sum of interior angles is equal to 180 degrees.

Students will be able to find scale factor and areas of two similar figures.

Students will be able to find the relationship between scale factor and areas of scaled drawings.

Students will be able to create 2 unique snowflakes that meet the criteria of having 6 sides, 6 lines of symmetry and 60 degrees angle of rotation.

Nature of STEM:

Nature of science: students will learn about the science of snowflakes, how a snowflake forms a hexagonal shape and grows before forming dendrites, and how the Global Precipitation Measurement satellite helps NASA scientists measure the size and shape distribution of snow particles in a storm to help improve weather predictions of snowfall.

Math: Students will learn how to measure angles, learn the angle sum of a triangle property, find scale factor and areas of scaled drawing and find the relationship between scale factor and areas of scaled drawing.

Arts Integration: Students communicate their understanding of snowflake characteristics and how to measure angles by creating visual arts of snowflakes.

Engaging Context/Phenomena:

The phenomena of this lesson are about snowflakes. How are they formed? Why does NASA study and monitor snow data?

Data Integration:

Students will view a video and animations of snowflakes from NASA's Goddard Media Studios. https://svs.gsfc.nasa.gov/12507
They will analyze the data to give them background knowledge of how snowflakes develop and why NASA studies and monitors snowflakes.
Students will read an overview about NASA's Global Precipitation Measurement mission to give them better understanding of the purpose of it : https://gpm.nasa.gov/missions/GPM
Students demonstrate they learned about the Global Precipitation Measurement mission and why a snowflake forms a hexagonal shape first by writing down their new understanding and questions from the videos, then by answering these questions:

Observations I have about the videos and animations	Questions I have about the videos and animations

1) How does NASA collect the rain and snow data?
2) Why does NASA study and analyze rain and snow data?
3) How can the Global Precipitation Measurement mission help improve numerical weather predictions of snowfall in a storm?
4) Every snowflake is unique, but they all have the same number of sides. How many sides does a snowflake have? How does it form?

Differentiation of Instruction:

Students can use paper protractor and ruler if they don't have the actual protractor and ruler.

Short videos such as how to draw angles using a protractor and how to create paper snowflakes will be available to students so they can go back, rewind and fast forward as needed to help them.

Students who need extra help with certain parts of the assignments can be grouped together to receive extra help from me.

For the visual arts, students can draw snowflakes instead of making the paper snowflakes as long as their final products are meeting the criteria of a snowflake (6 sides, 6 lines of symmetry and 60 degrees angle of rotation).

Class recordings will be available to the students so they can go back and review the class recordings as needed.

ELL students can copy and paste texts from the article or worksheet into Google translate if needed.

Extended time to complete the assignments will be given to students with extended time as their accommodations on their IEPs or 504 plans.

Real-life Connection:

My students live in Colorado where we do get snow. After this lesson, students will have better understanding of how snow develops and the importance of studying and monitoring snow. They will learn about scale factor and the relationship between scale factor and areas of scaled drawings. The concepts of scale factor and areas can be used in many objects in real life such as reduction and enlargement of photos, canvas artwork, etc. They will also learn how to use a protractor and the tool is useful in real-life. For example: I had to use a protractor to measure the angle above my garage to replace a damaged siding a few years ago.

Possible Misconceptions: Students might not know that each snowflake is unique and all of them have 6 sides. Students might think that the area of a scaled drawing is the scale factor times bigger than the original rather than scale factor squared times bigger.

Lesson Procedure:

ENGAGE

Procedure:

Students will read and view the NASA videos about the Global Precipitation Measurement mission and how the satellite helps NASA scientists measure the size and shape distribution of snow particles in a storm to help improve weather predictions of snowfall and why a snowflake forms a hexagonal shape and grows before forming dendrites.

NASA Goddard Media Studios: https://svs.gsfc.nasa.gov/12507

NASA Global Precipitation Measurement Mission Overview: https://gpm.nasa.gov/missions/GPM

Students demonstrate they learned about the Global Precipitation Measurement mission and why a snowflake forms a hexagonal shape first by writing down their new understanding and questions from the videos, then by answering these questions:

Observations I have about the videos and animations	Questions I have about the videos and animations

1) How does NASA collect the rain and snow data?

2) Why does NASA study and analyze rain and snow data?

3) How can the Global Precipitation Measurement mission help improve numerical weather predictions of snowfall in a storm?

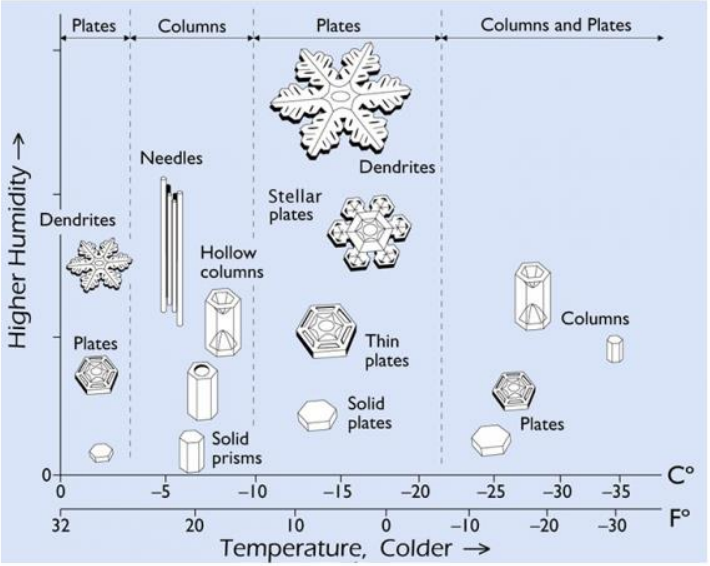
4) Every snowflake is unique, but they all have the same number of sides. How many sides does a snowflake have? How does it form?

Students will view images of different snowflakes from the Snowflake Bentley website to view how each one of them is unique.
https://snowflakebentley.com/images

Students will view the diagram from the Science News for Students website to answer the question below.
https://www.sciencenewsforstudents.org/article/how-snowflake-made

- Based on the diagram, what type of shape of a snowflake would you see at 0 ℃ to -5 ℃ and lower humidity?

- Based on the diagram below, at what temperature range in Celsius and level of humidity do the largest snowflakes form?



This diagram shows how temperature and humidity affect the shape of a snowflake. Note the six-sided shape. It's instrumental in how the crystals form and grow. The largest flakes tend to occur at temps close to freezing. As temperatures drop, flakes with fewer branches become more common. Scientists are still probing how temperature and humidity affect a flake's shape.

I will lead a class discussion to discuss their responses.

This will assist them in the next stage of the lesson as the students will find the area of a hexagonal snowflake that is composed of 6 triangles and find areas of scaled drawings of the snowflake.

Modification:

Class recordings will be available to the students so they can go back and review the class recordings as needed.

ELL students can copy and paste texts from the article or worksheet into Google translate if needed.

Standard Address:

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Formative/Summative assessments:

Students will share their answers through the chat/mic as well as record their answers on the student worksheet (Dunivan Final Student Worksheet)

Resources:

NASA Goddard Media Studios: https://svs.gsfc.nasa.gov/12507

NASA Global Precipitation Mission Overview: https://gpm.nasa.gov/missions/GPM
Snowflake Bentley website: https://snowflakebentley.com/images

Science News for Students website: https://www.sciencenewsforstudents.org/article/how-snowflake-made

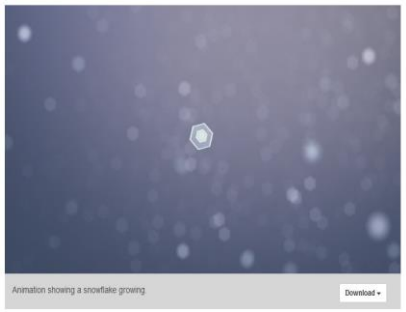
Student worksheet: Dunivan Final Student Worksheet

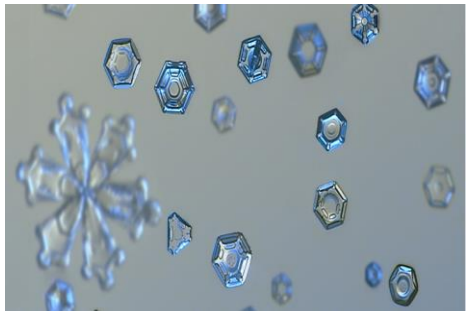
EXPLORE

Procedure:

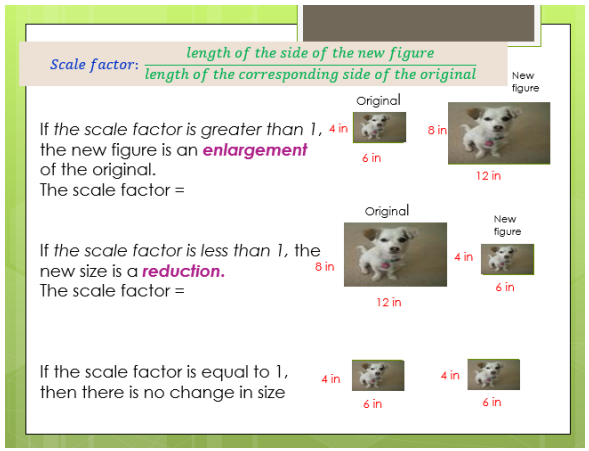
The students will review the animation showing a snowflake growing from a hexagonal shape and explore the area of a hexagonal snowflake and the areas of scaled drawings of the snowflakes as the lengths grow 2 to 3 times longer.

NASA's Goddard Media Studios: https://svs.gsfc.nasa.gov/12507





I will give examples on how to find scale factors of scaled drawings (see my PowerPoint below) and I will also go over how to find the area of a hexagonal snowflake (figure 1) on the student worksheet (Dunivan Final Student Worksheet). The students will find scale factors from figure 1 to figure 2 and figure 1 to figure 3. They will also find the areas of figure 2 and figure 3.



Students demonstrate they learned that a snowflake forms a hexagonal shape first, and then grows, by finding the areas of the original shape and scaled drawings with side lengths that are 2 and 3 times longer. The students will find the area of hexagonal snowflakes by finding the total area of 6 triangles.

For each drawing, the students will find the area of the triangle then the area of the hexagon that is composed of 6 equilateral triangles.

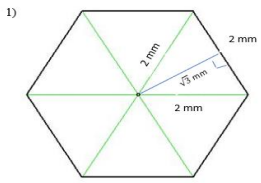


Figure 1

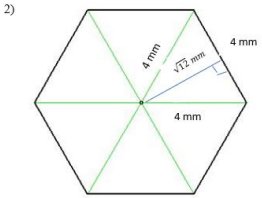


Figure 2

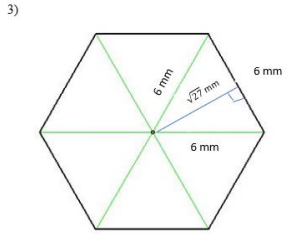


Figure 3

This will assist them in the next stage of the lesson because the students will explain the relationships between scale factors and areas of scaled drawings which is that the area of the new figure is (scale factor squared) times bigger than the original figure.

I will lead a class discussion to discuss their findings after they have time to work and collaborate with their peers.

Modification:

Students who need extra help with finding area of hexagonal snowflakes will be grouped together to receive extra help from me. ‘

Class recordings will be available to the students so they can go back and review the class recordings as needed.

Extended time to complete the assignments will be given to students with extended time as their accommodations on their IEPs or 504 plans.

Standard Address:

Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (CCSS: 7.G.B.6)

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. (CCSS: 7.G.A.1)

Formative assessments:

Students will share their answers through the chat/mic/whiteboard as well as record their answers on the student worksheet: Dunivan Final Student Worksheet .

Resources:

My PowerPoint as shown above.

Student worksheet: Dunivan Final Student Worksheet

NASA's Goddard Media Studios: https://svs.gsfc.nasa.gov/12507

EXPLAIN

Procedure:

The students will explain the relationship between scale factors and areas of scaled drawings which is that the area of the new figure is (scale factor squared) times bigger than the original figure.

For example:

If the side lengths of the snowflake grow 2 times longer, then the area is $2^2 = 4$ times bigger than the area of the original shape.

If the side lengths of the snowflake grow 3 times longer, then the area is $3^2 = 9$ times bigger than the area of the original shape.

I will lead a class discussion to discuss their findings after they have time to work and collaborate with their peers.

This will assist them in the next stage of the lesson as students will create visual arts of snowflakes starting from hexagonal shapes of snowflakes.

Modification:

Students who need extra help with finding the relationship will be grouped together to receive extra help from me. ‘

Class recordings will be available to the students so they can go back and review the class recordings as needed.

Extended time to complete the assignments will be given to students with extended time as their accommodations on their IEPs or 504 plans.

Standard Address:

Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (CCSS: 7.G.B.6)

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. (CCSS: 7.G.A.1)

Formative assessments:

Students will share their answers through the chat/mic/whiteboard as well as record their answers on the student worksheet: Dunivan Final Student Worksheet .

Resources:

Student worksheet: Dunivan Final Student Worksheet .

ELABORATE

Procedure:

I will demonstrate how to create the paper snowflakes and I'll have the directions listed on the PowerPoint as well (see below). Students will create their own 2 unique visual arts of snowflakes to demonstrate their understanding of snowflakes properties and how to use a protractor.

Students will measure the angles of each triangle and find the angle sum of the triangle which is always equal to 180 degrees. They will be able to visualize that they can create many triangles when the angle sum of a triangle is 180 degrees.

How to create the hexagonal snowflakes.
1) Fold your paper in half (hamburger style).

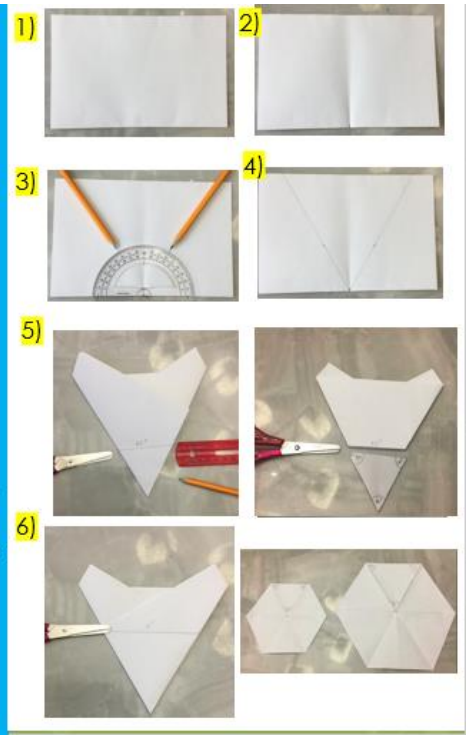
2) Fold your paper again to find the center and mark it with a pencil (this will be the vertex).

3) Place the center of your protractor at the vertex and make sure that the line of the protractor lines up with the edge of your paper, then mark at 60 degrees and 120 degrees with your pencil. Draw lines from the vertex to your marks to create three 60-degree angles.

4) Fold along the two lines that you drew.

5) Use a ruler and draw a line that is 2.5 inches long, then cut it. When you open it up, you should get a hexagonal shape with side lengths of 2.5 inches.

6) Repeat the steps to create another hexagon with a side length of 4 inches.



7) After step 5, fold your triangular shape in half then cut your paper to create the "crystals" of the snowflakes. See below for some examples:

Modification:

Students can use paper protractor and ruler if they don't have the actual protractor and ruler.

Students can draw snowflakes instead of making the paper snowflakes as long as their final products are meeting the criteria of a snowflake (6 sides, 6 lines of symmetry and 60 degrees angle of rotation).

Students can view the video below if they need extra help using a protractor.

How to draw angles with a protractor: **https://video.link/w/A6HTb**

Students can view the video below so that they can review, rewind and fast forward to help them with the process to create paper snowflakes. **https://video.link/w/2LHfc**

Class recordings will be available to the students so they can go back and review the class recordings as needed.

Standard Address:

7th VA: Cr2.3.7a Apply visual organizational strategies to design and produce a work of art, design, or media that clearly communicates information or ideas.

Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. (CCSS: 7.G.A.2)

Formative/Summative assessments:

Students will share their answers through the chat/mic/whiteboard as well as record their answers on the student worksheet: Dunivan Final Student Worksheet .

Students will record the measurement of angles inside each triangle and the angle sum of a triangle on the student worksheet (Dunivan Final Student Worksheet).

Students will show their understanding of using a protractor and snowflake properties by creating visual arts of snowflakes that meet the criteria (6 sides, 6 lines of symmetry and 60 degrees angle of rotation).

They will explain how their visual arts are meeting the criteria by answering the question on the worksheet and they will take a picture or create a video recording to show their snowflakes.

Resources:

My PowerPoint and pictures as shown above.

A video on how to draw angles with a protractor: **https://video.link/w/A6HTb**

A video on how to create a paper snowflake: **https://video.link/w/2LHfc**

Student worksheet: Dunivan Final Student Worksheet

EVALUATE

Procedure:

Students will complete their worksheets by typing/writing their answers then take a picture/scan it for submission into the dropbox.

Students can take a picture or create a video recording of their visual arts and submit it into the dropbox.

Modification:

Students can draw snowflakes instead of making the paper snowflakes as long as their final products are meeting the criteria of a snowflake (6 sides, 6 lines of symmetry and 60 degrees angle of rotation).

No points will be taken off for students with extended time as part of their accommodations on their IEPs or 504 plans.

They can add audio recordings in the dropbox to help clarify their answers.

Standard Address: All the standards listed above.

Summative assessment: Students' answers on the worksheet as well as participation during class will be evaluated using the rubric: Dunivan_Final Snowflakes Rubric.

Resources:

Student worksheet: Dunivan Final Student Worksheet

Rubric: Dunivan_Final Snowflakes Rubric.

Teacher Background:

The teacher needs to know the science behind snowflakes.

The teacher needs to know 7^{th} grade math standards (how to use a protractor, find scale factor, area of a triangle, area of a hexagon and the relationships between scale factor and area of scaled drawings).

The teacher needs to know how to create paper snowflakes.

All resources are listed in my lesson plan above and below.

References:

Braun, Scott. (n.d.). NASA Global Precipitation Measurement. NASA's Goddard Space Flight Center. https://gpm.nasa.gov/missions/GPM

Chapman, D. (2020, January 10). How to make paper snowflakes. One little project at a time. https://onelittleproject.com/how-to-make-paper-snowflakes/

Colorado Department of Education. (2020). 7th grade Mathematics Standards. http://www.cde.state.co.us/CoMath/StateStandards

Cappucci, M. (2019, February 14). Explainer: The making of a snowflake. Science News for Students. https://www.sciencenewsforstudents.org/article/how-snowflake-made

Fitzgibbons et al. (2017, February 17). GPM Gets Flake-y. NASA's Goddard Media Studios. https://svs.gsfc.nasa.gov/12507

Jericho Historical Society. (n.d). Snowflake Bentley. *https://snowflakebentley.com/images*

National Core Arts Standards. (2015). Visual Arts- Creating. National Coalition for Core Arts Standards. https://www.nationalartsstandards.org/sites/default/files/Visual%20Arts%20at%20a%20Glance%20-%20new%20copyright%20info.pdf

NGSS Lead States. (2013). Next Generation Science Standards: For States, By States. https://www.nextgenscience.org/dci-arrangement/ms-ess2-earths-systems

Real Math Solutions. (2016, February 21). Angles: Drawing Angles with a Protractor [YouTube]. https://www.youtube.com/watch?v=3NHnTHhnv8g

Science Beyond. (2011, January 27). Better Snowflakes Through Science: a fun, at-home math experiment [YouTube].

https://www.youtube.com/watch?app=desktop&v=xh_Qg3RCKPU

Snowflakes: Student Worksheet

Engage:

1) Read about the Global Precipitation Measurement mission and view the videos, then write down your new understanding and questions from the videos.

https://gpm.nasa.gov/missions/GPM

Goddard Media Studios: https://svs.gsfc.nasa.gov/12507

Observations I have about the video	Questions I have about the video

Answer the following questions:

2) How does NASA collect the rain and snow data?

3) Why does NASA collect and analyze rain and snow data?

4) How can the Global Precipitation Measurement mission help improve numerical weather predictions of snowfall in a storm?

5) Every snowflake is unique, but they all have the same number of sides. How many sides does a snowflake have? How does it form?

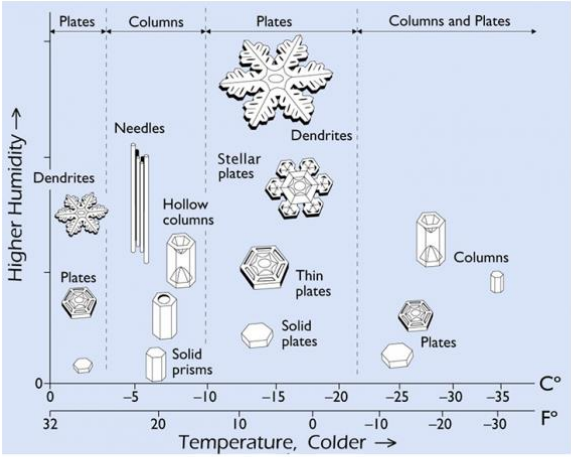
Please view the images of the different snowflakes from this Snowflake Bentley website: https://snowflakebentley.com/images

View the diagram from the Science News for Students website then answer the question below.

https://www.sciencenewsforstudents.org/article/how-snowflake-made

6) Based on the diagram, what type of shape of a snowflake would you see at 0 ℃ to -5 ℃ and lower humidity?

7) Based on the diagram below, at what temperature range in Celsius and level of humidity do the largest snowflakes form?



This diagram shows how temperature and humidity affect the shape of a snowflake. Note the six-sided shape. It's instrumental in how the crystals form and grow. The largest flakes tend to occur at temps close to freezing. As temperatures drop, flakes with fewer branches become more common. Scientists are still probing how temperature and humidity affect a flake's shape.

Collaboration/Discussion time: Share your response with the class.

Explore: Scale Factors and Areas.

Find the area of each hexagon by finding the total area of 6 equilateral triangles.

Goddard Media Studios: https://svs.gsfc.nasa.gov/12507

Note: These pictures are not drawn to scale.

1)

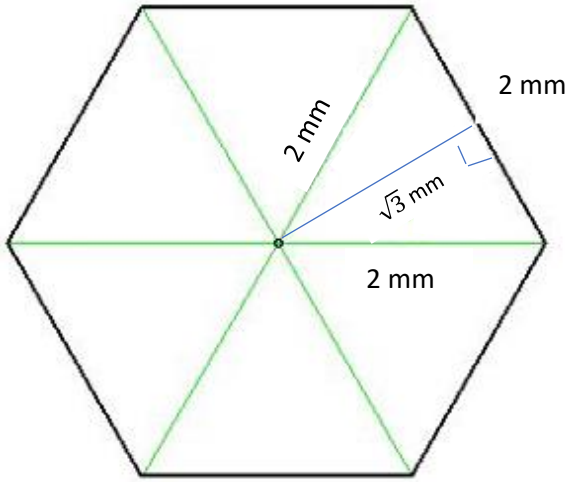


Figure 1

a) Find the area of each triangle in square millimeters. Show your work!

b) Find the area of the hexagon in square millimeters. Show your work!

Collaboration/Discussion time: Share your response with the class.

2)

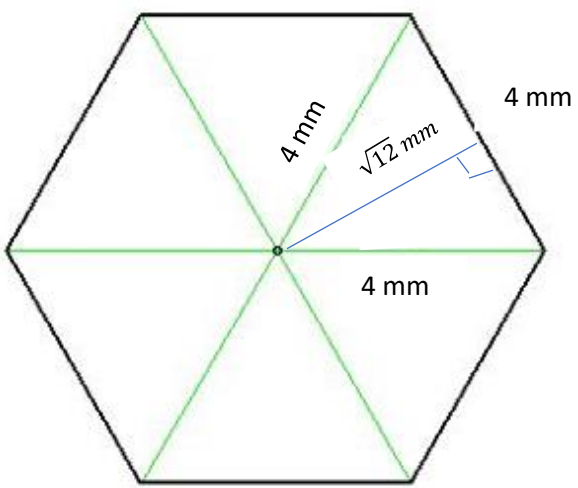


Figure 2

a) Find the area of each triangle in square millimeters. Show your work!

b) Find the area of the hexagon in square millimeters. Show your work!

3)

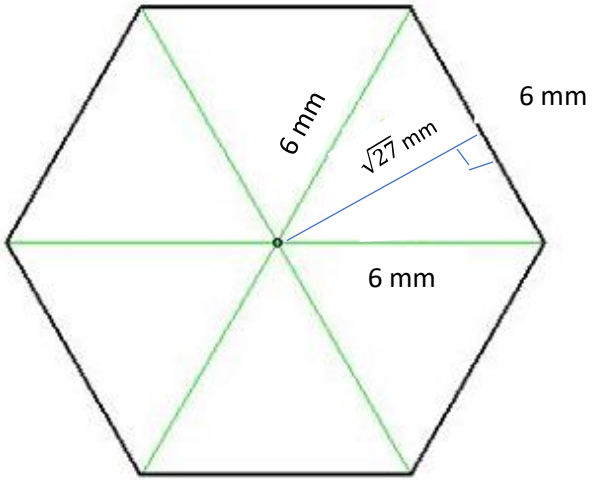


Figure 3

a) Find the area of each triangle in square millimeters. Show your work!

b) Find the area of the hexagon in square millimeters. Show your work!

Collaboration/Discussion time: Share your response with the class.

Explain: Relationship between scale factor and area of scaled drawing.

4a) What's the scale factor from figure 1 to figure 2 above?

b) How many times bigger is the area of the new hexagon (figure 2) compared to the area of the original hexagon (figure 1)? Show your math work!

5a) What's the scale factor from figure 1 to figure 3 above?

b) How many times bigger is the area of the new hexagon (figure 3) compared to the area of the original hexagon (figure 1)? Show your math work!

6) How can you use the scale factors to predict the relationship between the areas for each pair of similar hexagons?

Collaboration/Discussion time: Share your response with the class.

Elaborate: Visual Arts

1) A hexagonal snowflake is composed of 6 equilateral triangles. Measure the three angles of each triangle then find the sum of the three angles inside the triangle. Write your answers below.

2) Repeat the steps above with your second hexagonal snowflake.

3) What do you notice about the angle sum of each triangle? What conclusion can you make about the number of triangles that you can make when the angle sum adds up to 180 degrees?

4) Please explain how your visual arts meets the requirement of a snowflake.

Snowflakes Arts Integration Rubric. Total=_____/15 points

Objectives:

I will be able to explain the reason for NASA to study and monitor snow data.

I will be able to use a protractor to measure angles and determine that more than one triangle when the angle sum of interior angles is equal to 180 degrees.

I will be able to find scale factor and areas of two similar figures**.**

I will be able to find the relationship between scale factor and areas of scaled drawings.

I will be able to create 2 unique snowflakes that meet the criteria of having 6 sides, 6 lines of symmetry and 60 degrees angle of rotation **(visual arts criteria).**

Criteria	Exemplary 4	Meets the standards 3	Approaching 2	Not yet approaching 1
Critical Thinking	Demonstrates full understanding and analysis of the objectives (all 4 objectives-see above).	Demonstrates partial understanding and analysis of the objectives (3 out of 4 objectives -see above)	Demonstrates basic understanding and analysis of the objectives (2 out of 4 objectives-see above).	Demonstrate very minimal understanding or analysis the objectives (1 out of 4 objectives-see above).
Visual Arts	Creates unique final snowflakes that meet all the criteria listed (having 6 sides, 6 lines of symmetry	Creates unique final snowflakes that meet 2 of the criteria listed (having 6 sides and	Creates unique final snowflakes that meet 1 of the criteria listed. (6 sides only, no	Creates unique final snowflakes that don't meet any of the criteria listed (not having 6 sides, not having 6

	& 60 degrees angle of rotation).	some lines of symmetry but angle rotation is not 60 degrees rotation).	symmetry and angle rotation is not 60 degrees).	lines of symmetry & not having angle rotation of 60 degrees).
Communication		Gives very clear explanation with excellent audio or written and visual presentation explaining how the final products meet the objectives and criteria.	Gives good explanation with audio or written and visual presentation explaining how the final products meet the objectives and criteria.	Gives very minimal explanation and effort on the presentation of the final products.
Collaboration	Attends all required sessions and participates in all class discussions.	Attends most required sessions and participates in most class discussions.	Attends some required sessions and participates in some class discussions.	Missed most required sessions and participates in few class discussions.