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

Stocking Stuffers—Best Insulator

Grades: 4-6 **Duration:** Approx. 2 hrs.

Summary: Which socks should you wear to play outside? The cotton, wool, fleece, or quilted? Students will test the insulating qualities of different materials in both wet and dry conditions. They will collect data and create a graph of their findings.

Michigan GLCE's addressed SCI: S.IP.04.11-16; S.IA.04.11-15; S.RS.04.14-17; P.PM.04.53. MAT: M.UN.04.01-03; D.RE.04.01-03.

Objectives:

Students will:

1. Use the scientific method to evaluate the insulating qualities of different materials
2. Use thermometers to collect data
3. Evaluate their results using a bar graph
4. Identify potential errors in experimental design.

Materials:

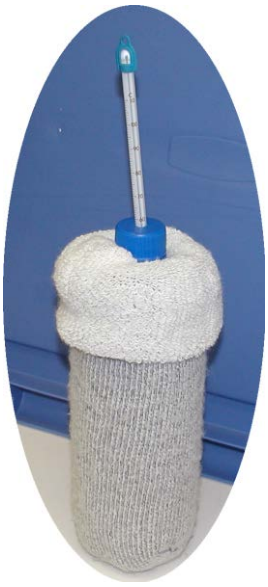
Snowshoes for all students

For each group of 2-3 students:

- 1 Plastic bottle with thermometer hole drilled in lid
- Thermometer
- 1 sock
- Clipboard
- Data Sheet (handout)
- Graph Sheet (handout)
- Pencil

thermometer through lid

Whole assembly: bottle, thermometer, sock



Materials (cont.):

For Leader:

- Cooler with large bottles of warm water (enough for 600 mL per group)
- Different types of socks: wool, cotton, quilted, fleece
- Small bucket for dunking one sock from each pair
- Bottle (no sock), and thermometer for control
- Stop watch
- Small funnel

Pre-Activity:

1. Discuss the investigative question: "How do the insulating qualities of different materials compare? What do students already know about this topic? What kinds of materials do they think are the best/worst insulators? Why would this be an important topic to investigate? Brainstorm types of insulation that animals (and humans) can use to stay warm.
2. Ask students for input on how we could investigate this question using the scientific method. Guide students toward developing a plan that mirrors the procedure specified below OR tell them that we will be using the "already established" procedure. This will be a controlled experiment. Make sure students understand what this means and what the variables in this experiment are. Also, discuss what potential problems may arise that would produce unreliable data (example- not everyone knows how to read a thermometer, or some students bury their bottles in the snow, while others don't, etc.)
3. Hand out *Data Sheet* and *Graph Sheet* to student groups.
4. Explain *Data Sheet* to students.
5. Show four types of socks (hand these around for students to see and touch)
6. Have students predict which material will insulate best Students record their predictions on data sheet.

Activity:

1. On snowshoes, students find a spot outside to set up their experiment.
2. Leader pours some water in a bucket for use in step #5.
3. Students wrap their bottle in chosen/assigned insulating material
4. Using funnel and beaker, leader pours 300 mL warm water in each bottle (or do this inside).
5. Pour 300 mL into the **control** bottle. Take all readings with students, and record this data.
6. If possible, place the thermometers in the bottles so they are in the water, but readable out the top of the bottles.
7. At the same time, all students take an **initial temperature** reading, and record this on their D*ata Sheets*. (If thermometers need to be removed, make sure readings are taken and thermometers are immediately replaced. Readings fall quickly in the cold air.)
8. Have students set the bottles in the snow.
9. Take a short snowshoe hike. Discuss insulation if possible
10. After hike, record final temperature.

Assessment—Graphing:

1. **Remind students about titles, keys and axis labels on their graphs.**
2. Control can be graphed on board as an example.
3. Have a large graph started on the classroom board, dry erase board, or poster paper.
4. Each group comes to the front to record their CHANGE in temperature
5. Compare the ability of different socks to insulate.
6. Whose prediction was correct?
7. Discuss how this experiment applies to being dressed properly in cold weather
8. Discuss any problems with the experiment (accuracy is a BIG problem – students tend to take measurements with different degrees of accuracy). Would you do anything differently next time?