# GRADE TWO WINTER NATURE WALK: Water in Winter

## OBJECTIVES:

- Use a thermometer to measure temperature.
- Compare the temperature of air inside and outside the school.
- Relate temperature to the state of water: solid or liquid.
- Discover locations of highest and lowest temperature outside. Find out why some areas are warmer than others.
- Recognize the effect of temperature on the winter survival of animals.

## PREPARATION:

- The room coordinator schedules the walk for January, February, or early March, preferably when there is snow or ice on the ground. If possible, the walk takes place in late morning or afternoon so that the air is warmer and some melting might have taken place. The walk should last about 30 minutes. Don't stay out longer than the comfort level of the children allows.
- The BBY Coordinator gathers materials and checks thermometers by verifying they all register the same temperature (within a degree or so). Allow thermometers to be in the same location for several minutes before taking a reading. If the reading is not the same, note and label how much the variation is. Place one thermometer for each group outside in a plastic cup or hang them from a shrub just outside the door the classwill use to exit the building. This will reduce the wait-time it takes for the thermometer liquid to fully respond.
- Be sure children are dressed appropriately.

## MATERIALS:

### Provided by the BBY Coordinator

- One deep plastic cup or yogurt container to hold thermometers for initial outside measurement.

### Materials per student group:

- Thermometers (3 or more ). Should have both Fahrenheit and Celsius scales. Should have a string loop or strip of surveyor's tape through the top hole.
- Tissues or paper towel to dry thermometer bulb if it gets wet.
- Clipboard, "Temperature Report: Our Big Backyard" reporting form, and pencil.
- Trowel (for snow, ice and soil).
- Hand lenses (3 or more).
- Optional—for snow and ice: 4" x 4" squares of black paper for observing crystals (3 per group); clear plastic cups for snow, 1 per student or pair; permanent marker pen.

## ACTIVITIES

- Measure indoor and outdoor air temperature.
- Find water outside (if possible), note whether it is solid or liquid, and measure its temperature. Locate places where water is frozen and places where it has melted and try to explain why this has happened. Optional: Collect snow in a cup; predict water level.
- Brainstorm places in the schoolyard that might have the highest and lowest temperature, and measure the temperature of a few of these; try to figure out why some places are warmer than others.
- Relate air or ground temperature to the ways animals survive in winter.

## PRE-WALK ACTIVITIES: TO BE LED BY THE TEACHER

1. **Mathematics Connection: Temperature measurement. (ESSENTIAL.)**
   Plan to teach the following Everyday Mathematics lessons before the winter walk:
   Lesson 4-3, Exploring Temperature.
   Lesson 4-4, Temperature Changes.
   Math Journal 1, pg. 87, 90, 91. (Activities that follow supplement the journal pages.)

2. Science/Mathematics Connection: Measuring Temperature Activity. (**ESSENTIAL.**)
   (See Enrichment Activity pg. 271 in the EDM teacher guide: Writing Number Stories about Thermometer Experiments.)

   CAUTION: Remind students that the glass part of the thermometer can break and they need to handle the thermometer with care. (The red liquid inside is alcohol and does not pose a hazard.)

   - Ask a child to put his or her finger on the bulb and hold it for 30 seconds. While waiting, ask the children to predict what will happen. (temperature goes up) Ask: *Why not hold the bulb if you are measuring air temperature?* (You would measure your finger temperature!) Demonstrate how to hold the thermometer by the metal edges rather than by the bulb.

   - Remind the students to be sure that the bulb of the thermometer is dry when measuring air temperature. If the bulb is wet, dry the thermometer bulb with the tissue before using it to measure air temperature. If there is water remaining on the bulb, until it completely evaporates, the temperature reading will be lower than the air temperature.

   If you have time, allow the ice in the ice water to melt and the resulting water to come to room temperature. Ask students to measure the temperature of the water in the cup as it warms up. Ask: *What makes ice turn to liquid water? What can you do to change water from a solid to a liquid?* (Warm it; add heat). *How could we make the liquid water change back to ice?* (Cool it; lower its temperature in a freezer or outside.) (See Lesson 2, Changes.)

3. Science Connection: Changes--Properties of Water. (Lessons 1, 2, and 5.)
   Ask questions such as:
   What do you know about water?
   What does water look like? What color is water?
   What does it feel like? Is it soft or hard?
   Can you hold water in your hand?
   Is water runny or can you pick up a piece?
   Can you walk on water?
   Is water hot or cold?

   Sometimes water is clear and you can see through it, like a rain drop or ice cube. Sometimes water is cloudy, or different colors when things like salt or dirt or food coloring dissolve in it. Sometimes it looks white when it is snow.

Sometimes water is runny and goes through our fingers when we try to pick it up. That's when it is a liquid. But sometimes water becomes solid and hard, and then we can pick up a piece of solid frozen water or a snowflake.

Sometimes water is a gas. You can't see water vapor—it is invisible. We only know it is there because it can change back into a liquid if it cools—like it does when tiny cloud droplets form, or when you "see your breath" in winter (invisible water vapor in your breath becomes a cloud of water droplets).

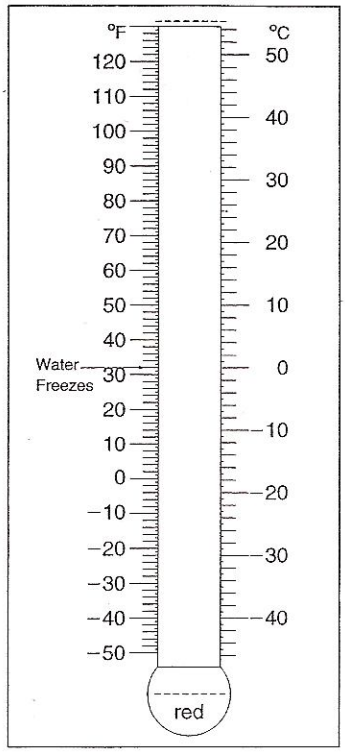
4. Tell children that they will go outside on their Big Backyard walk to look for water and measure the temperature of air and water and other things. Ask: *Where do you think we can we find water outside today? Do you think the water we find outside will be a solid or liquid today? Why? What place do you think will be warmest outside? Coldest? Give a reason for your answer.*

**Draw a line on the thermometer to show CLASSROOM AIR TEMPERATURE**

**Draw a line on the thermometer to show WATER AND ICE TEMPERATURE**

**CLASSROOM AIR**

**WATER AND ICE**



**NATURE WALK: TO BE LED BY BIG BACKYARD VOLUNTEER**

1. **Wondering about water.**

**Inside discussion with your group:** Ask: *Why don't we have snow and ice in the summer?* (The air is too warm)*? Do you think the water we find outside will be a solid (ice) or liquid? Why*? (Depends on the temperature) Say*: Today, we will use a thermometer to measure how cold or warm the air and water are. Let's start by measuring the temperature of the air in the school in* $^{o}F$.

- As appropriate, review the following (from the classroom activity led by teacher):

> CAUTION: Remind students that the glass part of the thermometer can break and that they need to handle the thermometer with care. (The red liquid inside is alcohol and does not pose a hazard.)
>
> - Hold the thermometer by the plastic or metal edges or string loop so fingers do not warm the glass.
> - For most thermometers, each line represents two degrees. Although scientists use Celsius in measuring temperature, we will use the Farenheit scale because it is more familiar (to Americans).
> - It may take several minutes for the thermometers to adjust to each new location.
> - Be sure the thermometer bulb is dry before using it to read air

- Measure the air temperature in the hallway and/or classroom while you walk toward the outside door. Have a student team read and record the inside air temperature on the walk report form.

- Ask: *Do you think outside air will be a lower temperature or a higher temperature than inside air today? What do you think the temperature of the outside air will be?*

2. **Measuring temperatures outside the school.**

- Just outside the school building, have your group measure the air temperature in degrees Fahrenheit, using the thermometer in the previously placed cup. Have a student team read and record the outside air temperature on the data sheet attached.

- Remind the children that water is sometimes a solid and sometimes a liquid. Ask: *Where do you think we will we find water outside today? In places where there is water, do you think it is liquid or solid or both today? Explain your thinking*. (Depends on whether the temperature of the water is higher or lower than the freezing point of water, 32° F). (snow on the playground, snowdrifts near the building, ice, puddles in the walkway or parking area, water in mud, icicles, etc.). Ask: *If the same amount of rain or snow falls all over the schoolgrounds, why do you think there is snow/liquid water in some places and not others?* (wind, snow plows, evaporation—dries up, some places are warmer and some colder)

- Ask*: Of the places we can see, where do you think the temperature is highest? Where do you think it lowest?* Have children look all around the schoolyard for places they think will have a higher or lower temperature than the one they just recorded for air. Encourage them to explain their choice. If it does not come up, ask how the color of an object in sunshine might affect its temperature. (Think walking barefoot across a black parking lot compared to white beach sand or grass in the summer). Children will discover as they explore that in sunshine dark colored material like asphalt heats up more than lighter colored objects. As a group, decide on 3 or more areas to investigate. Be sure to include locations with water if possible.

    - Possible locations:
        - In a puddle
        - Under leaves or a log. (If dark colored leaves are on top of the snow, they sometimes melt into the surface, leaving a leaf print.)
        - On the asphalt black top. (Bare, or with snow, ice, or puddles.)
        - Under the soil. (If possible, use the trowel to make a hole for the thermometer.)
        - Sunny spot vs. shade on the same type of surface. (Remember to shield the bulb from direct sun so you just get the air or ground temperature of the sunny location. Use a clipboard or loosely cover the bulb with a bit of tissue to prevent sun from shining directly on it. )
        - Under or on the playground equipment. Note color of surface.
        - Ground level vs. shoulder level air temperature.
        - Inside a mitten with and without a hand in it.

- Go to each of the places your group thought they might find the highest and lowest temperatures. Carefully place a thermometer in the location you want to measure. You may want to leave thermometers in several places at once and return after a few minutes to take readings. If you tie a bit of bright surveyor's tape or string to the thermometer, it will be easier to find when you return. Be sure to gently dry the thermometer bulb with tissue if it gets wet.

- While you are waiting for the thermometers to register, invite children to use their bare fingers to feel a spot and sense the degree of warmth. Dark things absorb more heat energy than light colored things. Usually there is a finger-sensitive contrast between black asphalt in the sun vs. asphalt in the shade or a brick wall in a building or asphalt vs. snow, or dark dry soil compared to ice, etc.

- Return to the locations where you have placed the thermometers. Give each pair of students a turn at reading a thermometer. Invite students to record the location, type of material measured and temperature on the report form. If the temperature of snow, ice, or liquid water is measured, record the state of the water: solid or liquid.
- At each location ask: *Why do you think the temperature is lower/higher/the same as the outside air temperature here? (Encourage students to give a reason for their answer)* Collect all thermometers.

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**Optional: When snow and/or ice are available**

**Find high and low temperatures with snow and ice:**

- On top of or inside a snow bank, or both. (Use the trowel. Try different depths. Snow actually acts like a blanket to keep temperatures from going much below freezing, as it is a good insulator.)
- On or under ice.
- Edge of the black top where snow is melting.
- Near a dark colored tree surrounded by snow. (There is usually a melted area near the trunk—the dark trunk absorbs sunlight and heats up slightly more than the white snow.)
- Snow or icicles on a school roof- - can't measure temperature, but can try to explain patterns. *Why is snow/ice on one part of a roof and not on another?* (dark roof heats up in the sun and not in the shade; heat can escape from the school through parts of the roof*;* wind*)*

**Examine snow or ice crystals.**

- Use a trowel to put a little snow or ice on black paper (or a coat sleeve) for each pair of children. Invite them to examine it with a hand lens. Ask them to describe its properties: *Is snow/ice a solid or liquid?* Watch as the crystals melt. Ask: *Why are the crystals melting?* (Heat from their hand raises the temperature of the snow above the freezing point.) *How could you change the liquid water back into ice?* (Make it colder.)
- Ask: *Does all snow feel the same? Think about snow that is good for making snowmen—what is it like?* Have children remove their mittens and take a bare handful of snow. (Remind them that these are scientific samples, not snowballs!) Ask children to predict what will happen if they squeeze the snow. Invite them to try it and see what happens (the snow changes to ice and then starts to melt). Ask: *Why does the snow change to ice, then to liquid water?* (air spaces in the snow get squeezed out forming clumps of ice; heat from your hand melts the ice)
- Look at a snowbank and try to find places where the weight of snow has caused the bottom layer to change to ice. You can use the trowel to dig down to the ice.
- Just before returning to school, have each student or student pair collect a half a cup of snow. Tell them that they will bring the snow into their classroom. Back in the classroom, label each cup with the child's initials and mark the level of the snow. Have them predict and mark where they think the water level will be when the snow melts and how long it will take to melt. Ask them to explain how they arrived at their prediction.

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**Water as a Gas (Optional)**

- Water as a gas is a difficult concept for second graders, as water vapor is colorless. But if evaporation (liquid water changing to a gas) comes up—--you may note that water is also found in the air as an invisible gas. This is called water vapor. If water vapor cools, it can change back to a collection of tiny liquid droplets that we call a cloud or fog or dew. (So clouds are not gas, but liquid drops. You may also see a cloud of condensed steam coming from a chimney, or the children may notice a "cloud" where the warm moist breath from their nose or mouth changes back to liquid drops in the cold air.)

3. **Animals in winter.**

   - Ask: *How do you stay warm when the outside air temperature is low?* (Coats, mittens, move around to find a warmer place, etc.)

   - Ask: *If you were an animal, where would you go in the schoolyard to stay warm today? (use information from the report form to find highest temperature) Where would you find liquid water to drink?* Invite children to give examples of how animals stay warm in the winter. (Migrate to a warmer place, grow thicker fur, find a shelter, perhaps go underground.) Some animals survive over the winter by finding a slightly warmer place that protects them from the cold and/or allows them to find liquid water. When the air is below freezing (32 **°** F**)**, snow actually acts like a blanket that keeps the ground below from getting even colder. Like a fluffy blanket or winter jacket, the air in snow acts as an insulator. Some animals make tunnels underground to reach a level that is not as cold as the surface.

4. **Wrap up.**

   - List all children's observations and questions. Ask: *Where was the highest temperature outside? Where was the lowest? What do you think made the difference? (***Optional:** *Where was water solid ice or snow? Why was it a solid rather than liquid water? What do you think will happen to the snow in the cup when we bring it inside?*
   - Walk back to the school.
   - Give the "Temperature Report: Our Big Backyard" recording sheet to the teacher.
   - Return all materials to the Big Backyard supply area.

Water Molecule Game (optional for "waterless" walk or classroom)

A water molecule is a tiny bit of water that is too small to see. Many water molecules can join together to form liquid water or ice. Ask students to pretend they are water molecules. Have them join hands loosely. The walk leader pushes gently past the loose hands. Tell them that this is what liquid water is like. The molecules stay together a little, but can be moved around and through.

Imagine the sun is shining and heats up the water molecules. Now they begin to jiggle and separate into individual bits. Drop hands. They move away from each other. The leader can move freely between the molecules. This is a gas.

Imagine night comes. The air gets cooler and the molecules come together again. At first they loosely join hands in a liquid. But then it gets colder. Ask the children to hold hands firmly and stiffen their arms so they are straight. In order to do this they need to move away from each other. The space they took up just got bigger—just like ICE does when liquid water becomes a solid. The leader can't walk between two water molecules now because they are solid water crystals.

**TEMPERATURE REPORT: OUR BIG BACKYARD**

GROUP LEADER: DATE: TIME:

Indoor air temperature: _____ºF

Outside air near school: _____ºF

| LOCATION | MATERIAL MEASURED (air, snow, ice, liquid water, blacktop, soil, grass, etc.) | TEMPERATURE ° F |
|---|---|---|
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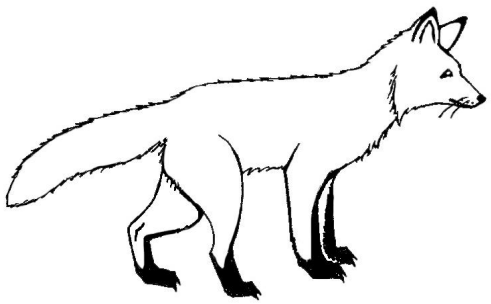
Where do you think an animal would go <u>in the schoolyard</u> to find the highest temperature today?

Where do you think an animal would go to find <u>liquid</u> water to drink today?

Most surprising discoveries:

Questions we still have:



**POST-WALK CURRICULUM INTEGRATION OPPOPTUNITIES: TO BE CHOSEN AND LED BY THE TEACHER**

1. Literacy Connection: Winter Number Story.
   Write a winter story about two days in an animal's life in your school's Big Backyard. On one day, the air temperature at noon is 50ºF and the next day it is 25ºF. Include ways the animal stays warm and where and when it finds liquid water. Include at least one temperature reading.

2. Science Connection: Changes, Lesson 2.

   - On your Big Backyard walk you may have found several locations with water. What temperature did you find for liquid water (varies, but above 32° F) In locations with ice or snow, what temperature did you find? (at or below32 °F )

   - Ask: *Why do you think some locations outside are warmer than others even on a cold winter day?* (Insulation of soil, snow, or grass, heat from school building, heat from dark asphalt.)

   - Ask: *Why do you think you found snow and ice in some places and not in other places? What is the evidence for your explanation? (How did you decide on your idea?)* Have student groups share their findings. Snow removed by plowing and shoveling is obvious. Wind can also move snow. Ask: *How do shadows affect the temperature of ice or snow?* (Encourage them to use data they collected on the walk to show that the temperature of air in the shade is lower than air in the sun.) Also ask how temperature might be affected by sunshine falling on dark vs. light colored objects. In Grade 1 they should have learned that dark colored objects (black top, tree trunks, or dead leaves on the snow) are heated more by the sun than light colored objects (from Grade 1 lesson from the Investigating Light and Shadow unit). Even in winter, water can evaporate (as in Lesson 2).

   - Ask: *What do you think makes snow and ice turn to water on the playground?* (Higher air temperatures, warmer soil or warm blacktop.) Where does that water go? (Water sinks into soil, flows away, or evaporates into the air--but evaporation is a difficult concept for second graders. Accept all answers that have a logical, even if not correct, explanation.)

   - Encourage the students to record observations on the cup of snow in their Science Notebook. Have them include their predictions as to how much water will be in the cup when the snow melts and how long the process will take. Ask: *What did you find out by melting snow in the cup?* (Snow changes to liquid water by absorbing heat from the room. The snow takes up more space than the liquid water. Discuss how the children arrived at their predictions.)

3. Science Connection: Changes, Lesson 2.
   Ice cubes can be put in different places outside as part of the "ice cube melting race." A variation on extension 4 in this lesson, page 40, might be to put very warm water in zip lock bags, instead of ice cubes. Challenge students to find materials that can be used to help the water in the bag stay warm. They can try different types of insulation, different locations, etc.

4. Going Further: Ask: *When we go out again in the spring, how do you think our observations on water and temperature will be different? If we compare our winter walk data with other grade 2 classrooms, will it be exactly the same or different? Why or why not?* (Walks may take place on different days and different times of day.)