

## Polar Bear

### Snow Amazing! Inspiration

Polar bears are the Arctic's top wildlife predator. With its amazing sense of smell, a polar bear can smell a seal nearly 1.6 km away. One seal provides the polar bear with the same amount of meat found in 400 hamburgers! But this mighty species is at risk as climate change melts the sea ice beneath polar bears' paws.

 [Polar Bear \(\*Ursus maritimus\*\)](#)

 SMART Board / Promixa Ready

 Northern Resources

# Gr.5 Snow Mechanics

## SNOW AMAZING!

**OBJECTIVE** Students will examine how snow impacts life in the NWT.

Northerners live in a world dominated by ice and snow. Snow is an excellent way to discuss the concepts of property change in matter. A snow crystal begins as a single drop of water on a particle in a cloud. As snow collects in the autumn, it develops layers depending on the amount of snow that falls. Snowflakes change through action of wind and warmth from the Sun, causing drifts, ridges and cornices.

Most northerners no longer need to understand snow and ice for survival – however it is absolutely essential for plant, animal and human life in the Arctic. Polar bears, for example, rely on sea ice to hunt for seals and on snow to make the maternity dens where female polar bears spend the winter nursing their cubs. Perhaps your students have not considered the importance of snow to other species ability to survive.

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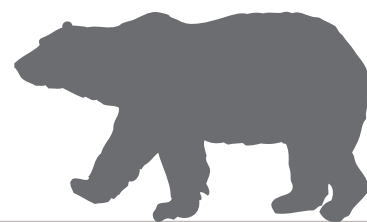
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# CURRICULUM Links



The activities and resources in this document are intended to tie in with grade 5 science curriculum *Matter and Materials: Properties of Change in Matter* and *Earth and Space Systems: Weather*, Grade 5 language arts as well as the *Dene Kede* and *Inuuqatigiit* curriculum relating to the land. You can find specific learning outcomes for each of these by following the links below.

The *Dene Kede* and *Inuuqatigiit* curriculum contain a lot of useful advice about bringing northern culture, language and traditional knowledge into the classroom. In culture-based education, teachers are expected to offer students the opportunity to extend learning experiences necessary in K–12 skills. Teachers are to involve students in key experiences, both on the land

and in school. In addition, culture-based education is enhanced with the involvement of Elders. ECE has developed a resource to provide valuable information about inviting Elders to contribute to lessons and related activities. Interview templates are included as well as practical advice about compensation (see **Teacher's Resources**).

Here are some examples of where the lessons in this resource connect with these different curricula. Some suggestions for making connections have been included in the lesson plans, too.

## Grade 5 Science & Technology

### General Learning Outcome

Investigate common changes of state (e.g., melting, freezing, condensing, evaporating) and make informed choices about materials when finding solutions to problems in designing and constructing objects based on their understanding of the states of matter.

### Specific Learning Outcomes

Students will classify plants according to visible characteristics (e.g., bark, leaf shape, root systems, type of flower, seed or berry)

### Connected Lessons

#### **Lesson 2 - How Snow Changes**

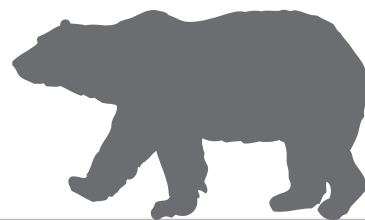
This lesson provides an opportunity to discover and measure a snow profile.

## Grade 5 Language Arts

ELA: (GO.SO)

1.1, 1.2, 2.2, 2.4, Lesson 1, 2, 3, 4:  
Snow Notes Notebook  
3.1, 3.2, 3.3, 3.4 – Lesson 2:  
Experiment

# CURRICULUM Links



## Dene Kede

### General Learning Outcome

With the aid of the Dene language, students can explore the following thematic units: Northern Lights, the Land & Sky, Geography and Land Use. Related legends include: [A Time of Two Winters Together](#) and *Winter camp* stories 10, 14, 20.

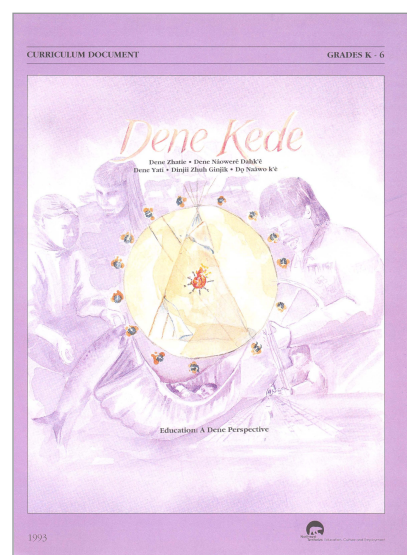
### Specific Cultural Expectations

Students will understand the importance and meaning of their relationship to the land.

### Connected Lesson

#### **Lesson 2 - How Snow Changes**

Students read and reflect on the Dene Kede legends about winter (7, 10, 14, 20).



## Inuuqatigiit

### General Objectives

Students will begin to develop a habit of frequently observing the weather and noting changes, explore beliefs about weather and how Inuit cope with the weather, and begin to learn traditional ways of predicting weather using the Sun, moon, stars, etc.

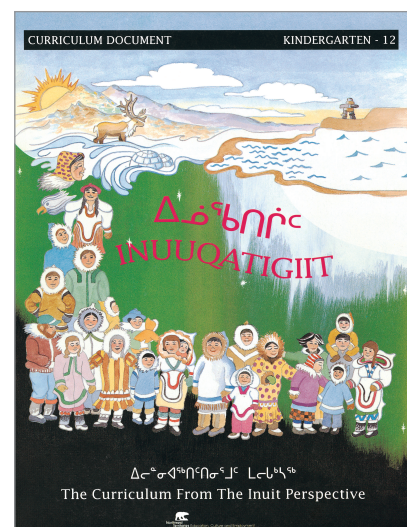
### Key Activities

Have the students write stories about being caught in a storm. *What did their families do during the storm?* As a class observe the weather several times each day and keep detailed records. Continue this over a period of time – notice patterns and challenge students to begin to predict the weather.

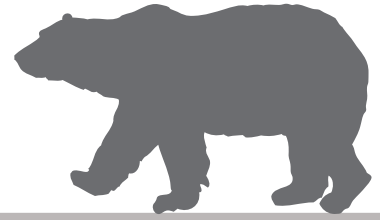
### Connected Lesson

#### **Lesson 1 - The Science of Snow** **Lesson 2 - How Snow Changes**

These lessons provide opportunities to discuss how the land will always have winter, cold and storms and that children will need to be prepared to cope with the weather.







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## Snow Notes Notebooks

Students can design their own snow notes notebooks for recording observations and questions as they explore the snow and weather. Keeping a field journal helps develop scientific inquiry and research skills. Journals can be simple, homemade books with lined pages or sections for note taking and plain sections for sketching. ***Great Stems*** has an excellent, step-by-step guide for making nature journals. You can find the link in the **Teacher's Resources** section on page 6.

Journals can be used as assessment tools for almost all of the lesson ideas in this resource. Some suggestions for how to use them have been included. Consider pairing students who need help writing their ideas down with a student who can scribe for them, allow them to complete their notebook on the classroom computer or create a video blog.

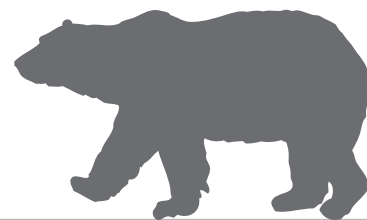


[\*\*Green Teacher Magazine\*\*](#)

See the section on evaluating nature journals.



# TEACHER'S Resources



## Books

### **Amazing Arctic and Antarctic Projects You Can Build Yourself**

Carmella van Vleet  
Illustrated by Steve Weinberg  
Nomad Press, 2008  
ISBN 978-1934670095  
[www.nomadpress.net](http://www.nomadpress.net)

### **APUN The Arctic Snow Teacher's Guide**

Matthew Sturm  
University of Fairbanks Press, 2009  
ISBN 978-1602230705  
[www.alaska.edu/uapress/](http://www.alaska.edu/uapress/)

### **APUN The Arctic Snow Student Text**

Matthew Sturm  
University of Fairbanks Press, 2009  
ISBN 978-1602230699  
[www.alaska.edu/uapress/](http://www.alaska.edu/uapress/)

### **Snow**

Valerie Bodden  
Creative Paperbacks, 2014  
ISBN 978-0898129212  
[www.thecreativecompany.us](http://www.thecreativecompany.us)

### **Snow Amazing: Cool Facts and Warm Tales**

Jane Drake and Ann Love  
Art by Mark Thurman  
Tundra Books, 2004  
ISBN 978-0887766701  
[www.tundrabooks.com](http://www.tundrabooks.com)

### **Snow and Ice Canadian Winter Weather**

Nicole Mortillaro  
*Canada Up Close* series  
Scholastic Canada, 2005  
ISBN 978-0439957465  
[www.scholastic.ca](http://www.scholastic.ca)

## Videos

### **Bill Nye the Science Guy (24:00)**

Full episode on seasons  
<https://www.youtube.com/watch?v=XuJoh8gi05g>

### **The Chemistry of Snowflakes (2:00)**

<https://www.youtube.com/watch?v=VYrF3sFBY20>

### **Building a Snow Cave: Ray Mears's Extreme Survival (4:00)**

How to make a warm, snow cave hide-out if caught in the mountains  
<https://www.youtube.com/watch?v=XOJQPz1s-1c&list=PLA1C1470F81D49D8D&index=6>

### **How to Build an Igloo: A Boy among Polar Bears (3:00)**

A young Inuit builds his first igloo  
<https://www.youtube.com/watch?v=R-x5QOSqP3E>

### **How to Make a Perfect Igloo: Ray Mears's World of Survival (4:00)**

Make the best igloo  
<https://www.youtube.com/watch?v=1aSL9La5ivo>

### **Science and historical research about snow (3:30)**

<http://www.discovery.com/video-topics/other/snow.htm>

### **Snowflake Safari (animated) (4:00)**

<http://www.sciencefriday.com/video/12/31/2009/snowflake-safari.html>

## Websites

### **Elders in Schools Handbook**

[http://www.ece.gov.nt.ca/files/publications/elders\\_in\\_schools\\_handbook\\_en\\_web.pdf](http://www.ece.gov.nt.ca/files/publications/elders_in_schools_handbook_en_web.pdf)

### **Great Stems**

Find a step-by-step guide for making journals  
<http://www.greatstems.com/2013/05/wildlife-projects-for-kids-making-a-nature-journal.html>

### **Green Teacher Magazine**

A handy guide for evaluating students' nature journals  
<http://greenteacher.com/back-issues-index/green-teacher-69-fall-2002/>

### **Historical weather data for Yellowknife**

[http://climate.weather.gc.ca/climateData/monthlydata\\_e.html?timeframe=3&Prov=NWT&StationID=1706&mlyRange=1942-01-01%7C2007-11-01&Year=1942&cmdB1=Go#](http://climate.weather.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=NWT&StationID=1706&mlyRange=1942-01-01%7C2007-11-01&Year=1942&cmdB1=Go#)

### **AVG snowfall for Canadian cities**

<http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/phys08a-eng.htm>

### **"The Unfrozen North" article**

<http://www.theglobeandmail.com/news/national/the-unfrozen-north-circa-2067/article17934974/>

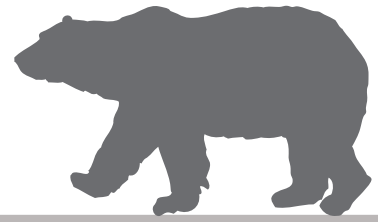
### **Species At Risk**

<http://nwt-speciesatrisk.com/en/>

### **WWF polar bear information**

[http://www.wwf.ca/conservation/arctic/wildlife/polar\\_bear/](http://www.wwf.ca/conservation/arctic/wildlife/polar_bear/)

# LESSON Plans



## Lesson 1: The Science of Snow

**1 class period. Includes formations of snow, types of snowflakes how they form and the science of snow.**

Begin your exploration of snow with your students by asking them to share what they think of when they hear the word **snow** using a mind web or mind map.

Based on your class discussion, ask students to reflect on what they know and what they might like to find out about snow. See **Teacher's Resources** for detailed weather information if needed.

### ▶ **Snow Discovery** (3:30)

Discovery video on historical research on snow and snowflake formation.

### ▶ **Science Friday: Snowflake Safari** (4:00)

Present-day research on snowflake shapes (amusing animation and commentary).

### ▶ **Chemistry of Snow** (2:00)

Bytesize science clip on the chemistry of snow.

## ? Mind Map it out!

### Discussion Questions

- *How does snow form?*
- *How many shapes can a snowflake be?*
- *How many different kinds of snow have you seen?*
- *How many different words do you know to describe snow?*
- *What happens to the snow that is on the bottom layer of the snow cover?*
- *Explore the idea of where snow falls and why. What is the range of snow accumulation in Canada? In North America? On planet Earth?*

## Assessment Opportunity

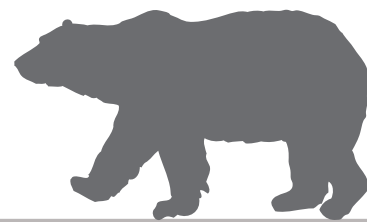
Provide an opportunity for students to create their own snow notes notebooks (see **Journals** section). Students can also create their notebooks using a computer (if possible).

Based on your class discussion, review and guide your students to reflect on what they know and what they might like to find out about snow. Ask students to fill in the first two pages of the notebook.

Page 1 - When I think of snow I think about...

Page 2 - K-W-L Chart - Fill in 5 ideas in the **Know**, and **What I Want to Learn** of students' personal K-W-L chart.

# LESSON Plans



## Lesson 2: How Snow Changes

### 2 to 3 class periods.

Before snow can accumulate to build a layer of snow cover, the ground must freeze. The first snowfall of the year usually melts upon contact with the ground, as there is a lot of heat stored in the ground. Once the ground has frozen, the snow does not melt and the layering process begins. Researchers are noticing that the evening average temperatures are rising as the Earth is absorbing more heat energy. Some climate change researchers say that climate change happens at night.

### The unfrozen north, circa 2067

There are three main metamorphic (change) factors that alter the original snowflake: wind, heat and cold (Source APUN – The Arctic Snow).

**Wind** blows the snow around, beating the flakes together, often grinding them into fine particles.

**Temperature Gradient** is the difference in temperature within the snow pack. Under the snow cover, the heat from the Earth is released and it causes water vapour to move between snow particles. This movement of vapour happens through the process of sublimation and condensation. It is the reason why the deepest layer of snow has the largest grains and appears to be very crumbly.

**Solar Heat** heats the top layer of snow and can cause the surface to become hard and icy, as well as causing meltwater to create “hidden icicles” within the snowpack.

In order to see the changes in the snow your students will need to have a close-up look at a snow profile.

## Classroom Investigation Snow Pit

Students will work as a class or a group to construct a snow pit near their school and study the exposed layers of snow. The class or group will identify an undisturbed area and dig a snow pit. Students will then examine the snow pit to see if they can identify and mark different layers in the snowpack.

### Show a video on igloo building

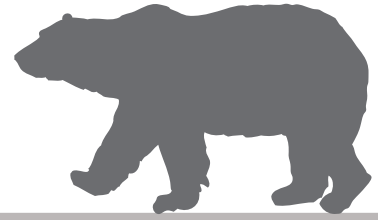
(see **Teacher’s Resources**).

### Teacher Notes

- This activity will likely be most effective if run towards the end of the winter season.
- If you are doing a weather study as part of the Earth and Space strand, Dene Kede – The land and Sky or Inuuqatigiit - Weather and Weather Forecasting, conduct this activity at the end of the weather observation month. The top layers of snow will correlate to the most recent weather events.
- Depending on the class size, have students work as a class or in large groups to do this activity
- Assign responsibility in the activity process (e.g., one person measures the snow profile depth, two people identify the layers, one person measures the thickness, one person records the measurements, etc.).
- It will be useful for the teacher to explain why the differences in the snow layer happen and what the names of the snow crystals are (e.g., large coarse crystals at bottom of snow cover are called “depth hoar” (some may call it “sugar snow”), firmer upper layers are made of bonded snow crystals that have “sintered” (bonded together). This type of snow can be cut/sliced into snow blocks for igloos). *Can they identify an icy crust between layers?* This would indicate a former top layer that changed due to wind and Sun exposure.



# Lesson Plans



## Snow Pit Activity Continued

You'll need: Black construction paper, sampling cylinder (old soup can with ends removed), shovel, permanent black markers, magnifying glasses, medium-sized plastic freezer bags, measuring tape, popsicle sticks, thermometer, ruler or metre stick, calculator, digital camera. Optional - Multiple graduated cylinders and a weigh scale (small spring scales are useful outside).



© Peter Ewins / WWF-Canada

## Steps

1. Take your students out to explore the snow in the school yard, a neighbouring yard or park. You will need to find a section of snow cover that has been undisturbed by human impact (no snowmobile tracks or footprints). As a class, identify the ideal location to dig the snow pit(s).
2. Assign each student a responsibility in the activity process (e.g., one person measures the snow profile depth, two people identify the layers, one person measures the thickness, one person records the measurements, etc.).
3. Students are to take turns digging out a 1 m x 1m square pit (can be made larger if necessary).
4. Students should be able to identify several different types of snow crystals in the snow pit.
5. Students will collect these snow samples using a sampling cylinder (you can use an old soup can with both ends removed) that they will push into each layer of snow. Spread the sample out on black construction paper and provide the students with magnifying glasses so they can see the crystals clearly.

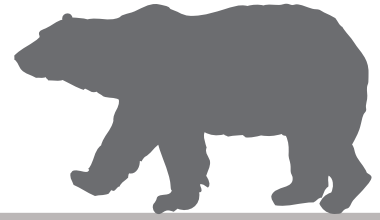
## Assessment Opportunity

On page 3 of their snow notes notebooks, students will record their observations about their snow pit.

### **Snow pit data to be recorded in snow notes notebook:**

- Total depth of the snowpack
- For each layer: thickness (distance from top to bottom of snow layers), temperature (current), range of snow grain size (describe), volume of snow sample (use graduated cylinders) and weight of snow sample (weigh melted sample).

# Lesson Plans



## Extension

If your class has also been recording daily weather observations, students can compare the data that they collected for each layer in the snow profile with the daily weather measurements. Have students identify relationships between the physical characteristics of each snow layer data and their weather data.

## Student Reflection

Now is a good time for students to revisit their K-W-L charts in the snow notes notebooks. In addition to reflecting upon what they learned through the process of digging and measuring a snow pit, encourage them to reflect on the changes in the temperature of the snow layers. *What does this mean for the survival of plants and animals?*

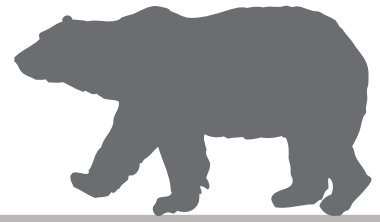
## Lesson 3: Cultural Connection

### 1 to 2 class periods.

Using the cultural curriculum for your region, provide your students with several choices of activities that relate to an area of interest (weather predicting, northern lights, etc.). Consider inviting an Elder to discuss the importance of snow to animals, plants and people (see guide to Elders in the Classroom in **Teacher's Resources**).



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## Catch snowflakes

On a snowy day, take the students outside with black construction paper and magnifying glasses. If possible, take digital photos and prepare a snowflake slideshow.

## Art activity

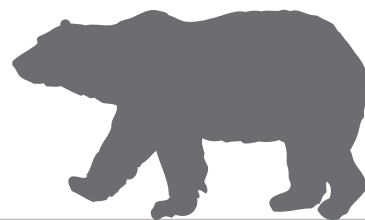
Make cutout snowflakes. Templates can be printed and traced, but it is better if students create their own; as in nature, no two should be alike.

## Imagine snowflake

Students write about the journey of the flake starting in the cloud and following its path to landing somewhere on Earth.



# URLS



Some hyperlinks have been embedded throughout the **Snow Mechanics** resource. If a link appears to be broken, try visiting the homepage or keying in the URL as it's written below.

#### Learn more about polar bears

[http://www.wwf.ca/conservation/arctic/wildlife/polar\\_bear/](http://www.wwf.ca/conservation/arctic/wildlife/polar_bear/)

#### Grade 5 science curriculum

<http://www.ece.gov.nt.ca/files/Early-Childhood/K-6%20Science%20%26%20Technology%20CurriculumFINAL%20.pdf>

#### Dene Kede curriculum

<http://www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#dene-kede-grade-6>

#### Inuuqatigiit curriculum

<http://www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#inuqatigiit>

#### Elders in Schools Handbook

[http://www.ece.gov.nt.ca/files/publications/elders\\_in\\_schools\\_handbook\\_en\\_web.pdf](http://www.ece.gov.nt.ca/files/publications/elders_in_schools_handbook_en_web.pdf)

#### Green Teacher Magazine

<http://greenteacher.com/back-issues-index/green-teacher-69-fall-2002/>

#### Discovery Video

<http://www.discovery.com/video-topics/other/snow.htm>

#### Science Friday

<http://www.sciencefriday.com/video/12/31/2009/snowflake-safari.html>

#### Chemistry of snow

<https://www.youtube.com/watch?v=VYrF3sFBY20>

#### Climate change article in the Globe and Mail

<http://www.theglobeandmail.com/news/national/the-unfrozen-north-circa-2067/article17934974/>

#### Igloo-building video 1

<https://www.youtube.com/watch?v=R-x5QOSqP3E>

#### Igloo-building video 2

<https://www.youtube.com/watch?v=1aSL9La5ivo>



ECOLOGY NORTH



WWF is Canada's largest international conservation organization, working to build a future where people live in harmony with nature. The Schools for a Living Planet program empowers educators and students of all ages with the tools they need to lead us into a sustainable future. Schools for a Living Planet is grounded in the principles that make WWF a global success - including strong science and a focus on solutions.

Ecology North is a charitable, non-profit organization that has engaged Northerners in hands-on learning opportunities in the Northwest Territories since 1971. Our mission is to bring people and knowledge together for a healthy Northern environment. Education, public engagement and youth involvement are integral to all of our program streams that include climate change adaptation, watershed protection planning, waste reduction, food sustainability and alternative energy promotion.

This project was made possible with the financial support of CIBC. For more information, visit [www.cibc.com](http://www.cibc.com).

WWF-Canada and Ecology North would like to thank the classroom teachers across the Northwest Territories who contributed many of the ideas presented here, especially Jennifer Thompson, Kathy Tollenaar and Shawn Mosey. Ecology North Education Committee member Stephanie Yuill also provided guidance. This resource is available as a free download from WWF Canada Schools for a Living Planet. Visit [schools.wwf.ca](http://schools.wwf.ca). © 1986 Panda symbol WWF-World Wide Fund For Nature (also known as World Wildlife Fund). ® "WWF" is a WWF Registered Trademark.