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OREGON MUSEUM OF SCIENCE AND INDUSTRY
TRAVELING EXHIBITIONS

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EXHIBITION OVERVIEW

Snow: Tiny Crystals, Global Impact provides interactive learning experiences that explore the nature and wonder of snow and the impact of climate change on our snowy planet. Walk through a snowstorm for an up close look at the crystals in different types of storms. Peek inside the snowpack to discover how it changes over time and how animals make their homes in snow. Learn how snow shapes and sustains life on Earth and about snow's vital roles in sustaining our water supply and cooling our planet.

From the wonder of snow crystals, to the complexity of the layered snowpack, to unique stories of snow from Iñupiaq elders, ***Snow: Tiny Crystals, Global Impact*** offers experiences for visitors of all ages with a focus on learners ages 9–14. Explore all the ways this fundamental weather phenomenon impacts our lives—no matter where we live!

Exhibit Themes:

Falling Snow

How does snow grow? Are all snowflakes unique? Dive into the science of snow crystals through engaging and challenging interactive experiences.

Explore emotions of wonder, curiosity, and inspiration.

Snowpack

Many living things have evolved to live in and under the snow. Consider your own relationships with snow on the ground and the many different ways we experience it.

Explore emotions of connection, empathy, and caring.

Snowscapes

Does snow affect your daily life? See how all ecosystems are impacted by snow and snowmelt, even ones downstream where no snow falls.

Explore emotions of motivation and protection.

Melting Snow

As our global climate changes, so does Earth's snow. Feel the impact of warming conditions and explore ways to respond to climate change with your community.

Explore emotions of caring, grief, hope, and action.

Next Generation Science Standards (NGSS)

Science education content in ***Snow: Tiny Crystals, Global Impact*** relates to the following NGSS Practices, Crosscutting Concepts, and Disciplinary Core Ideas.

Practices

1. Asking questions and defining problems
2. Developing and using models
3. Analyzing and interpreting data
4. Constructing explanations and designing solutions

Crosscutting Concepts

1. Patterns
2. Cause and effect
3. Systems and system models
4. Structure and function
5. Stability and change

Disciplinary Core Idea

Physical Science	
PS1	Matter and Its Interaction
PS2	Motion and Stability: Forces and Interactions
PS3	Energy
Life Science	
LS1	From Molecules to Organisms: Structures and Processes
LS2	Ecosystems: Interactions, Energy, and Dynamics
LS4	Biological Evolution: Unity and Diversity
Earth & Space Science	
ESS2	Earth's Systems
ESS3	Earth and Human Activity

EXHIBIT DESCRIPTIONS

Entrance

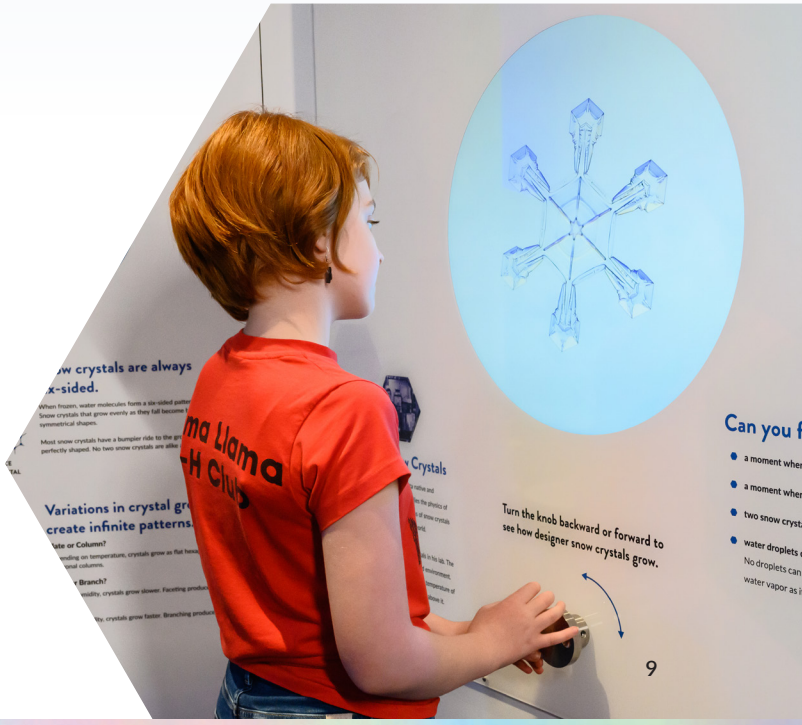
This snowy scene magically changes when viewed from different angles. Look for sudden snowfall, kids at play, and fresh tracks across the snow.

Falling Snow

Experience the sights and sounds of three interactive snowstorms while you explore the conditions that shape falling snow. Try to catch and identify six different giant snow crystals. Watch the animated thermometer and humidity gauge to see how changing weather conditions form each kind of snow crystal.

Watching Snow Grow

Watch snow crystals grow and shrink before your eyes. Play with remarkable videos of snow crystal formation created by physics professor Ken Libbrecht in his lab at Caltech. Look for examples of two kinds of crystal growth: branching or faceting.



Making Sense of Snow Crystals

Learn how Japanese scientist Ukichiro Nakaya created a system for explaining snow crystal growth. His Nakaya Diagram shows how crystals grow under different temperature and humidity conditions. Match different kinds of crystals to the story of how they formed. Two sets of snow crystals are available to solve the puzzle: early photographs taken by Wilson Bentley and color micrographs by Ken Libbrecht.

Snow on the Ground

Explore the layers in three different kinds of snowpacks: Maritime, Taiga, and Tundra. Pull out vertical cross-sections for a closer look at distinctive snow crystals found in Taiga and Tundra snow. Use a polarizing filter to view Maritime snow's metamorphism from wet grains to slush. Peer through peepholes to discover life hidden in the snow.

Snow and Arctic Life

Watch oral histories recorded by Iñupiaq elders and culture-bearers to learn about life in the Arctic community of Kotzebue, Alaska. Listen to personal stories about their relationship to and knowledge of snow as well as how changing weather and climate impact their way of life.

Snow Play

Play together to build and decorate your own special snow person. Stack up foam snowballs of different sizes and dress your person up with colorful bits and pieces. Find inspiration in our photo gallery of playful snow people from around the world.

Storing Water for Later

Compare rain and snow falling on a mountain in winter. One side of the mountain shows snowfall; the other side, rain. Both provide the same amount of water. One side releases water right away, the other stores water and slowly releases it during warmer, drier months when we need it most.

Snowmelt Journeys

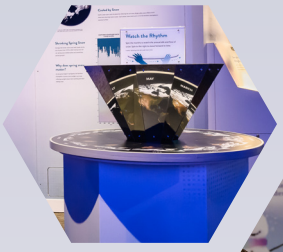
Explore an interactive map of the Western U.S. to follow the journey snowmelt takes from high mountains to distant cities and farms. Trace the Colorado River through seven states and discover how its essential water supply is stretched to reach many hot, dry, and far away places.

Adapting Our Water Use

Discover how we use water in the U.S. and need to adapt to expected water shortages. Lift up raindrop-shaped blocks to compare major categories of water use. Each block activates lights in a bar graph to show its percentage of total water use. Explore ideas for conserving water for each category.

Keeping Earth Cool

Feel the temperature difference between a white surface and a dark blue surface. Both are being warmed by heat lamps, but one stays cooler. Learn how bright white snow cools the Earth by reflecting light and heat from the sun.



Changing Global Patterns of Snow

Spin the praxinoscope and look in the mirrors to see an animation of North America's annual snow cover. Watch how snow cover shrinks and grows in a yearly rhythm. Explore a nearby graph to learn how climate change is impacting snow, especially in the spring.

Working Together for a Better World

Share your snow and climate stories. Cut out a simple snow crystal and write a response to a question about snow or climate change. Add your snow crystal to the collection bins to build up our snowpack of responses. Selected snow crystals are displayed for inspiration. Learn how others are taking action on climate.

COMMUNICATING ABOUT CLIMATE CHANGE

Members of the general public often have high levels of trust in museums, positioning museum educators with a powerful opportunity to facilitate productive, friendly dialogues that focus on meaningful solutions. Still, educators often have anxiety around talking with the public and students about climate change. What if visitors see the topic as partisan or controversial? What if climate change is too depressing? This guide can help.

Tips and Tricks for discussions about climate change

The following recommendations draw from interpretation techniques developed by the FrameWorks Institute for the National Network for Ocean and Climate Change Interpretation (NNOCCI). FrameWorks has pioneered Strategic Frame Analysis®, an evidence-based approach to communication grounded in the cognitive and social sciences. NNOCCI is a national network of researchers, informal educators, and organizations who communicate about climate change.

This short guide is not a replacement for training in Strategic Frame Analysis. Educators can learn more through these resources:

- Two page guide https://www.frameworksinstitute.org/publication/infographic-how-can-your-climate-communications-be-clearer-and-more-effective/
- Access NNOCCI's resources at www.climateinterpreter.org
- Read more about framing climate issues at www.frameworksinstitute.org
- Take a free online course designed for informal educators.
    - Visit https://frameworksacademy.org/
    - Go to 'Specialized Sponsored Courses' and select 'Framing for Climate Interpreters.'
    - Place the course in your shopping cart (don't worry, it's free!).
    - 'Check out' and enter your information.
    - You will receive an email from FrameWorks Academy with instructions for accessing your course materials.

Use an explanatory tone.
Avoid framing climate change as a catastrophe. An alarmist tone can feel overwhelming and unsolvable. When talking about climate change, you will have more productive conversations when you seek to explain rather than persuade.

- Use matter-of-fact, optimistic language to discuss the causes, problems, and solutions associated with climate change.
- Avoid language that emphasizes opinion or political ideology. This allows all visitors, regardless of their political affiliation, to feel included in the conversation.

Instead of…	Use…
Politicians	Civic leaders
Policies	Approaches
Laws	Programs
Regulations	Municipal codes
Government	Specific state or city names

Center values.
Climate conversations are more effective when they appeal to widely shared values. NNOCCI research has identified two values that measurably impact people's support for addressing the root causes of climate change:

- ***Protection.*** "It is crucial for us to protect people, and the places we all depend on, from being harmed by the issues facing our environment."
- ***Responsible Management.*** "By taking practical steps to address problems facing our environment today, we are acting in the best interest of future generations."

Use tested metaphors.

People are more likely to act if they understand how something works. An Explanatory Metaphor is an easy-to-remember comparison that quickly and effectively explains the mechanisms involved in an abstract or complex topic. Two explanatory metaphors, developed and tested by FrameWorks, are a good fit for the concepts explored in ***Snow: Tiny Crystals, Global Impact:***

- ***Heat-trapping blanket.*** "When we burn fossil fuels for energy, carbon dioxide is released. This excess gas builds up in our atmosphere and acts like a blanket that traps heat around the world, disrupting our climate."
    - Using terms like "heat-trapping gasses" is clearer for the public to understand than "greenhouse gasses." Research shows that many people don't grasp how a greenhouse works.
- ***Regular vs. Rampant Co_2.*** "Regular levels of CO_2 are created by normal life processes, but rampant levels of CO_2 are produced when we burn fossil fuels for energy. We need to reduce rampant CO_2 ; it's out of control."
    - The word pair of "regular vs. rampant" helps the public make sense of how CO_2 can be a naturally occurring, essential part of human respiration *as well as* a threat to nature's balance.

Focus on hope and action.

The effects of climate change can feel overwhelming, but when visitors hear about collective, systemic initiatives to address it, they feel more hopeful. Community-level solutions can be on the scale of a local or regional organization, such as a school, place of worship, workplace, city, or state. Children can also think about solutions on the level of the groups they are part of: neighborhoods, classes, schools, and extracurricular organizations. You will boost your effectiveness as a facilitator if you research local organizations, initiatives, and ideas for how visitors can support them. Find stories of how your local and regional communities are addressing climate impacts and the actions they are taking to build equitable, healthy, resilient communities. Look for initiatives that fit these themes, which FrameWorks' research has found to be effective with the public:

- ***Ingenuity.*** "By being resourceful and innovative, we can come up with new ways to tackle difficult problems."
  For example, LED lights use 75% less electricity than older lighting and soon the U.S. will have converted, saving 569 TWh annually by 2035, equal to the annual energy output of nearly a hundred 1,000-MW power plants (Department of Energy website).

- ***Energy Shift.*** "By using energy sources that don't add to the heat-trapping blanket effect, such as solar energy, we can get the climate system back to functioning the way it should."

- ***Energy Efficiency.*** "While we work towards moving away from fossil fuels for energy altogether, we can use much less of the kinds of energy that add heat-trapping gasses to our atmosphere."

- ***Change the Conversation***. "We all have a part to play in building support for action on climate and ocean change. By talking more often about these issues, and by joining groups, we can make a difference."

Use exhibits.

Snow: Tiny Crystals, Global Impact is designed to prompt conversations about climate change. As you facilitate exhibits, use their content to guide the conversation toward the causes, effects of, and solutions to climate change. By discussing the impact of climate change on snowy communities, you can transition into a dialogue about your local challenges and opportunities for community, city, or state level action.

CLIMATE CHANGE Q&A

Q. Why is snow important?

A. Snow is needed to help regulate Earth's temperature. Snow helps cool the earth by reflecting up to 85% of incoming sunlight instead of absorbing sunlight and turning that energy into heat. Melting snow fills rivers, reservoirs, and groundwater in many regions of the world, including the drier western United States, where it is the major source of freshwater. Snow on mountain tops that melts in spring and summer flows downhill to be used hundreds of miles away for agriculture, hydroelectricity, drinking water, and habitat for animals and plants.

Q. How does snow help cool the earth?

A. Dark objects absorb more sunlight than light objects, and this light turns into heat energy. Light colored objects reflect sunlight so their temperatures don't change much. Snow is bright white–it is the most reflective natural substance on Earth. By reflecting sunlight, snow helps keep Earth cool. As snow melts, darker land or water is exposed which absorbs sunlight instead of reflecting it. As our planet warms, shrinking snowpacks and earlier snowmelt accelerate warming.

Q. Why does spring snow matter?

A. In the western United States and other dry areas of the world, snow on mountains is a crucial source of water. During the hotter spring and summer months, as snow gradually melts on nearby mountains, the water runs downhill into rivers. That water is needed to replenish rivers, reservoirs, and groundwater and provide water for agriculture, hydroelectric power, habitat for animals and plants, and drinking water. Compared to rain which runs off rapidly and can cause flooding, snow melts gradually enough that it replenishes rivers and is absorbed into the ground.

With our warming planet, many areas are seeing more rain and less snow in the winter. Less winter snow, and earlier melting of snowpack in the spring, means that there is less water during drier summer months. See the exhibits *Snowmelt Journeys* and *Adapting Our Water Use* to find out about water conservation and how different communities are adapting to changing water patterns.

Q. What's the difference between global warming and climate change?

A. Global warming only refers to the rising average surface temperature of the earth. Climate change includes global warming and all the effects that come from rising temperatures. These include a warming and rising ocean, ocean acidification, changing rain and snow patterns, more intense storms and hurricanes, more frequent droughts and wildfires, and shrinking glaciers, ice sheets, and snow cover.

Q. What is causing climate change?

A. Earth's climate has changed over the millennia due to natural causes. These changes were catalyzed by periodic shifts in Earth's orbit, which affect the amount of sunlight reaching different parts of the planet, and were amplified by the amount of carbon dioxide gas in the air. But right now, we are seeing change above and beyond these regular cycles—we are seeing rampant levels of the heat-trapping gas CO_2 from burning fossil fuels and a steep increase in temperatures as a result. In the last 150 years, the earth has warmed much faster than it has in the past 24,000 years. The global warming that we are experiencing now is driven by the use of fossil fuels for energy and other human activities, like deforestation and overconsumption.

When we burn fossil fuels (coal, oil, and methane gas), we add excess carbon dioxide (CO_2) gas into the air. This buildup of CO_2 acts like a blanket that traps heat. As our planet warms, the ocean warms too. The ocean acts like the heart of the climate system, pumping heat and moisture around the planet. A warming ocean disrupts this flow, which disrupts weather and climate patterns around the world. Changing weather and climate affect food and water resources for people, animals, and plants. As different areas get warmer and drier, plants and animals that need colder and wetter climates have shorter growing seasons or migrate to colder areas to find food and water.

Q. Climate change is such a big problem; I can't really make a difference.

A. One drop of water won't get you wet, but a thunderstorm can drench you in seconds. It's the same with fighting climate change. Communities—tens, hundreds, thousands, or millions of people—working together is the answer. We have made larger changes before, and we can do it now if we work for large-scale, systemic

solutions. Joining a group and talking to others are key ways to amplify your individual impact.

Remember: human civilization has survived ice ages and other warm periods and continued to go on. We can make it through the current changes as well.

The *Working Together For a Better World* exhibit is designed to help facilitate conversations with visitors around local climate actions. Direct visitors to local organizations and groups that are building equitable, healthier, and more resilient communities.

Work with Nature. Intact ecosystems naturally cool our planet, store carbon, and protect water. We can help by planting trees and restoring natural areas.

Advocate for Change. How does your community need to adapt? Speak up for the changes you want to happen. Find a local group and add your voice and skills.

Support Renewable Energy. There's no healthy future in burning dirty fossil fuels. Transitioning to renewable energy protects our climate, reduces air pollution, and conserves water.

Share Your Climate Story. Everyone has a story, because climate change is underway everywhere. Your story can help others see how the climate is changing and inspire action.

MUSEUM AND CLASSROOM ACTIVITIES

Snow: Tiny Crystals, Global Impact was developed and produced by OMSI as part of ***Our Winter World,*** a collaborative project led by the Geophysical Institute at the University of Alaska Fairbanks (UAF) and funded by the National Science Foundation. The project team in Alaska developed and delivered outreach programs about snow to Indigenous villages across the state and created the ***Our Winter World*** website. We have included several of their activities in this guide.

Visit http://ourwinterworld.org/ for more educational resources including activities using real snow.

Activities:

1. Paper Snowflakes
2. Snow Crystal Symmetry
3. Design Challenge: Snow Boots
4. The Language of Snow
5. Earth's Freshwater Resources

Snow Active Learning Log

The Active Learning Log offers questions and activities to engage students visiting ***Snow: Tiny Crystals, Global Impact.*** Before your visit, make a copy for each student or distribute a copy to each group leader or chaperone to use with their group. These are also great questions for museum educators to pose to visitors.

**Remember to bring pencils and something to write on.*

Paper Snowflakes

This activity is adapted from the Our Winter World website.
http://ourwinterworld.org/2022/02/08/paper-snowflakes/

Duration: 20 minutes
Age Range: Ideal for ages 3 and up

Overview

Students fold paper circles and cut out their own six-sided snowflake designs. This activity reinforces the fact that snow crystals (or snowflakes) have hexagonal (six-sided) symmetry.

Materials

- Paper Snowflake template (in Appendix)
- Types of Snow Crystals chart (in Appendix)
- Scissors
- Examples of paper snowflakes already cut out (optional)

Activity Procedure:

1. Print copies of the Paper Snowflake template.
2. Cut out the circle.
3. Fold circle in half along line 1.
4. Fold the halved circle into thirds along lines 2 and 3.
5. Figure out how you want to cut your snowflake and cut your lines.
6. Unfold your snowflake and see what you created!
7. Optional: Look for examples of paper snowflakes online. Are there some designs that couldn't actually be found in nature? Which ones? Paper snowflake crafts are sometimes made with four- or eight-sides. These may be pretty, but snow crystals in nature only have six sides or arms. Sometimes they can appear to be twelve-sided/twelve-armed when two snow crystals stick together or "aggregate" and then continue to grow as one. However, their symmetry is always a multiple of six.

What's the Science?

When we see these crystals falling from the sky, we usually call them snowflakes. Snowflakes can be individual snow crystals, or they can be clumps of snow crystals stuck together. Snow crystals can be different shapes and sizes, but they all have six sides or arms. Sometimes when we find them they are broken, so we can't see all of the arms.

Look at the Types of Snow Crystals chart:
http://www.snowcrystals.com/guide/snowtypes4.jpg
Find and count the six sides and six arms of crystals shown in the chart.

Because snow crystals have six identical sides/arms and an individual crystal looks the same no matter which side/arm is "up," we say that snow crystals have hexagonal symmetry.

Optional Modifications:

- For students who want a challenge, show them (or encourage them to find online) photographs of specific snow crystal shapes and challenge them to create a paper snowflake that looks like the example.

References

Many different examples of photographs of real snow crystals can be found on Ken Libbrecht's website: http://snowcrystals.com

- Snowflake Science: A Snowflake Primer
  http://www.snowcrystals.com/science/science.html
- Types of Snowflakes Chart
  http://www.snowcrystals.com/guide/snowtypes4.jpg
- Snowflake Photographs
  http://www.snowcrystals.com/photos/photos.html
- Designer Snowflakes
  http://www.snowcrystals.com/designer/designer.html
- Videos of snow crystals growing under controlled conditions in Ken Libbrecht's laboratory
  http://www.snowcrystals.com/videos/videos.html

Learn more at these exhibits in *Snow: Tiny Crystals, Global Impact*.

- *Watching Snow Grow*
- *Making Sense of Snow Crystals*

Snow Crystal Symmetry

This activity explores hexagonal symmetry using paint to create six-sided snow crystals.

Duration: 10-15 minutes
Age Range: Ideal for ages 3 and up

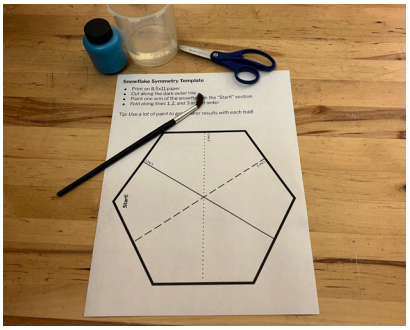
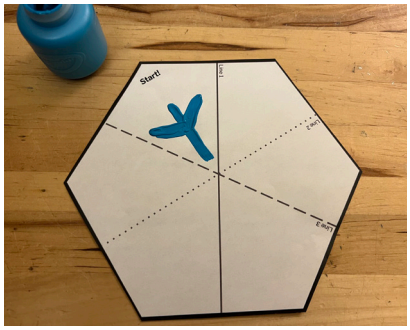
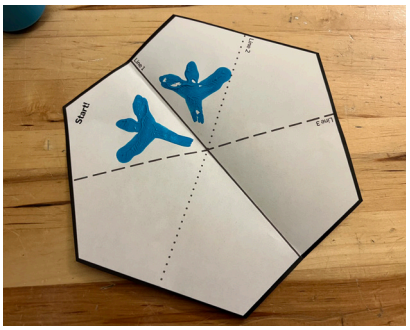
Materials

- Snow Crystal Symmetry template (in Appendix)
- Scissors
- Paint brush
- Craft paint
- Cup of water

Activity Procedure:

1. Print the Snow Crystal Symmetry template on 8.5 x 11-inch paper.
2. Cut along the bold outer lines.
3. In the section labeled “Start,” paint one arm of your snowflake.
4. Fold along line 1, pressing the paint onto the paper. Unfold.
5. Fold along line 2, pressing the paint onto the paper. Unfold.
6. Fold along line 3, pressing the paint onto the paper. Unfold.
7. Admire your symmetrical, 6-armed snowflake!

Tip: Use more paint on your first snowflake arm to get clearer results with each fold.


What's the Science?

When an object or organism is symmetrical, it has parts that look the same when it is rotated or flipped across a plane or around a center point. For example, if you draw a line down the center of a butterfly, the wings to the left and right of that line look the same.

Snow crystals have six-fold symmetry, meaning that they have six arms that are all alike. This forms the classic hexagon shape we associate with snowflakes. Snow crystals have both **reflective** and **rotational** symmetry. This is what that means:

> **Reflective Symmetry**: An object or organism mirrors itself when cut down the center. Example: mammals (including humans).
>
> **Rotational Symmetry**: The object or organism's mirrored parts are arranged around a central axis. Example: sea stars.

Why are snow crystals symmetrical? Snow crystals form when water vapor in the air freezes directly into ice. When the vapor is freezing, water molecules form hydrogen bonds that arrange in the shape of a hexagon (six-sided shape). Once the hexagon pattern begins, additional water molecules that make contact with the crystal bond in the same pattern to form a symmetrical crystal with six arms.

As it travels through the atmosphere, the temperature and humidity conditions a snow crystal experiences affects its pattern. However, since all six arms of the crystal take the same path through the clouds, each arm grows in the same way, creating a unique but symmetrical crystal. Similarly, no two snowflakes are exactly the same because of the unique conditions each crystal experiences.

Discussion Questions:

- When a snow crystal is growing, does one arm grow at a time, or do all six arms grow together?
- Does your snowflake have reflective or radial symmetry, or both?
- Aside from the examples given above, what other things in nature are also symmetrical? Do they have reflective or rotational symmetry, or both?

Learn more at these exhibits in *Snow: Tiny Crystals, Global Impact*.

- *Watching Snow Grow*
- *Making Sense of Snow Crystals*

Design Challenge: Snow Boots

Have you ever tried to walk in really deep snow? What happened? Snow-adapted animals have more success than humans walking, running, digging, and even sliding in the snow. How can adaptations found in nature help you design your own snow boots?

Duration: 10-15 minutes
Age Range: Ideal for ages 9-14
(See Optional Modifications for younger audiences)

Materials

- Snow Boot template (in Appendix)
- Scissors
- Tape and/or glue
- Artificial snow, kinetic sand, or other snow-like material for testing
- Photos of animal tracks/prints (optional)
- Recycled/found materials, such as:
    - Cotton balls
    - Foam
    - Fabric
    - Sticks
    - Rubber bands
    - Cardboard
    - Popsicle sticks
    - Pipecleaners

Activity Procedure:

1. **Prepare your materials**
    a. Print or draw the Snow Boot template on cardstock paper.
    b. Cut around the line of the template.
    c. Gather recycled and found materials to build your snow boot

2. **Design the sole of your snow boot**
    a. Your goal is to design the sole of a snow boot that sits above the snow.
    b. Use the recycled and found materials to build a model of your snow boot's sole on the paper template.

3. **Test your snow boot**
    a. Put your design to the test! Use powdered snow or sand to test your design.
    b. Make changes to your design and model based on your tests

What's the Science?

Evolution on Earth has been hard at work creating organisms and processes that are highly adapted to their specific environment. Animals that have evolved in environments like the Arctic tundra in Alaska are well adapted to life in the snow. Biomimicry is the term we use when humans incorporate the structures and functions of nature into human-made designs.

Try using biomimicry to design a snow boot. First, learn about Arctic animals to find inspiration for creating a snow boot. Visit the *Getting Around* page on the ***Our Winter World*** website to learn more about animal adaptations for walking on snow. http://ourwinterworld.org/snow-and-living-things/animals/getting-around/

Human-designed items are loaded with biomimicry. One of the most basic examples is how someone many years ago looked at birds and decided to imitate their shape and structure to create a flying device for humans—and today we have airplanes.

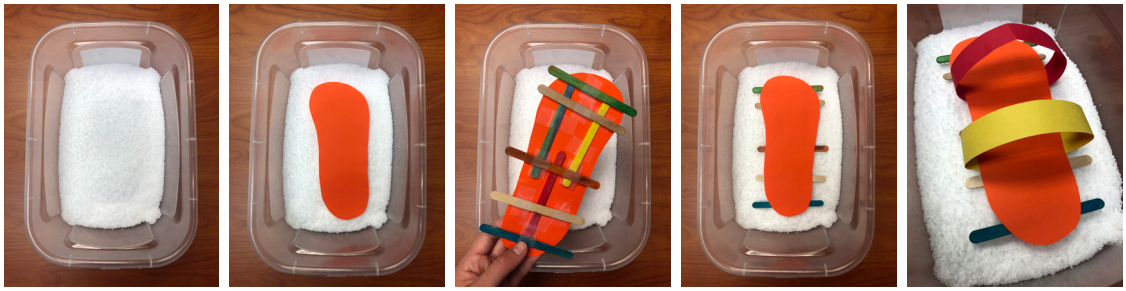
Discussion Questions:

- How did your snow boot design evolve as you were creating it?
- What are some characteristics of your shoe that you think will make it useful to walk on snow? Was anything inspired by nature?
- Did anything in your design not work out, and how did you change it to work better?

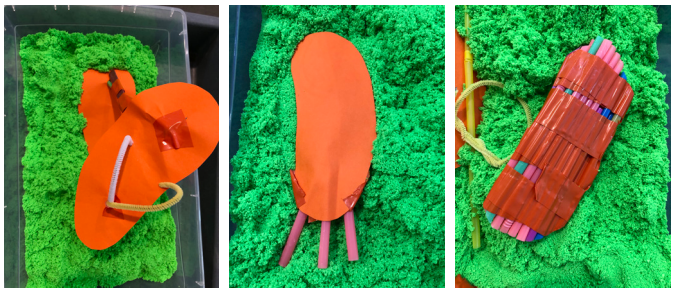
Optional Modifications:

- Have each student trace around their foot to make a snow boot template.
- Younger audiences can focus on drawing their snow boot on the template with crayons, and imagining new creative uses for their boot.
- Have learners look up more examples of animal adaptations for walking in snow. What new inspirations do they find?

Setup photos with white artificial snow:



Visitor testing photos with green kinetic sand:



The Language of Snow

What words do you use to talk about snow? Are they the same words your friends and family use? What about people that live on the other side of the world? Interview those around you to learn more about language and the effect our environment has on our vocabulary.

Duration: 10 minutes
Age Range: Ideal for ages 9 and up
(See Optional Modifications for younger audiences)

Materials

- Language of Snow interview worksheet
- Pencil
- A friend or family member

Activity Procedure:

1. Print the Language of Snow interview worksheet or use a blank sheet of paper.
2. Write down all the words you use for snow or to describe snow.
3. Find a friend or family member you can interview, and ask them what words they use.
4. Learn how your vocabulary is similar or different.

Alaska Native Languages

Snow is a prominent element of the environment in Alaska. All of Alaska's Indigenous languages include a wide range of terms to describe different kinds of snow features, snow events, and the importance of snow to people. Some of these cultures have over 70 explicit words for different types of snow (but not hundreds as some sources may claim).

Visit the *Snow in Language* page on the ***Our Winter World*** website. How do these words compare to your list of snow words?
http://ourwinterworld.org/snow-and-people/snow-and-alaska-native-peoples/snow-in-language/
You can learn more about *Snow and Alaska Native Peoples* here:
http://ourwinterworld.org/snow-and-people/snow-and-alaska-native-peoples/

What's the Science?

The vocabulary we use is shaped by the people and places we live around. In environments where snow is rarely or never present, words to describe snow are limited. In communities that experience snow regularly, more words for snow emerge to describe the diversity of conditions that exist.

Discussion Questions:

- Did you learn any new words for snow?
- What affects the words we have and use to describe snow?
- In your own culture or geographic location, when do you use many different words to describe weather? For example, if you live in an area where it rains a lot, what different words are used to talk about rain?

Optional Modifications:

- For younger audiences, you can ask them to list books, stories, or movies they know where snow appears, and have them tell you the story of how snow was a part of it. Write down the words they use to talk about snow and compare it to what other friends or family members have shared.

Learn more at these exhibits in *Snow: Tiny Crystals, Global Impact*.

- *Snow and Arctic Life*
  Watch the video "Words for Snow" to hear words from the Iñupiaq language.

Earth's Freshwater Resources

Adapted from ***Our Winter World***
http://ourwinterworld.org/2022/05/27/earths-freshwater-resources-snow-as-a-water-source/.

Duration: 10 -15 minutes
Age Range: Ideal for ages 9-14

Materials

- NASA photo of Earth from Space–Blue Marble, found here: https://solarsystem.nasa.gov/resources/786/blue-marble-2002/
- 5 gallon bucket full of water
- 2 cup measuring cup
- ½ cup measuring cup
- 2 eye droppers
- 2 ice cube trays

Overview

Students observe various forms of water (clouds, Greenland ice sheet, oceans) in a photo of Earth from space and watch a teacher-led demonstration illustrating the distribution of Earth's water resources, emphasizing the very small amount of Earth's water that is fresh water and available to humans and ecosystems.

This activity is an abbreviated version of several related lessons from the National Oceanic and Atmospheric Administration (NOAA) that address water resources, water use, and water conservation.

Activity Procedure:

1. **Engage/activate prior knowledge**
    a. Ask students to think about ways they use water everyday, and where the water they use comes from (from NASA Freshwater Availability classroom activity).

2. **Observing water on planet Earth**
    a. Show the "blue marble" photo. Draw their focus to WATER in the image. What are the blue areas? (Oceans, which are made up of water.)

b. One of Earth's nicknames is the "Blue Planet." Why? (About 70% of Earth's surface is covered by water, which appears blue.)
c. Not all water appears blue though! What are the white swirls? (Clouds, which contain water droplets or ice particles.) What about the solid white area in the upper right portion of the photo? (Snow on the Greenland ice sheet—water in its solid form.)
d. Water is one thing that makes Earth so special among all the planets. All living things on Earth need water to survive.

3. **Introduction to freshwater as a limited resource**
    a. Would we want to drink the water in the oceans? Why or why not? (No. It is salt water, and it does not help our bodies the way that *freshwater* does. Most living things can't use salt water for survival. Similarly, farmers can't use salt water to irrigate crops.)
    b. Even though there is a lot of water on Earth, it's mostly (97%) salt water. The amount of freshwater is only a small portion of the total water on Earth (3%), and that is the only water that people and land-based ecosystems can use.

4. **Visually represent the distribution of Earth's water resources**
    The following demonstration is adapted slightly from the NASA Global Precipitation Measurement Mission lesson plan, "Earth's Water."
    a. The demonstration starts with a 5-gallon bucket filled with water. This represents all of the water (100%) on Earth.
    b. We just learned that most of the water on Earth is salt water; the rest is called freshwater. We are going to focus on freshwater. (Remove two cups of water from the bucket). These two cups represent all of the freshwater on Earth, which makes up 3% of Earth's total water supply. (Move the bucket representing the oceans out of the way, since we are only considering freshwater from now on).
    c. Where and in what forms can freshwater be found on Earth? (Lakes, rivers, glaciers, snow fields/ice, permafrost, aquifers/underground, as water vapor in the atmosphere/in clouds. Guide them toward identifying polar ice caps/glaciers as containing water in its frozen form).
    d. Remove ½ cup of water from the 2 cups of water representing all freshwater. Pour the remaining 1 ½ cups of water into an ice cube tray. The 1 ½ cups of

water in the ice cube tray represent the amount of freshwater that is stored as ice in glaciers and polar ice caps, and therefore not available for human use.

e. Focus on the remaining ½ cup of water. This represents the liquid freshwater that is in the ground, surface waters (rivers and lakes), and water vapor in the atmosphere. So if the 5 gallon bucket represents all of the water on Earth, this half cup shows how much of that total (1%) is freshwater that is available to use.
f. Not all of the 1⁄2 cup of water is clean and usable for human consumption. Use an eyedropper to remove one drop of water from the ½ cup. This drop represents the amount of freshwater that is clean and available for humans to use.

5. **The sources of freshwater**
    a. Living things need freshwater to survive. Besides the freshwater that we need to drink, cook, and wash, humans use freshwater for growing the food that we eat, generating electricity (power generation), and producing things that we use and buy. Only a small amount of Earth's total water can be used by humans for these things.
    b. Where does the water that we use come from? (Lakes, streams, groundwater) And where does that water come from? (Rain, snow)

References

Freshwater Availability lesson plan. No date. Precipitation Education, Global Precipitation Measurement Mission, NASA. https://gpm.nasa.gov/education/lesson-plans/freshwater-availability-classroom-activity
Earth's Water lesson plan. No date. Precipitation Education, Global Precipitation Measurement Mission, NASA. https://gpm.nasa.gov/education/lesson-plans/earths-water
Where Is Earth's Water? 2021. USGS Water Science School, U.S. Geological Survey. https://water.usgs.gov/edu/gallery/watercyclekids/earth-water-distribution.html

Learn more at these exhibits in *Snow: Tiny Crystals, Global Impact.*

- *Adapting Our Water Use*
  Compare major categories of water use in the U. S.
- *Storing Water for Later*
  Compare snow and rain as sources of water during the year.
- *Snowmelt Journeys*
  Discover how dry and distant cities and farms rely on snowmelt for their water supply.

Name_____

1. Play with a snowstorm in **Falling Snow**. What kind of snow crystal did you see in the snowstorm? Draw a picture or write its name.
   *__Bonus__: Add another kind of snow crystal.

2. At the **Keeping Earth Cool** exhibit, is the white or blue hemisphere warmer?

   Circle one: **Blue** **White**

   Why is one warmer than the other?

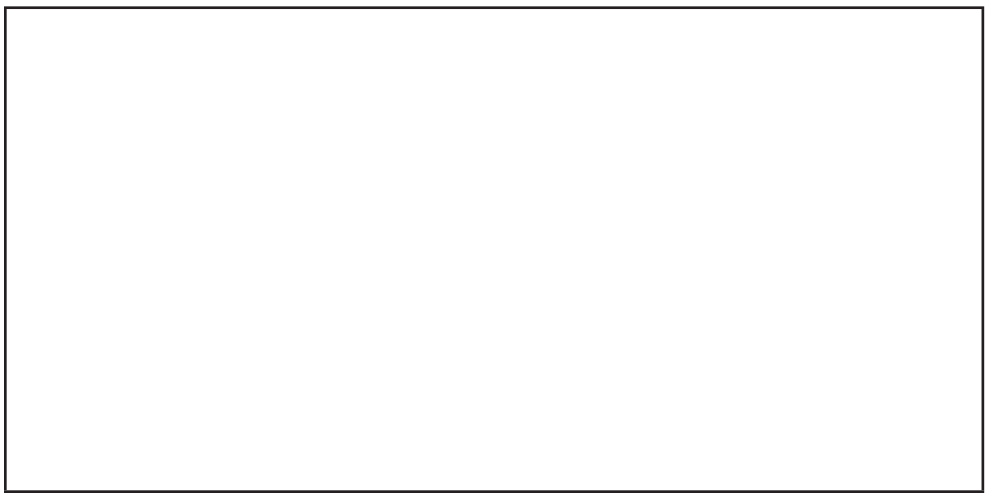
   ---

3. Visit **Storing Water for Later** and compare rain and snow falling on a mountain. What differences do you see?

   Why is snow better for towns and farms than rain?

   ---

4. Visit **Snow on the Ground.**
   Draw an animal that makes their home on or under a snowpack.



   Circle the kind of snow they live in:

   Maritime **Taiga** **Tundra**

   How does this animal use or rely on snow?

   What might happen if the animal's environment suddenly had less snow?

   ---

5. Visit **Working Together for a Better World**. Together with your community, what can you do to create positive change for snow on Earth?

Bonus question:

6. There are snowshoe hares hiding around the exhibit—how many can you find?
   I found _____ hares!

1. Play with a snowstorm in **Falling Snow**. What kind of snow crystal did you see in the snowstorm? Draw a picture or write its name.
   *__Bonus__: Add another kind of snow crystal.

Answers will vary. Possible answers include:

- *Hollow Column*
- *Capped Column*
- *Stellar Plate*
- *Stellar Dendrite*
- *Rimed Dendrite*
- *Graupel*

2. At the **Keeping Earth Cool** exhibit, is the white or blue hemisphere warmer?

   Circle one: **Blue** **White**

   Why is one warmer than the other?

   Lighter surfaces reflect more heat than darker surfaces. The white hemisphere represents snow, which reflects more heat than the blue hemisphere, which represents water. Snow generally reflects about 6 to 8 times more heat than land or water do.

3. Visit **Storing Water for Later** and compare rain and snow falling on a mountain. What differences do you see?

   Rain provides water all at once. Water flows when it rains
   Snow is stored in the mountains during winter and melts through spring and summer.

   Why is snow better for towns and farms than rain?
   With snow, our towns and farms get water when we need it in drier months. Without enough snowmelt, towns and farms have water shortages in drier months.

4. Visit **Snow on the Ground.**
   Draw an animal that makes their home on or under a snowpack.

Drawings will vary. Animals in the exhibit include:
Maritime Snow
- *Wood Frog*
- *American Pika*

Taiga Snow
- *Hoary Marmot*

Tundra Snow
- *Brown Lemming*
- *Short-tailed Weasel/Ermine*
- *Willow Ptarmigan*

   Circle the kind of snow they live in: (See above)

   Maritime **Taiga** **Tundra**

   How does this animal use or rely on snow?

- ***Wood Frogs*** *freeze during the Arctic winter, thawing in early spring to "get the jump on" other frogs.*
- ***American Pikas*** *stay active under the snowpack all winter, feeding on plants they gathered and stored during the summer months.*
- ***Hoary Marmots*** *hibernate underground, using the snowpack to protect themselves from extreme winter temperatures.*
- ***Brown Lemmings*** *spend the winter under the snow, tunneling through the snowpack's bottom layer to feed on frozen plants. The snow keeps them hidden and insulates them from extreme cold.*
- ***Short-tailed Weasels*** *change color from brown to white in the winter. Their white coat camouflages them in the snow, making it easier to hunt and avoid being hunted.*
- ***Willow Ptarmigans*** *In winter, they turn white to blend in with the snow. Snow provides a hiding place and shelter from the cold.*

What might happen if the animal's environment suddenly had less snow?

Answers will vary. The animal may lose a source of camouflage, shelter, insulation from the cold, or a place to hide.

5. Visit **Working Together for a Better World**. Together with your community, what can you do to create positive change for snow on Earth?

   Answers will vary. Possible themes include:
   - *Learn more about how my community uses snow.*
   - *Practice water-saving methods at home or in school.*
   - *Teach others about the importance of snow.*
   - *Find ways to combat climate change.*
   - *Speak to local leaders about snow and climate change.*

Bonus question:

6. There are snowshoe hares hiding around the exhibit—how many can you find? I found _____ hares!

   There are 9 snowshoe hares total. Some are on the sides and backs of the exhibits and may not be visible.

RESOURCES AND REFERENCES

Curious to learn more? Check out these engaging books, websites, and videos all about snow!

Websites

Professor Ken Libbrecht's Snow Crystals website has a wealth of photographs, videos and other resources for exploring the science of falling snow. http://snowcrystals.com/

The ***Our Winter World*** website has resources and activities about snow science, culture, and climate from the team at the UAF Geophysical Institute that co-developed the exhibition. http://ourwinterworld.org/

The Center of Science and Industry (COSI) in Columbus, OH co-developed a COSI Connects science learning kit about snow in collaboration with the UAF Geophysical Institute. Kits are available for purchase from COSI. https://cosi.org/connects/kits/snow-kit.php

See snowflakes up close in this PBS video of a Colorado doctor capturing the uniqueness of snowflakes using a black sock and a camera. https://www.rmpbs.org/blogs/rocky-mountain-pbs/snowflake-photography-colorado-doctor/

The National Informal STEM Education (NISE) Network has a number of additional water, ice, snow, and climate activities to explore. https://www.nisenet.org/water

> Snowflakes: Nano at its Coolest
> https://www.nisenet.org/catalog/programs/snowflakes_nano_at_its_coolest
>
> Climate Change: A compilation of climate change public engagement and professional learning resources for informal science educators
> https://www.nisenet.org/climatechange

National Snow and Ice Data Center
https://nsidc.org/

NASA Global Climate Change Vital Signs of the Planet
https://climate.nasa.gov/

NNOCCI Climate Science Fundamentals
https://climateinterpreter.org/content/nnocci-climate-science-fundamentals

National Oceanic and Atmospheric Administration (NOAA) Climate
https://www.noaa.gov/climate

U.S. Climate Resilience Toolkit
https://toolkit.climate.gov/

Books on Snow Science

Field Guide to Snowflakes by Kenneth Libbrecht (2006)
http://www.snowcrystals.com/books/books.html

Field Guide to Snow by Matthew Sturm (2020)
https://upcolorado.com/university-of-alaska-press/item/5669-a-field-guide-to-snow

Apun: The Arctic Snow by Matthew Sturm (2009)
https://upcolorado.com/university-of-alaska-press/item/5885-apun-the-arctic-snow
This educational book explores Arctic snow. Recommended for grades 3 to 4.

Apun: The Arctic Snow Teacher's Guide by Matthew Sturm (2009)
https://upcolorado.com/university-of-alaska-press/item/5886-apun-the-arctic-snow-teacher-s-guide
The teacher's guide can be used to provide background material for teaching about Arctic snow cover, or it can be used alone as a text for more advanced students.

Children's Books about Snow

There are many, many wonderful picture books about snow. Here are a few favorites from the project team.

The Cat and the Hat Comes Back by Dr. Suess (All Ages)
It was voted favorite silly snow book by the project leaders.

The Snowy Day by Ezra Jack Keats (Ages: 1 to 7)
A true classic that every child should be introduced to. It shows a little boy discovering the joys of tracks in the snow, snow angels, and snowmen, and his sadness when the snowball he tries to save in his pocket disappears when he goes inside.

The Snowman and the Sun by Susan Taghdis (Ages: 3 to 5)
This book introduces the water cycle to young children in a simple format. The illustrations are very fun.

Snow by Cynthia Rylant (Ages: 3 to 7)
This beautifully illustrated book explores falling snow and the lovely memories it evokes.

The Snowflake: A Water Cycle Story by Neil Waldman (Ages: 4 to 9)
A snowflake travels through all its changes in the water cycle, month by month. It is a poetic introduction to the water cycle told as a story.

Over and Under the Snow by Kate Messner (Ages: 4 to 9)
As a young child skis with a parent, they learn about many of the animals that live over and under the snow. It is a playful introduction to how animals adapt to the winter.

Snowflake Bentley by Jacqueline Briggs Martin (Ages: 4 to 12)
The true story of Wilson Bentley and how he was able to create detailed photographs of snowflakes. It starts with his curiosity about nature as a young child and how he later learned to "capture" snowflakes and share them with the world.

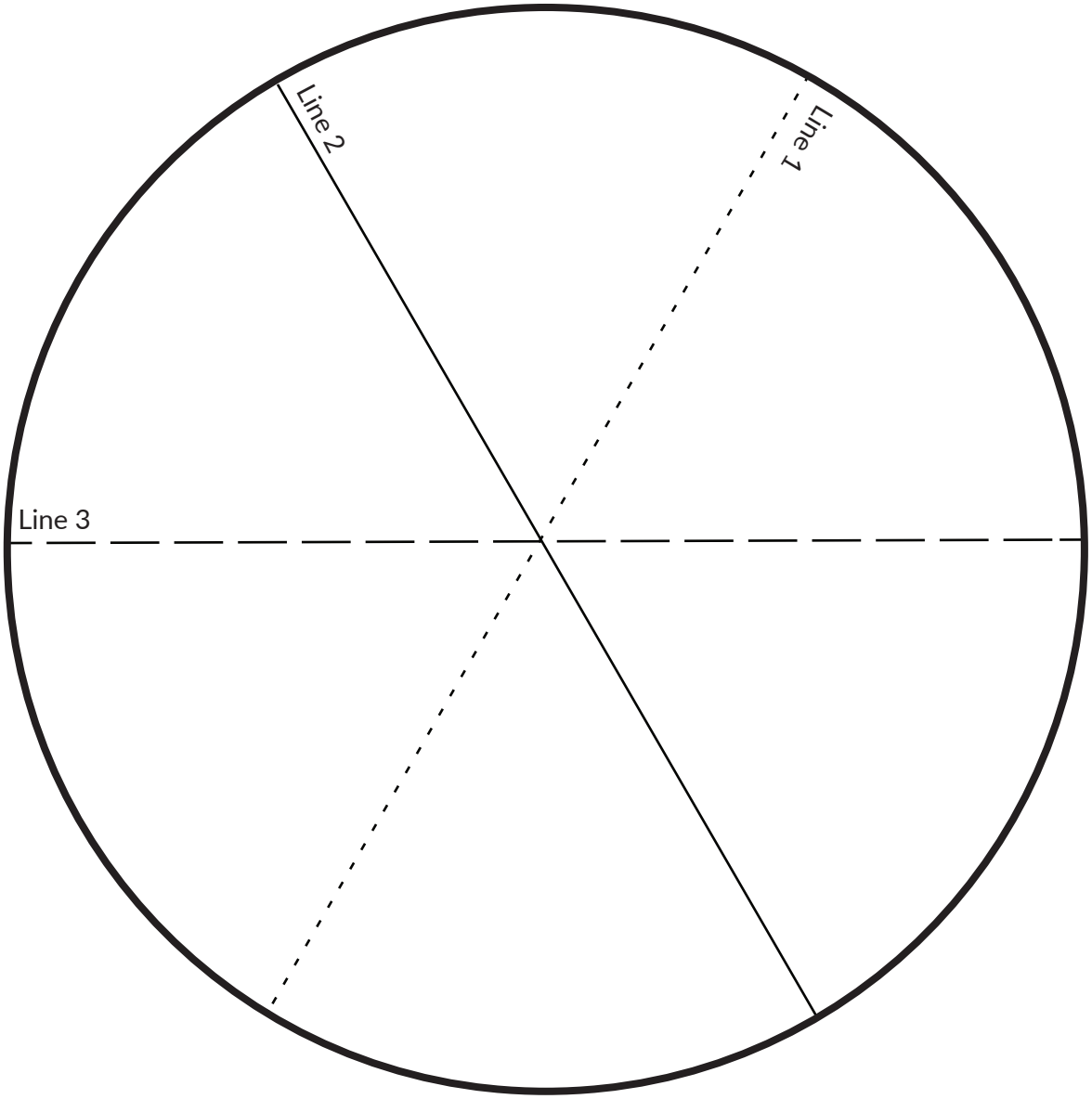
The Story of Snow by Mark Cassino with Jon Nelson, Ph.D. (Ages: 5 to 12)
The book tells the story of how snow crystals form into many different shapes (plates, columns, stars) and how to preserve snow crystals for observation. It is a science book, but written with an easy to understand text.

APPENDIX

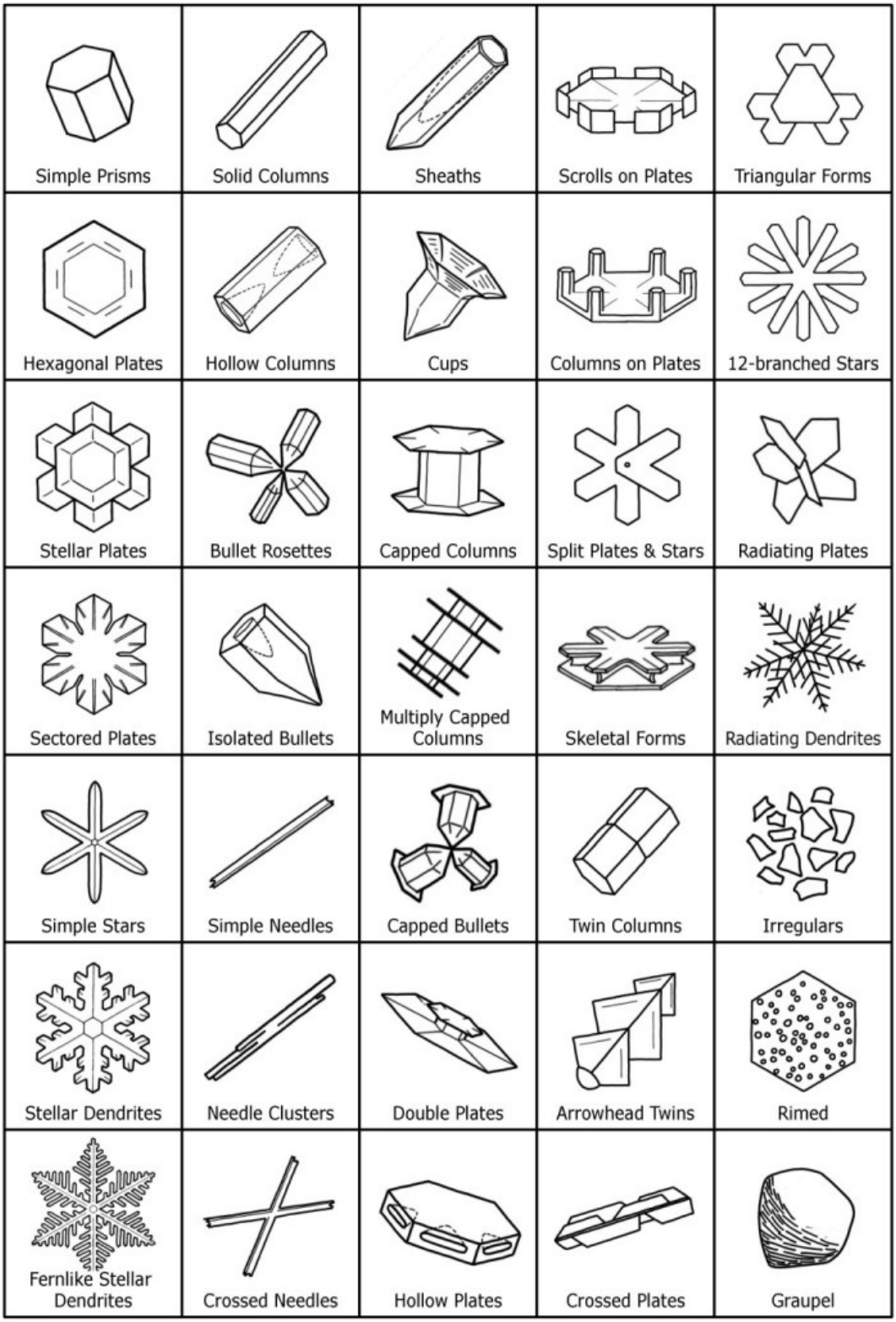
1. **Paper Snowflake Template**
2. **Types of Snowflakes Chart**
3. **Snow Crystal Symmetry Template**
4. **Snow Boot Template**
5. **Language of Snow Interview Sheet**

Paper Snowflake Template

- **Print on 8.5 x 11-inch paper.**
- **Cut out the circle.**
- **Fold the circle in half along line 1.**
- **Fold the half circle in thirds along lines 2 & 3.**
- **Plan your snowflake design and cut it out of the folded paper.**

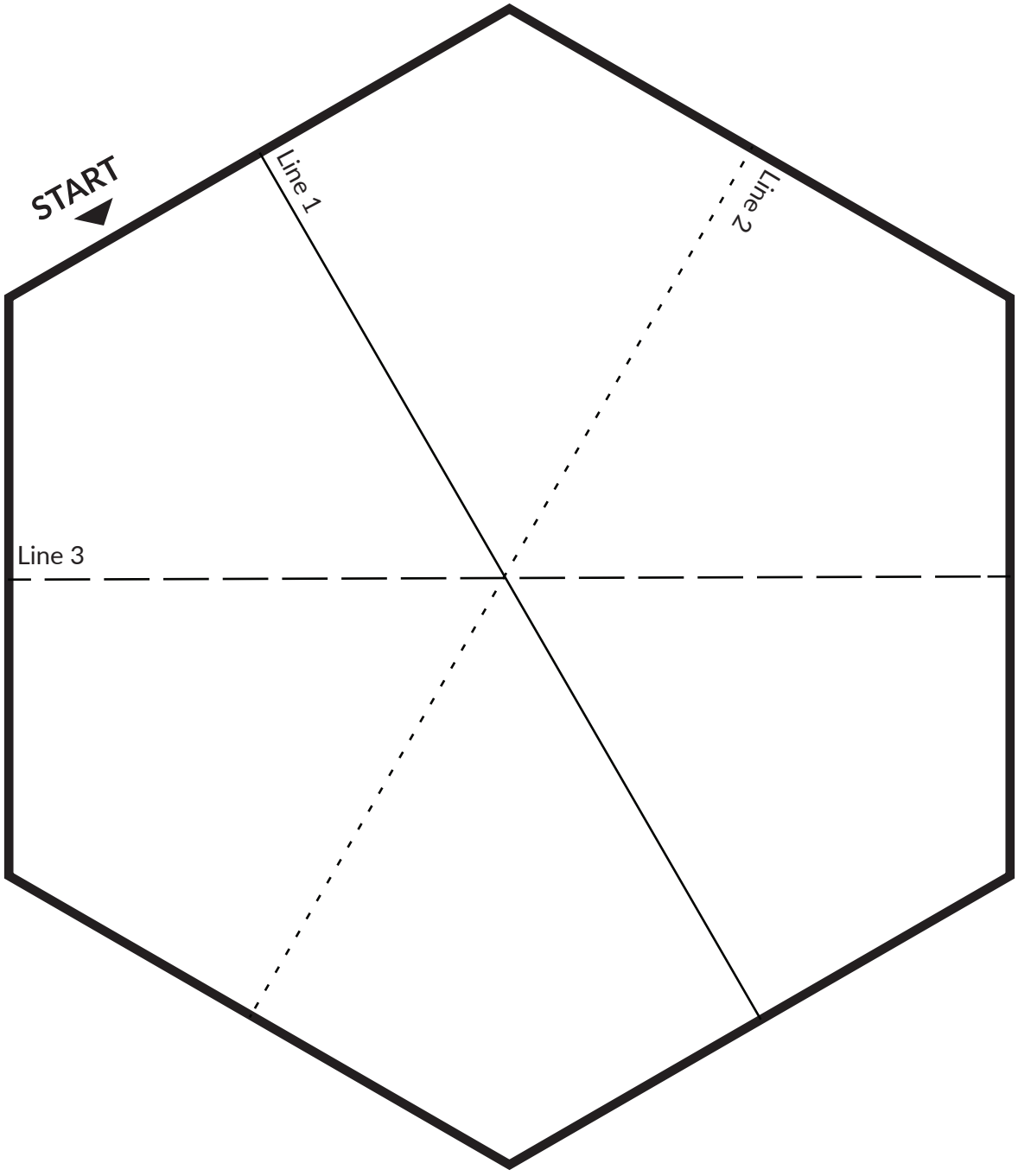


Types of Snowflakes Chart



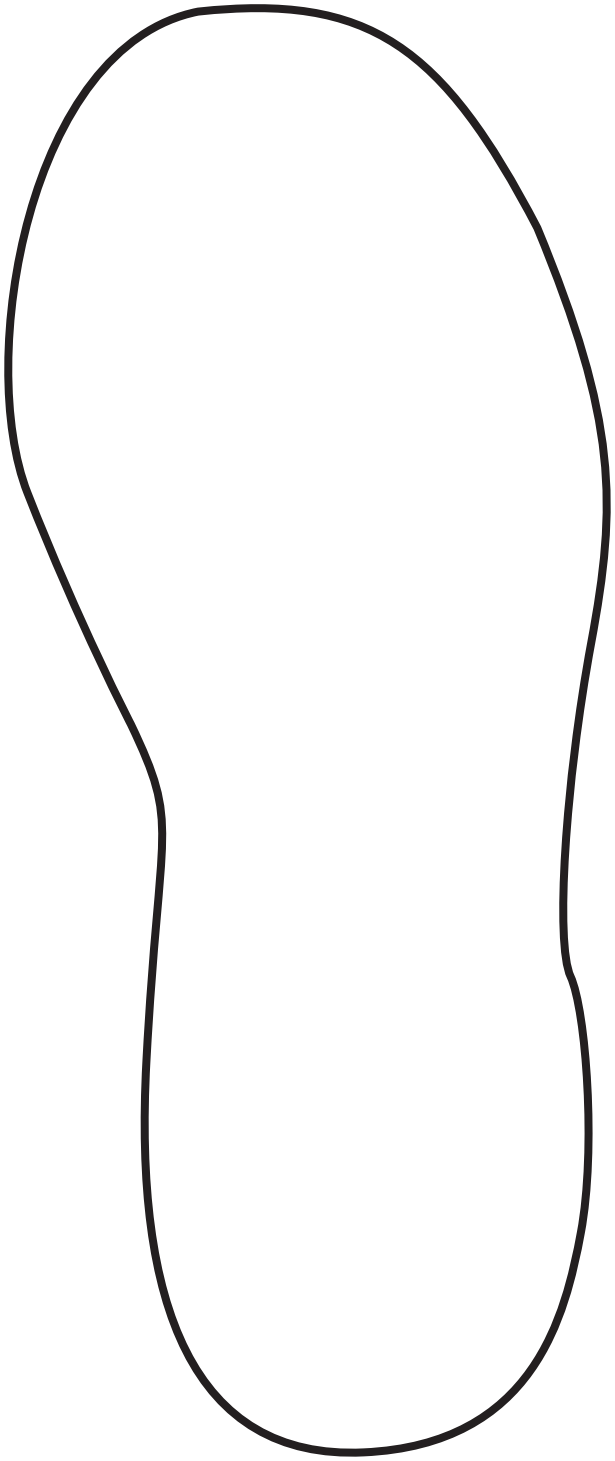
source: Ken Libbrecht http://snowcrystals.com/

- **Print on 8.5x11 inch paper.**
- **Cut along the dark outer line.**
- **Paint one arm of the snowflake in the "Start" section.**
- **Fold then unfold along lines 1, 2, and 3 in that order.**



Snow Boot Template

- **Print on 8.5x11 inch paper.**
- **Cut along the dark outer line.**
- **Use this as a base to build your snow boot.**



The Language of Snow Interview Worksheet

What words do you use to talk about snow? Are they the same words your friends and family use? Interview someone using this worksheet to learn more about what words they use to describe snow.

What word do you use to describe falling snow?

What words do you use to describe snow on the ground?

What word do you use to describe melting snow?

ICE AGE

MICHIGAN'S FROZEN SECRETS

EDUCATOR GUIDE

grpm.org

GRAND RAPIDS PUBLIC MUSEUM

Be curious.

EXHIBIT OVERVIEW

Ice Age: Frozen Secrets features many of the majestic creatures that roamed North America during the last Ice Age. The exhibit is designed to give students tactile experiences with Ice Age specimens. The history and science of the Ice Age is told through engaging information panels and colorful graphics that explain geologic periods and illustrate glacier formation, size, and flow.

Expect to see these life-size, authentic-looking creatures from the Ice Age:

Sabertooth cat	Mammoth	Woodland musk ox
Glyptodont	Ice Age Bear	Dire wolf
Giant beaver	American mastodon	Giant ground sloth

Other Features:

- Simulated dig boxes reveal surprising remains of extinct creatures. Learners can use brushes and 'excavate' fossil casts of bones and teeth.
- Early human cave art examples inspire young visitors to make their own artistic rubbings of Woolly Mammoth and Sabertooth Cat.
- A glacier extent wall display illustrates the approximate maximum extent of the glacial ice sheet at the peak of the Ice Age.

Accessibility Features:

- Multi-sensory exhibit with interactive elements that enliven the senses, including tactile experiences.
- Visit grpm.org/accessibility for a complete list of accessibility features at the GRPM.

Please Be Sure To:

- Take and share photos.
- Ask questions.
- Treat exhibit displays and banners with respect.
- Be aware and respectful of other visitors.
- Continue researching and learning about these topics when you return home.

CLASSROOM CONNECTIONS

Key Concepts:

- The Ice Age, which includes many periods of glacier-building over the last two million years, has done much to shape the landscape of the northern and central regions of the United States.
- As glaciers moved across the Earth, they scarred and gouged the surface, contributing to the topography of today.
- Many of the smaller animals that populate North America today are close relatives of animals that once roamed the continent.
- The megafauna (large animals) that lived during the Ice Age have largely disappeared and are known only by the giant bones that have been discovered.

Essential Questions:

- What is the Ice Age?
- How did glaciers impact the surface of Earth?
- How did early humans survive in the inhospitable climate of the Ice Age?
- What may have caused the megafauna of the Ice Age to go extinct?

Curriculum Connections.

Ice Age: Frozen Secrets can be utilized to address the following content area standards:

English Language Arts Common Core Standards

- Reading: Informational Text
- Speaking and Listening

Michigan K-12 Science Standards

- Earth and Human Activity
- Earth's Systems
- Ecosystems: Interactions, Energy, and Dynamics
- Life Science

Michigan K-12 Social Studies Standards

- Geographical Inquiry and Analysis
- Physical Systems
- Environment and Society
- Identifying and Analyzing Public Issues
- Contemporary Global Issues

BACKGROUND

What is the Ice Age?
Science shows that the Earth was proceeding to an ice age as early as 50 million years ago. Climates all over the Earth already were changing, cooling. Plate tectonics—the moving of the Earth's plates—were contributing to the changes by forcing shifts in the jet stream and ocean currents, resulting in the eventual cooling of the Earth. As ice sheets advanced southward, glaciers formed.

The Ice Age, which ended about 11,000 years ago, has done much to shape the landscape of the Northern and Central Regions of the United States. As glaciers moved across the Earth, they scarred and gouged the surface, contributing to the final topography we see today.

Many of the smaller animals that today populate North America are close relatives, if not nearly exact copies, of animals that once roamed this continent. However, the megafauna that lived during the glacier-building periods of the Pleistocene Epoch have largely disappeared and are known only from the giant bones that have been found and the infrequent cave painting and pictographs left behind by ancient humans in North America and Europe.

BACKGROUND

What is a Glacier?
A glacier forms when more snow falls during the winter than the summer can melt away. If snow is still present after summer, a new snowfall will begin the process of glacier building. If all the snow melts during the summer, there will be no glacier.

If the summers stay chilly, an ice cap will begin to form. Oddly enough, the summer temperatures are more responsible for glacier formation than the winter cold. The global freeze of the Earth begins when the summers in the northern latitudes become colder and colder. At the height of global glaciation, the winter snowfall far outpaced summer melting and ice covered about one third of the surface of the Earth. Icebergs also floated freely in the oceans of the world.

During the Pleistocene Epoch there were many periods of glaciation (glacial advances) that are called glacial stages. Between these periods of glaciation there were also periods that were warmer, similar to those of today. These periods were called interglacial periods.

There were 17 glaciations identified from ice cores retrieved from ice deep beneath Greenland. There have been four major periods of glaciation. They are named Nebraskan, Kansan, Illinoisan and Wisconsinan.

One theory for periods of large glacial activity is that the Earth travels around the sun in an ellipse rather than a perfect circle. At the farthest point of this rotation, the Earth is cooler due to the relative distance to the sun. These cooler periods loosely conform to periods when the Earth's orbit is at its maximum distance from the sun.

At the peak of the Ice Age, the ocean levels dropped substantially. As water evaporated from the oceans and fell in northern latitudes, sea levels dropped and salinity increased. Some estimates place the ocean level at about 400 feet below the level of present day oceans. This low level exposed many areas along the continental shelf. Mammal skeletons have been found in underwater caves off the coast of Florida, attesting to the fact that at one time the sea level was lower.

BACKGROUND

Glossary

- Asphalt Pits – These pits, commonly called tar pits, formed deep oil-based seeps where animals became trapped, died and sank into the asphalt, providing a great medium for preserving the animal remains. Asphalt pits have been found in California.
- B.P. – Abbreviation of 'Before Present'.
- Carbon Dating – A process of dating remains based on the decay of the radioactive isotope carbon-14.
- Carnassial – Tooth adapted for shearing flesh.
- Carnivore – An animal that feeds predominantly on other animals.
- Clovis – A common term used to describe ancient human remains and tools found by archeologists near Clovis, New Mexico.
- Continental Ice Sheet – Giant sheets of ice covering vast expanses of land.
- Coprolites – Excrement. Coprolites left by the end process of digestion often lend clues to the diet of the animals that left the coprolites. Deposits are often discovered in dry caves.
- Drumlin – An elongated, whale-shaped rounded mound with its axis parallel to the movement of the glacier.
- Erosion – The constant process of weathering away of rocks and dirt by wind, water and snow.
- Eskers – Large narrow ridges of gravel deposited by a stream flowing under a glacier.
- Extinct – Animals and plant species that no longer inhabit the Earth.
- Fossil – Evidence of prehistoric life. It includes plant, animal and trace evidence.
- Glacier – A large mass of slow moving ice.
- Glacial Drift – The accumulated debris deposited by a glacier.
- Herbivore – An animal that feeds predominantly on plants.
- Incisor – Tooth for cutting or gnawing, located at the front of the mouth along the apex of the dental arch.
- Interglacial Stages – A varying period of time between glaciation periods.
- Megafauna – Term used to denote the large extinct creatures that once roamed the Earth.
- Moraine – The accumulated gravel, sand, and clay deposited by a glacier along its side (lateral) or at the end of the glacier (terminal).
- Omnivore – An animal that feeds on both plants and other animals.
- Pleistocene – The Epoch or Period of time from about 2 million years ago to the present day.
- Topography – The surface features of a place or region.
- Vertebrate – An animal with a backbone and interior skeletal structure.

Can you discover the diet of these extinct Ice Age animals?

Decide if each animal listed was a carnivore or herbivore.

Carnivore – An animal that feeds predominantly on other animals/meat.

Herbivore – An animal that feeds predominantly on plants.

Short-Faced Bear _____ Mastodon _____

Mammoth _____ Giant Sloth _____

Sabertooth Cat _____ Giant Beaver _____

Woodland Musk Ox _____ Dire Wolf _____

Can you discover the diet of these extinct Ice Age animals?

Decide if each animal listed was a carnivore or herbivore.

Carnivore – An animal that feeds predominantly on other animals/meat.

Herbivore – An animal that feeds predominantly on plants.

Short-Faced Bear _____C_____ Mastodon _____H_____

Mammoth _____H_____ Giant Sloth _____H_____

Sabertooth Cat _____C_____ Giant Beaver _____H_____

Woodland Musk Ox _____H_____ Dire Wolf _____C_____

Animals: Living or Extinct?

Mark each of the animals listed below with either an 'L' for living or an 'E' for extinct.

Extinct – Animals and plant species that no longer inhabit the Earth.

_____Grizzly Bear

_____Giant Ground Sloth

_____Raccoon

_____Mammoth

_____Antelope

_____Woodland Musk Ox

_____Dire Wolf

_____Mule Deer

_____American Lion

_____Armadillo

_____Glyptodont

_____Moose

_____White-Tailed Deer

_____Short-Faced Bear

_____Wolf

_____Mastodon

_____Beaver

_____Rabbit

_____Sabertooth Cat

_____Cougar

_____Flat Headed Peccary

_____Three Toed Sloth

Animals: Living or Extinct?

Mark each of the animals listed below with either an 'L' for living or an 'E' for extinct.

Extinct – Animals and plant species that no longer inhabit the Earth.

L Grizzly Bear
E Giant Ground Sloth
L Raccoon
E Mammoth
L Antelope
E Woodland Musk Ox
E Dire Wolf
L Mule Deer
E American Lion
L Armadillo
E Glyptodont

L Moose
L White-Tailed Deer
E Short-Faced Bear
L Wolf
E Mastodon
L Beaver
L Rabbit
E Sabertooth Cat
L Cougar
E Flat Headed Peccary
L Three Toed Sloth