Quinzee Day Activities

Grade Level: 9th and 10th

Class: Physical Science and/or Earth Science; can be adapted for upper level Physics.

Goal: To examine heat conservation and winter survival by building a Quinzee hut and to examine the properties of the snowpack.

Objectives:

Students will be able to:

1. Construct a Quinzee survival hut.
2. Describe the snow temperature profile based on the data collected.
3. Describe the types of snow found at different levels within the snowpack and how they metamorphosed into these types.

Background Information:

Anyone, even experienced winter wilderness adventurers, can get caught unexpectedly by weather or even equipment failure. The experience has the potential to be life threatening. The three keys to winter survival are shelter, water, and warmth. Taking a few precautions and heeding some tips can make the difference between surviving safely, complete with all fingers and toes, or not. Again, shelter, water, and warmth are imperative. It gets dark fast during the northern winter months. However, the more time before sunset you have, the more comfortable — or less uncomfortable — the night will be. Building a snow shelter is a relatively quick activity. Snow shelters work well because snow is a much better an insulator than the average tent

Snow

Snow is a form of precipitation. However it is in the form of ice crystals. The ice crystals form as hexagonal prisms due to the molecular structure of water. The ice crystals precipitate in one of the following forms:

- **Snow crystals** -- Individual, single ice crystals, often with six-fold symmetrical shapes. These grow directly from condensing water vapor in the air, usually around a nucleus of dust or some other foreign material. Typical sizes range from microscopic to at most a few millimeters in diameter.
- **Snowflakes** -- Collections of snow crystals, loosely bound together into a puff-ball. These can grow to large sizes (up to about 10 cm across in some cases) when the snow is especially wet and sticky. A snowflake consists of up to 100 snow crystals clumped together.
- **Rime** -- Super cooled tiny water droplets (typically in a fog), that quickly freeze onto whatever they hit. An example of this is the small droplets of rime on large snow crystals.
- **Graupel** -- Loose collections of frozen water droplets, sometimes called "soft hail."
- **Hail** -- Large, solid chunks of ice.

Snow Pits

A snow pit is a trench exposing a flat, vertical snow face from the snow surface to the ground. It allows you to study the characteristics of the different layers of the snowpack that have developed as the snow has changed due to compaction and weather changes. Snow pits are regularly used in mountainous areas to determine if one layer might slip on another causing an avalanche. As snow accumulates and changes over time, it develops layers of snow marked by their physical differences and reflecting the life history of the snow pack.

Materials: (for each group of two students)

Snow Shovel Hand Trowel Thermometer Meter Stick

Procedure:

A. Building the Quinzee

1. Mark off a circular boundary of about 3 meters in diameter.
2. Mix up the snow within this circle. Then start piling snow from the surrounding area, on top of this area. Turn the snow as you pile it up, breaking up any excessive chunks. Continue until the pile is about 2 meters high and is shaped like a dome. DO NOT pack down the snow!
3. If available, find a dozen or so 30 cm long sticks and poke them through the top and sides of the pile. These become your guide for wall thickness when you begin to hollow out the hut.
4. Let the pile rest for a couple hours. The colder it is the faster it will harden.
5. Now it is time to dig! Start by making a small entrance hole at ground level (be smart and make this on the leeward side of the hut.
6. As you continue digging inward, start to slant upwards. You want the sleeping platforms higher than the door to allow the coldest air to flow down and out the door.
7. Continue hollowing out the structure, when you hit a stick, you know you have gone far enough and the walls will be the right thickness.
8. Continue until the entire structure is hollowed out and the sleeping area is finished.

B. Temperature Profile:

1. Find a relatively level area of undisturbed snow.
2. Describe the surface features of the area before you trample on it.
3. Using shovels, dig a trench through the snowpack, down to the ground level.
4. Take temperature readings at several depths in the snowpack. Insert the thermometer several centimeters into the face of the snow pit so that any effect of the air temperature can be ruled out.
5. Draw a schematic cross section of the pit carefully labeling all the layers, make sure you make accurate depth records.
    a. Start at the layer nearest the ground.
    b. If the layer is ice, record this layer as Ice.
    c. If the first layer is not ice, gently push your fist into the middle of the layer. If your fist penetrates the layer easily, record this layer as Very Soft.
    d. If your fist *doesn't* go in easily, hold your hand flat and horizontal so that the tips your four fingers are just touching the snow and push gently. If your four fingers penetrate the snow easily, record the layer as Soft.
    e. If your four fingers *don't* go in easily, push gently into the snow with the tip of one finger. If one finger penetrates the snow easily, record the layer as Medium.
    f. If one finger *doesn't* penetrate easily, gently push the sharpened end of a pencil into the snow. If the pencil penetrates easily, record this layer as Hard.
    g. If the pencil *doesn't* penetrate easily, gently push the tip of a knife into the snow. If the knife penetrates easily, record this layer as Very Hard.
    h. Repeat for all layers.

Assessment:

The diagram and temperature profile will be graded as a lab assignment.

Quinzee completion will be graded on participation and fitness of the structure.

Benchmarks:

P1.1C Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity–length, volume, weight, time interval, temperature–with the appropriate level of precision).

P1.1D Identify patterns in data and relate them to theoretical models.

P1.1E Describe a reason for a given conclusion using evidence from an investigation.

E2.2C Describe natural processes in which heat transfer in the Earth occurs by conduction, convection, and radiation.

Sources Used:

Halfpenny, J.C. and R.D. Ozanne 1989 ***Winter: an ecological handbook.*** 1st edition. Johnson Publishing Company, Boulder, Colorado. 273 pages.

http://www.call-wild.com/quinzee.html

http://www.troop208.com/Mambo/index.php?option=com_content&task=view&id=41&Itemid=2

http://consciouschoice.com/2002/cc1501/wintersurvival1501.html

http://sdsd.essortment.com/wintersurviva_reqo.htm

http://www.abc-of-snowboarding.com/snowtypes.asp

http://www.uoguelph.ca/~geology/glacial/snow.html

http://son.nasa.gov/winterstory/materials/SnowPitProcedures.pdf