Western Upper Peninsula Center
for Science, Mathematics and Environmental Education

A partnership of

Copper Country & Gogebic-Ontonagon Intermediate School Districts and Michigan Technological University
Serving schools and communities in Houghton, Baraga, Gogebic, Ontonagon and Keweenaw Counties

It's Snow Good!

Grade: 5 **Duration:** Approx. 2 hrs.

Summary:
What's really in that snowflake on your tongue? Students will investigate what makes up that wonderful white powder that falls around us for months on end. Students will predict the volume, and contents of snow. Students will also collect data and graph their data.

Objective:
Students will:

1. Explain why snow from different areas has varying volumes
2. Identify what is needed to make snow
3. Explain how air pollution can be measured using snow

Materials:

One for each group of 3 students:

- Thermometer
- 1 Plastic beaker
- 1 Graduated cylinder
- White coffee filter
- Rubber band
- Clipboard- per student
- It’s Snow Good data sheet- per student
- Snowflake ID sheet- per student
- Snowshoes- per student
- Pencil
- Magnifying glasses
- Scavenger Hunt
- 1 pH strip
- Meter sticks

Background:
Snow forms when there is enough moisture in the air, below freezing temperatures, and a nucleus (dust particle) for the moisture to collect around. This nucleus is the same that's needed for rain, but this precipitation is almost always more spectacular.

We've all gazed in wonder at the delicate beauty of snow as it drifts gently, silently to Earth. Each flake appears different from the next, and close inspection with a hand lens reveals the intricate nature of these crystals. Their delicate form is ephemeral, however, and the flakes begin to loose their hexagonal shape nearly as soon as they form.

On the ground, the snowpack structure varies depending on the depth. Near the ground, you will often find that there are more gaps between crystals than near the top. These gaps are caused when the moisture at the bottom of the snowpack vaporizes and moves upward. The result is a looser snow structure, which allows small mammals to move more easily beneath the snow near the ground.

Also, you'll find warmer temperatures near the bottom than at the top. This is due to the earth, which has collected solar energy in the absence of snow, slowly releasing heat energy. This heat energy travels very slowly through the snowpack since snow is such a good insulator.

When snow is collected and allowed to melt, the residue that remains is the nucleate, which the crystal formed around initially. Of course, if the snow has added debris such as dirt from the roadside, you will observe more than just the nucleate. The nucleate can be any airborne particle, from dust to exhaust, or other pollutant solids.

Introduction (10 minutes):

1. *Brainstorm* what it takes to make snow:
    - Temperatures below freezing (0 ^{o}C)
    - Moisture in the air
    - A nucleus for the snow to form around
        1. *What is a nucleus?*
2. Go over "How a snowflake is born" on the overhead.
3. *Predict* how much water a given amount of snow might yield
    - On average, snow yields ~ 1/10 its volume in rain water
    - Snow of different ages, and from different places in the snowpack yield different water volumes
4. Discuss the definition of a snowflake and discuss the different types of snowflakes.
    - A **snowflake** is a general term; it can mean an individual snow crystal or a few snow crystals stuck together. The water molecules in an ice crystal form a hexagonal prism. Snowflake shapes depend on temperature and humidity.
    - Show and distribute the different types of snowflake sheet.
5. Tell them we will be looking at *different aspects of snow*, including the acidity of snow and if there is particulates in it, predict how much water will be there when the snow melts in the graduated cylinder, temperature difference in snow depths, and for the scavenger hunt they will be identifying and drawing different snowflakes.

Activity:

1. Ask students, will there be more water left in the graduated cylinder or less water once the snowmelts. Tell students that they will be collecting 50-mL of snow. Write hypothesis on board.
2. Tell students we will be using the beakers to test the pH of snow. Also have students hypothesize about what they'll find on the coffee filter after the snow on it melts.
    - Ask students what kinds of things would we find on the beaker? Explain that there snow forms around a dust particle and also traps pollution and particulates in the air on the way down to hitting the ground.
    - Ask them what type of pollution/particulates could be in the snow? Explain there are natural pollutants and man-made pollutants. Man-made might be sand/salt, coal/oil burning, wood burning stoves, car exhaust. Natural pollutants are volcanic ash, pollen and dust.
3. Prepare beakers for experiment
    - Place coffee filter over top
    - Make sure there is a deep depression
    - Secure the filter with a rubber band
4. Have students go outside to collect snow without snowshoes on.
    - Small pits are dug for sampling
    - On data sheets, record where in the snowpack you will be collecting your sample from i.e. top, middle, bottom, record temperature, amount of snow collected, snow pack depth using meter sticks, and have students do the draw and describe snowflake column.
    - Collect snow from your chosen area
        - Dump 50-mL from the cylinder into the coffee filter
        - Refill the cylinder a second time **DON'T PACK THE SNOW**
5. Students take the snow back inside to melt. It often takes over an hour for the snow to melt. Put the beakers and cylinders in a warm place.
6. Have students put snowshoes on and return outside with thermometers, data sheets, magnifying glasses, and meter sticks. Have students use snowflake ID sheet to identify different snowflakes.
7. Do the Snow Good Scavenger Hunt.
8. After returning indoors, students will:
    - Record amount of water in cylinders. Address hypothesis given in the beginning of the field trip.
    - Test pH of the melt water of the beaker.
    - Record observations about what remains on the filter paper.

Assessment:

1. Students suggest what makes up the residue on the filters.
2. Compare water volumes and snowpack temperatures.
3. Students suggest correlations between temperature in different areas, and corresponding volumes.

4. Students suggest reasons for pH levels they found