



## Muskrat

### Land of The Midnight Sun Inspiration

Musk rats are rodents that can be found throughout North America, however, they thrive in the Mackenzie Delta of the Northwest Territories. The long hours of sunlight in the summer helps to provide an abundance of underwater plants – their main food source. In the shortened daylight of winter, their presence can be seen by bumps on ponds, lakes and rivers known as “pushups.” It is a place where they can feed and be safe from predators.

#### **Hinterland Who's Who**

For more information on the muskrat.

#### **SMART Board / Promixa Ready**

#### **Northern Resources**

## Gr.4 Sun Energy

### LAND OF THE MIDNIGHT SUN

**OBJECTIVE :** This resource introduces students to the characteristics of the Sun, why the earth has seasons, and explores solar energy in both traditional and modern uses.

On average, communities in the Northwest Territories receive over 2,256 hours of sunlight in any given year. Once the spring equinox has passed on March 21 northerners look forward to the steady increase in daylight hours until the summer solstice on June 21, when the Sun does not set until after midnight, and then begins to rise again a very short time later. In northern communities, twilight lasts all evening, from May to July.

The opposite is true in the winter. Many communities in the NWT have little or no sunlight for several weeks before and after the winter solstice on December 21. These communities experience darkness and twilight only. Residents of these communities look forward to welcoming the Sun back in January and February. The return of the Sun's light is cause for celebration! For example, Inuvik celebrates the Inuvik Sunrise festival in the second week of January.

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# CURRICULUM Links



The activities and resources in this document are intended to tie in with Grade 4 science curriculum *Matter and Materials: Properties of Change in Matter* and *Earth and Space Systems: Weather*, Grade 4 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 4 Science and Technology

### General Learning Outcome

Students will demonstrate an understanding that certain materials can transmit, reflect, refract or absorb light.

### Specific Learning Outcomes

Students will formulate questions about and identify problems related to the ways in which materials transmit, reflect, refract or absorb sound or **light** and explore possible answers or solutions.

### Connected Lessons

#### **Lesson 5 - Solar Energy Experiment**

This lesson provides an opportunity to formulate questions, test ideas, gather data and present results.

# CURRICULUM Links



## Dene Kede - Land

### General Learning Outcome

With the aid of the Dene language, students can explore the following thematic units: Sun (page 48 – 51) and the Land & Sky.

### Story 19 Kenny of Fort Norman

Related legends about the sun.

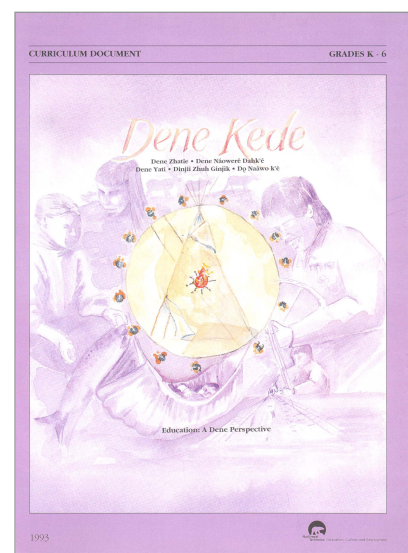
### Specific Cultural Expectations

Knowledge of the spiritual nature of the Sun and the gifts it gives to people will give students a great appreciation of it. Learning the survival skills that use the Sun will help them when on the land.

### Connected Lessons

#### **Lesson 2 - Traditional Knowledge - Using the Sun.**

This lesson will provide an opportunity to discover the cultural importance of the Sun to the Dene.



## Inuuqatigiit

### General Learning Outcome

Students will discuss beliefs about the sky, learn to observe the sky often and be aware of changes, understand what can be learned by looking at the sky.

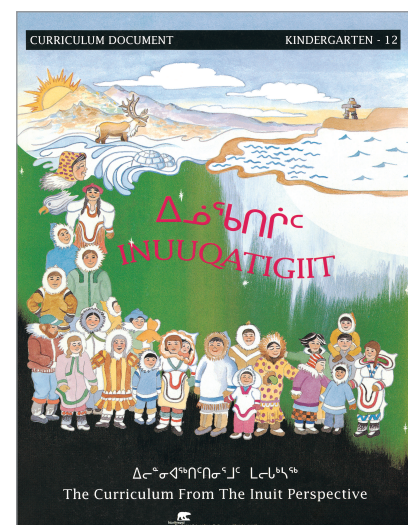
### Key Activities

Invite and Elder or knowledgeable person to tell stories about the sky or talk about traditional beliefs. Record while the person is talking. If possible, provide the person with pictures or photographs and class questions as a guide.

### Connected Lesson

#### **Lesson 2 – Traditional Knowledge – Using the Sun.**

This lesson will provide an opportunity to discover the cultural importance of the Sun to the Inuit, building on prior knowledge about the Sun as giver of light, warmth and life.



# Journal



## Sun Notes Notebooks

Students can design their own sun notes notebooks for recording observations and questions as they explore the sun. 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

Please see the section on evaluating nature journals in green teacher magazine.



# TEACHER'S Resources



## Books

### Arctic Lights, Arctic Nights

Debbie S. Miller  
Illustrated by Jon van Zyle  
Walker and Company  
ISBN 978-0802796362  
[www.walkeryoungreaders.com](http://www.walkeryoungreaders.com)



### The Delta is My Home

Tom McLeod & Mindy Willett  
Photos by Tessa Macintosh  
*The Land is Our Storybook* series  
Fifth House Publishers, 2009  
ISBN 978-1897252840  
[www.fifthhousepublishers.ca](http://www.fifthhousepublishers.ca)

This book has photos of muskrat trapping, flooding in Aklavik and the location of the Arctic Circle all of which are referred to in the Grade 4 resource.

## Videos

### Characteristics of the Sun (1:30)

[www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.sunbasics/characteristics-of-the-sun/](http://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.sunbasics/characteristics-of-the-sun/)

### Energy Sources:

#### Solar Energy (5:30)

[www.neok12.com/video/Solar-Energy/zX6661745f06417d615e4d67.htm](http://www.neok12.com/video/Solar-Energy/zX6661745f06417d615e4d67.htm)

### Earth in Motion: Seasons (5:00)

[www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.seasonsgame/earth-in-motion-seasons/](http://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.seasonsgame/earth-in-motion-seasons/)

Three interactive activities allow students to learn about seasons.

## Websites



### Elders in Schools Handbook

[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

[www.greatstems.com/2013/05/wildlife-projects-for-kids-making-a-nature-journal.html](http://www.greatstems.com/2013/05/wildlife-projects-for-kids-making-a-nature-journal.html)

Find a step-by-step guide for making journals.

### Green Teacher Magazine

[www.greenteacher.com/back-issues-index/green-teacher-69-fall-2002/](http://www.greenteacher.com/back-issues-index/green-teacher-69-fall-2002/)

This issue features a guide for evaluating students' nature journals.

### Gaisma

[www.gaisma.com/en/location/yellowknife.html](http://www.gaisma.com/en/location/yellowknife.html)

Determine the sunrise and sunset times for your community.

### Environment Canada

[www.weather.gc.ca](http://www.weather.gc.ca)

Excellent resource for finding temperatures, sunrise and sunset times and any weather statistics. Use search feature on the site to find references specifically for northern communities.

# LESSON Plans



## Lesson 1: Characteristics of the Sun and Seasons

**1 - 2 class periods. Covers concepts such as the Sun, seasons and the Arctic Circle.**

The southern boundary for all three Canadian territories is the 60th parallel. Every community “north of 60” experiences shortened daylight hours in winter, and very long summer days. Due to this fact, our region is often referred to as “North of 60” and “The Land of the Midnight Sun.” Due to all this exposure to sunlight, northern plants, animals and people have learned to make the most of the plentiful sunlight from March to September. Explain to the students that the class is going to have a closer look at solar energy and its effects on the north.

Concept check for understanding: NWT residents live above the 60th parallel. Ask students to find it on a class map or globe. Next, ask students to find the Arctic Circle.

Explain to the students that few people know what the Arctic Circle is and that Tom has a definition that all kids should know. Share the following quote from *The Delta is My Home*:

“The Arctic Circle (66 33 N latitude) marks the point where for a least one day in the year the Sun remains above the horizon for a full 24 hours. Aklavik is located at 68 13 N latitude, so it is in the “land of the midnight Sun.” At Aklavik, the Sun stays up all night in the summer (from May 26 to July 18). Of course, the reverse is true in the winter, when the Sun does not come up for about one month.”

Have students read *The Delta is My Home* by Tom McLeod and Mindy Willett (see **Teacher’s Resources**). It contains many mentions of the Sun, the spring and muskrats! Muskrats are most active at night.

Follow with an opportunity for the class to look at a map and figure out which communities in the NWT are actually in the land of the midnight Sun. Fort Good Hope is the closest to the Arctic Circle, and only Fort Good Hope and the communities north of it are truly in the land of the midnight Sun.



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# LESSON Plans



## ▶ Characteristics of the Sun (1:30)

Develop the students understanding of the Sun with this short PBS science video.

## ▶ Earth in Motion: Seasons (5:00)

Explains how Earth's orbit and tilt provide us with seasons.

### Class Discussion

- *How is the Sun different from other stars in terms of size and temperature?*
- *What is the Sun's role in the solar system?*
- *What does the narrator mean when she says that the sunlight you see actually left the Sun 8.5 minutes ago?*
- *The Sun is about 150 million kilometers away from Earth. How does that compare to the distance of other stars?*

(source: PBS Learning media).

### Assessment Opportunity

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

Ask the students to complete the first two pages in their homemade journals.

*Page 1* Students draw a large image of the Sun. To illustrate the Sun's rays, students can write any thoughts, observations or questions that they have after the class discussion.

*Page 2* Students respond to the following question: *How would you explain the reason for seasons to a younger student?* In their response, the student should write out what they would say, think of pictures or props (globe, light bulb, other planets) they could use and try it out!



© Zoe Caron / WWF-Canada

# LESSON Plans



## Lesson 2: Traditional Knowledge - Using the Sun

**1 to 2 class periods. Includes a discussion about the Sun in the north, its traditional usage and present day usage.**



### Kenny of Fort Norman

Read this story as a class.

Then:

- Invite an Elder to speak to the class about the traditional rituals, customs and beliefs in relation to the Sun.
- Ask the Elder about celebrations involving the Sun.
- Most traditional foods are dried on racks in the Sun, or over a campfire. Prepare a photo slideshow of dried fish, dried meat and dried fruits.
- Hear Elders tell legends and stories
  - How the Raven stole the Sun Back (North Slavey)
  - The Squirrel and the Bear (Chipewyan and Tlicho)
  - The Sun and the Moon
  - The Boy and the Sunbean (Chipewyan)
  - Dance in the the Drum in the Direction that the Sun Travels

Invite an Elder or knowledgeable person to tell stories about the sky or talk about traditional beliefs. Record while the person is talking. If possible, provide the person with pictures or photographs and class questions as a guide. Later, have the students publish a “newspaper” to share with their families and other classes.

Make a list of all the things you can learn by “reading” the sky. Have a celebration to thank the sky for each of its gifts.

## Assessment Opportunity

**Ask the students to complete page 3 in their Sun notes notebooks.**

*Page 3* Students draw a picture of a traditional activity that uses the Sun’s energy. They can also write several sentences to caption their pictures.



# LESSON Plans



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## Additional Dene concepts relating to the Sun include:

- Know that the Sun is a symbol of eternity. It is used in the quotation, “As long as the Sun shall rise...” in the signing of Treaty
- Know that the Sun is associated with rebirth
- Know that the Sun is the source of medicinal power
- Know that the Sun brought the gift of fire to the people
- Know that the person who rises with the Sun is given the gift of long life
- Identify the different positions of the Sun during the day
- Be familiar with different Sun phenomena in winter (Sun dogs, Sun dancing)
- Be able to use the Sun to tell the time, find direction and forecast weather
- Be able to use the Sun to tell the five seasons (Sahtu and Dehcho) or 6 seasons (Gwich'in, Tl'cho)
- Dry muskrat or beaver hides in the Sun
- Bleach hides in the Sun
- Know ways in which the Dene used the Sun to survive: making dry meat, making fire, preparing hides
- Thank the Sun for each new day, and use it well
- Challenge self to rise early each day (Dene law)
- Students select a micro-environment (a part of a shore, side of the school, patch in the bush) and observe the effects of the Sun during a period of time

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



# LESSON Plans



## Lesson 3: Developing a Class Book

**2 to 3 class periods. Concepts will develop Language and Visual Arts.**

This class project allows your students an opportunity to research and create a book for your school library or a community library reflecting the sunrise and sunset, and local flora and fauna in your region of the NWT. As a class, determine how many pages will be needed in your book including the front and back cover. Assign a pair or small group of students to each page of the book.

Begin by reading a story that reflects the range of light the north receives, for example *Arctic Lights*, *Arctic Nights* (see **Teacher's Resources**). Each page highlights what is happening on the 21st of each month, starting and ending with the summer solstice.

### Extension

*Arctic Lights*, *Arctic Nights* is written using Fahrenheit and takes place in Alaska. Task two students with calculating the temperature in Celsius (formula is  $(^{\circ}\text{F} - 32) \times 5/9 = ^{\circ}\text{C}$ , or use the class computer for an online tool. They can insert the metric temperatures.

### Illustrators

Students completing the content will need to research sunrise and sunset times for their particular page (e.g., June 21, July 21, August 21). In addition, they will need to determine what animals, plants and weather they want to illustrate. They can use pictures from the internet, magazines or draw their own.

### Authors

Each page must also have an author who will work on the text for their page. Ideally, the authors should meet as a group so that their text flows from page to page.

### Editors

Select a pair of students to be the editors of the text. They look at all the structures they have been learning in class such as capitalization, spelling and meaning of each sentence. They need to work with the authors to correct and revise text in preparation for publishing.

### Publisher

Once the text is written and the pages are illustrated the teacher can act as the publisher. Combine all the pages with the front and back cover. Enjoy your new class book! Invite others in to listen to your story!

## Assessment Opportunity

Observe how each student participated in their role during the creation of the class story. Allow students to peer-evaluate and self-evaluate as well.

# LESSON Plans



## Lesson 4: Solar Energy

**1 class period. Concepts include overview of solar power and how it can be used in the North.**

### **Energy Sources: Solar Energy (5:30)**

Provides a general overview of the concept of solar power through a series of questions and answers. At each question, pause the video and record each question on chart paper or white board. Time permitting, allow for a few minutes of class discussion before continuing the video.

## Video Discussion

- *What is solar energy?* Ask students to brainstorm a list of objects and/or machines they know are powered by the Sun. Continue with the video, as it will provide examples. This will be the foundation of your class discussion.
- *How does solar energy work?*
- *What are the pros and cons of solar energy?* See how the class list compares to the video's list.

The video states that two days of solar energy could provide more power than all fossil fuels combined is a staggering claim! Discuss using the following questions as a guide.

- *Have students noticed solar panels in the community if so, where are they located?*
- *What are some reasons why most communities in the NWT do not have more solar panels, solar water heaters, solar thermal panels and solar walls?* (Some examples may include; cost, lack of understanding regarding if solar panels can work in extreme weather or if they can be easily added into a home/building).

For more information on solar panels contact the Arctic Energy Alliance at [www.aea.nt.ca](http://www.aea.nt.ca).

## Assessment Opportunity

On page 4 in their Sun notes notebooks, have students list all the items they can think of that are run on solar power. This can be done in a think, pair, share setting. Then have them record the list they generated, and include the name of their partner.

Bonus: Challenge the students to find examples in the classroom.

# LESSON Plans



## Lesson 5: Solar Energy Experiment!

**1 to 2 class periods. Investigate, explore, record, present!**

The purpose of this lesson is to engage students to think about the flow of solar energy by testing four different materials (sand, salt, water and paper) and see which material can best store the Sun's energy.

You will need to prepare a cardboard box in advance, by painting the outside of the cardboard box black. Several students can help you complete this the day before. The experiment can be conducted as a whole class activity or in small groups.

You'll need: cardboard box, painted black; black paint; 5 metal cans (empty and washed); 5+ thermometers; sand; salt; water; torn-up paper.

Important! Each group must designate someone to take pictures of each step of the process using the class camera or iPad. The goal is for each group to have a photo (scientific) record of the experiment.



© Vincent Massey Collegiate

### Steps

1. Assign small groups to each of the five cans. Each group will be responsible for conducting the experiment for their can and recording all data.
2. Fill different cans with different materials: salt, water, paper, sand and sand/water.
3. Place a thermometer in each can. Ensure the thermometers are all facing the same way. Then, place the five cans in the cardboard box. Ask students to predict which material will hold the heat the longest and explain why they think so.
4. Use the worksheet on the next page to record predictions and results.
5. Place the box in direct sunlight for 30 minutes. Record the temperature of each can. After 30 minutes, remove the cans from the boxes and begin to monitor the temperature drop. Student groups can take turns stirring the contents of the cans occasionally. Students must also take turns reading the temperatures every 3 minutes for 15 minutes. Students are to record the temperatures on their worksheet. After 15 minutes, ask the students to graph their results (on chart paper, the computer or the whiteboard).

### Assessment Opportunity

Students can paste the results from the experiment in their Sun notes notebooks and respond to the following question.  
*What did you discover about solar energy?*

### Extension

#### Harnessing Solar Energy

Students can develop their presentation skills by presenting the results orally, in a poster or using a computer generated slideshow.

# SOLAR Energy Experiment



**By conducting this experiment you will find out how different materials absorb solar energy.**

Group Members .....

Date .....

Materials Needed (list) .....

Methods: (describe the process of the experiment)

Which material will hold the heat the longest? Why?

Our prediction:

## Results

### Temperature after sunlight exposure

Important! As each group presents record all the data in the chart below.

Material	30m	33m	36m	39m	42m	45m
Paper						
Salt						
Sand						
Water						
Sand & Water						

Provide a short presentation to the class on the results of the findings for your test material (water, paper, salt, sand or sand/water).

### Responses:

1) Which material's temperature falls the slowest?

2) How do your predictions compare with the results?

3) What material stores solar energy the best?

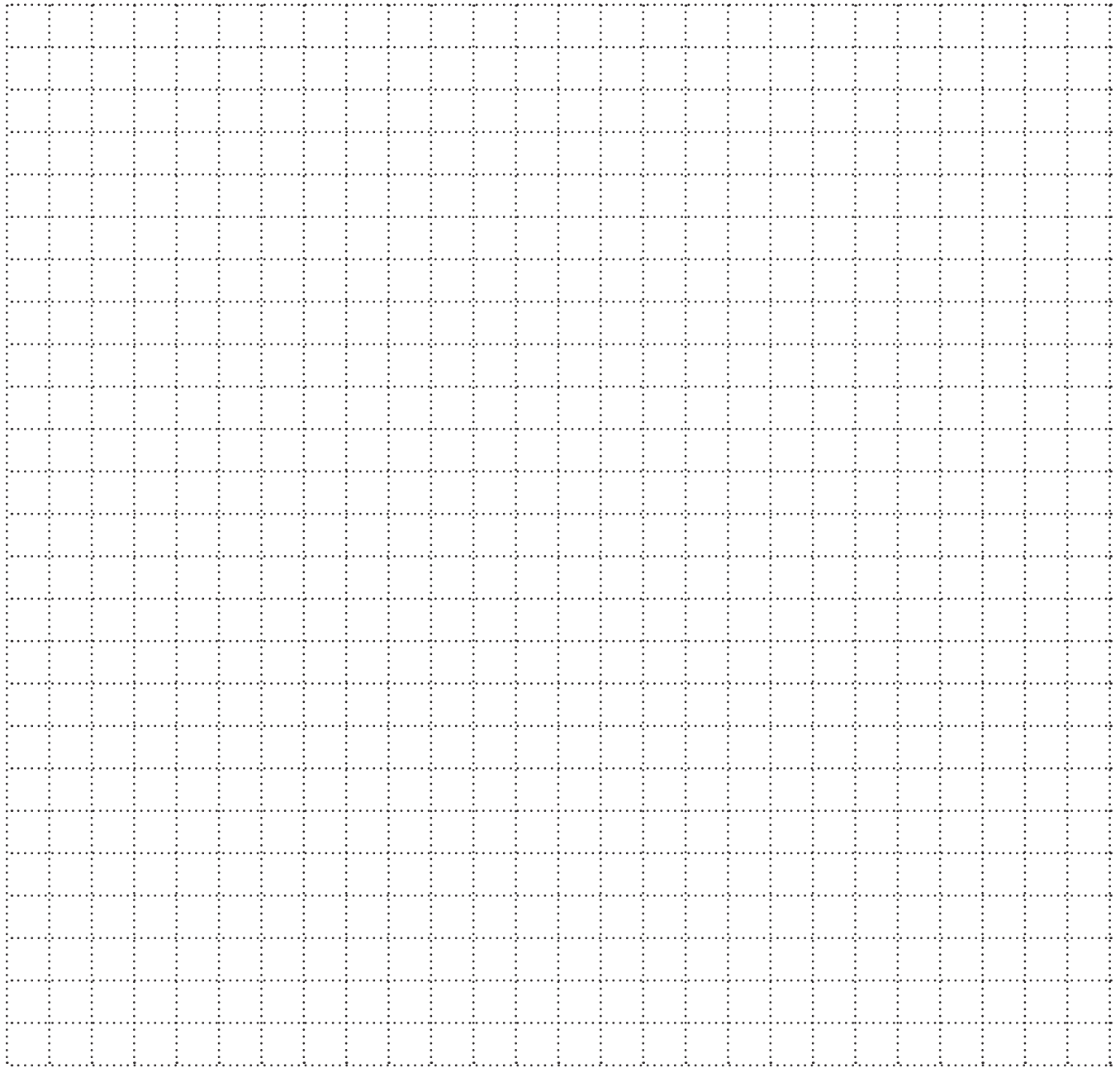
4) Do you think other materials exist that hold heat better than water? Please list and explain why you selected those materials.

5) The sand/water mixture represents soil. Seeing the results, what would a longer exposure time do to soil that was usually under snow and ice? What would a longer exposure time do to bare soil? How could this affect the permafrost layer?

6) Graph the results of your experiment.

( See next page )

# Solar Energy Experiment Graph





# WILD Ideas



© Charles Tetchco School solar oven picture / Green Learning Canada Foundation

## Solar Box Oven

Provide the materials for your students to create a solar box oven or solar grill. Challenge them to use the grill on a sunny June day to heat their lunch.

## Sunrise Festival

If your community does not have a sunrise festival or a summer solstice celebration, engage your students in planning a small event to mark the spring equinox (March 21) or summer solstice (June 21/Aboriginal Day).

## Muskrat Jamboree

If you live in or near Inuvik attend the Muskrat Jamboree held in April.

# URLS



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

#### **Hinterland Who's Who**

[www.hww.ca/en/species/mammals/muskrat.html](http://www.hww.ca/en/species/mammals/muskrat.html)

#### **Grade 4 science curriculum**

[www.ece.gov.nt.ca/files/Early-Childhood/K-6%20Science%20%26%20Technology%20CurriculumFINAL%20.pdf](http://www.ece.gov.nt.ca/files/Early-Childhood/K-6%20Science%20%26%20Technology%20CurriculumFINAL%20.pdf)

#### **Dene Kede curriculum**

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

#### **Inuuqatigiit curriculum**

[www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#inuqatigiit](http://www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#inuqatigiit)

#### **Elders in Schools handbook**

[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)

#### **Energy Sources: Solar Energy**

[www.neok12.com/video/Solar-Energy/zX6661745f06417d615e4d67.htm](http://www.neok12.com/video/Solar-Energy/zX6661745f06417d615e4d67.htm)

#### **Arctic Energy Alliance**

[www.aea.nt.ca](http://www.aea.nt.ca)

#### **Gaisma**

[www.gaisma.com/en/location/yellowknife.html](http://www.gaisma.com/en/location/yellowknife.html)

#### **Dene Kede Legend Kenny in Fort Norman story 19**

[www.ece.gov.nt.ca/files/K-12/Curriculum/dene-kede/Legends/story19.pdf](http://www.ece.gov.nt.ca/files/K-12/Curriculum/dene-kede/Legends/story19.pdf)

#### **Great Stems**

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

#### **Green Teacher Magazine**

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

#### **Characteristics of the Sun**

<http://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.sunbasics/characteristics-of-the-sun/>

#### **Earth in Motion: Seasons**

<http://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.seasonsgame/earth-in-motion-seasons/>



**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).

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