MKIW Office Tours

Tour Description

Students will learn about density; they will hypothesize, measure, and calculate snow density and the water content of snow in an open area and near trees during field lab. Using this information, students will learn to make predictions about the weather and climate and the effect on the forest, watershed and climate.

Objectives

Students will learn about the operations of the National Weather Service, density and winter dress.

Materials

Fake snow flakes (or real snow if fluffy and available!)
Clear Rubbermaid-type totes
Yard stick
Colored tape (painters)
2 sponges of identical volume and weight
Paint pan
Water
Water molecules
Sample clothes
HotHands

Procedures

Group 1

Density demonstration 1 – Snow density

1. Explain density is a simple fashion to the kids. Basically, density is the amount of *stuff* you have in an amount of *space*. The more stuff in the same amount of space the higher the density.
2. Demonstrate density using the snow in clear tote.
   a. Put the lid on the tote and snap close the ends with the handles
   b. Hold the tote on the sides, turn it upside down and shake it to fluff up the snow.
   c. Slowly turn the tote back over and remove the lid
   d. You may have to use the tips of your fingers to adjust the very top of the snow to level it a bit
   e. Measure the snow with a yardstick
   f. Put a piece of blue tape on the outside of the tote to mark the top of the snow
   g. Now put the lid back on and, keeping the tote right side up, settle the snow by shifting the tote back and forth (simulating the wind) and tapping it lightly on the table or floor (simulating gravity)
   h. Remove the lid and measure the snow again.
   i. Discuss how the snow pack changed with respect to density. Which time did the snow have the highest density? Be sure to remind the kids that nothing was added to the tote... it was always the same amount of snow and thus the same amount of water.
   j. Ask the kids **" If one mountain has snow 3 feet deep and another mountain has snow 1 foot deep, which mountain has the most water in snow?"**
      1. *(Answer: You can't tell because you don't know how dense the snowpack is. The 3 feet of snow could be very light and fluffy (low density) while the 1 foot of snow could be packed down (high density) and contain much more water.)*
   k. Ask the students, **"Out in the forest, where do you think the snow might be more dense - in the trees or out in the open?"**
      1. *(Answer: Should include thoughts like branches intercepting/slowing snowfall and wind in the trees, wind, exposure to sun in the open.)*
   l. Be sure to show them the pneumonic equation "We love density!" density = ❤ (this should be a heart with a horizontal line through it. The horizontal line splits the heart into an m over V (mass over volume)

1. *m* = mass = (weight of snow, or other item)
2. *v* = volume of snow or other item

Demonstration 2 – Sponges and water

1. Use 2 identical sponges.
2. Have a couple of students hold the sponges to compare their weights
3. Ask the students **"Is one heavier than the other?"** *(No. They should be equal.)*
4. Put one of the sponges in the paint pan and soak up some water.
5. Ask the student **"Is one heavier than the other?"** *(Ye.s So the weight/mass has changed.)*
6. Ask the students **"Has the volume (or space) changed?"** *(No.)*
   a. *So the wet sponge now has a higher density than the dry sponge because water now fills all the air spaces in the sponge.*
7. **Explain density in terms of the relationship between mass and volume.**
   a. **In the snow experiment, we left the mass (stuff) the same, but we changed the volume (space). In the sponge experiment, we changed the stuff (added water) but left the volume the same. A change in either variable will change the density.**
8. Ask the students **"Explain in your words what density is … give some examples in your life."**
9. Ask the students, **"There is a weatherman's saying, Ten inches of snow equals one inch of water. Do you think this would always be true based on what you've seen here?"** Discussion about what might change this. Hopefully students will discuss snow settling and what might cause settling as well as change in saturation of snow.

Snow Crystals

1. Ask the students **"Have you ever heard that snowflake has six sides? Why do you think this is?"**
2. Remind the kids how all things are made of "molecules", and molecules are made of smaller particles called "atoms". A water molecule consists of one atom of oxygen and two atoms of hydrogen – thus H_20.
3. Describe how water molecules are also like a magnet – they have a positive side (oxygen) and negative side (hydrogen). The atoms on the same molecule are locked in place.
4. Ask the students **"Have you ever heard the saying 'opposites attract'?"**
   a. Remind the students that in science positives and negatives are drawn toward each other but positives and positives push away from each other as do negatives and negatives.
5. Tell the students that the positive oxygen atom is so strong it is attracted to another negative hydrogen atom.
   a. So, the oxygen atom from one molecule and the hydrogen atom from another molecule pull closer together.
   b. Remember, the hydrogens want to be as far apart as possible, so the hydrogen from the new molecule will be attracted to the back of the oxygen molecule.
   c. Show this using the water molecule models.
   d. Keep adding a molecule at a time.
   e. Molecules may have to flip to become stable.
6. Describe that because the angles are locked in place, a definite structure has to form when many molecules join together. The opposites all pull as close together as they can and the 'sames' all push as far away from each other as they can. For water/ice, this molecular structure ends up having six sides. This is why snowflakes have six sides.

7. Discuss the space in the molecules – the spaces hold air which keeps the snowfall light and fluffy. When the crystals start breaking, and the snow starts packing together, the density increases.

Winter dress

1. The density experiment can lead to a discussion on insulative qualities of layered clothing, winter coats, hats, gloves etc. Tying this into what they've learned might encourage them to think more about how they dress on the day they go to the field.
2. Discuss how for skiing, snowboarding, snowshoeing, winter running or any other outdoor pursuit, the goal is to stay warm and dry. How to do it? Dress in multiple, lightweight layers.
    a. Layering clothing creates pockets of air between the layers. Each of these air pockets is a layer of insulation. The more insulation, the warmer you will be.
    b. A layering system usually includes three components: an inner moisture-wicking layer; a middle insulating layer or two; and an outer shell layer.
3. Layering is important for two reasons.
    a. First and foremost it allows you to adjust your clothing according to the amount of energy you're putting out, your metabolism that day and the weather. When you first start the day you will need three or four layers to maintain your body temperature. After you've snowshoed a while, you'll need less clothing. At this point you might take off your hat. As the day progresses and you put out more energy and the air temperature increases you may need to take off your outer coat to stay comfortable.
    b. The second reason to layer your clothing is that it's actually warmer.
        i. Three layers are warmer than one thick one of the same weight.
        ii. The effectiveness of layers is enhanced by the still air trapped between them. It's a case of one plus one equals two and a half or three.
    c. On the top, a long john's shirt, a turtleneck, a sweater and a coat
    d. On the bottom, over your long underwear, you'll need trousers. Practically anything will do as long as it's not made of pure cotton. Cords work just fine, so do track pants if they're not all cotton. ***Cotton jeans are a mistake*** - they grab and hold on to all the water that's within reach, your perspiration and the snow. Wearing jeans can really chill a snowshoer.
    e. You'll have the warmest feet in wool socks and boots not too tight. Cotton sport socks will grab the moisture as your feet perspire - a sure way to get cold feet.
    f. Gloves can be knitted wool or fleece. However, on really cold days most people will need mittens. If your gloved hands are cold, change to mittens and or put your hat on and climb a hill.
    g. Hats - anything goes as long as you like it and it keeps you warm when you need it. Remember that more body heat can be lost through your head if you don't wear a hat due to a higher concentration of blood vessels close to the surface and a lower concentration of body fat.

http://www.scarboroughskiclub.org/page26.html