

THERMOREGULATION: ICE STAND

What's the Point?

Did you know that the human body is excellent at regulating its own temperature? Still, when we exercise or are faced with extreme heat or cold, clothing is essential in helping our bodies maintain a safe temperature – this action is called **thermoregulation**. One example of this is keeping our bodies warm in cold weather. **Insulation** is a protective layer that prevents or slows heat loss, helping us stay warm. Materials that have spaces to trap air are better insulators. Some materials you can use are open and closed cell foam. **Open cell** foam has large air spaces that are not enclosed (like a baby bath sponge). **Closed cell** foam has smaller, enclosed air pockets (like thin craft foam). **Aerogel** is a synthetic ultralight material that comes from a modified gel. **Wool felt** is a compact material made from sheep's wool. In this activity, you will learn to identify the best insulating materials to keep you warm in cold temperatures.



Wool Felt Aerogel Open Cell Closed Cell

You will need:

- Wool felt sole
- Aerogel sole
- Open cell foam sole
- Closed cell foam sole
- Control (no sole – foot with sock)
- Large block of ice
- Towel
- 2 Plastic bags
- Temperature gun (optional)

Purchase supplies online or at your local craft store, shoe store, or drugstore. Use the pattern to cut soles if you cannot find ready-made insoles for purchase.

Glossary:

- Thermoregulation
- Insulation
- Open Cell
- Closed Cell
- Aerogel
- Wool felt

Chart 1: Comparison of Insulative Power of Materials used in Shoe Soles

	1 (warm)	2	3	4	5 (cold)	
Predicted					Control	
Actual					Control	Temp Gun Reading
Aerogel					No Sole (control)	
Open Cell					No Sole (control)	
Wool Felt					No Sole (control)	
Closed Cell					No Sole (control)	

Instructions:

1. Examine the four soles, comparing their thickness, flexibility, and weight.
2. Predict which sole will insulate your foot the best. Rank them 1-4 in Chart 1 (above), by writing the name of the material in the appropriate cell of the first row (Predicted). #1 is the best insulator and keeps your foot the warmest; #5 is the control (sock foot) and is the coldest.
3. Place a plastic bag on the ground and cover it with a towel; place the block of ice on top of the towel, then place another bag on top of the ice. The plastic protects the floor and your foot.



4. Place the Aerogel sole on the block of ice; wearing socks, stand with one foot on the ice (control) and one foot on the aerogel sole for 10 seconds.
5. Rate the insulative ability of aerogel by placing an X on appropriate cell in Chart 1 (1 = warm; 4 = cold). Wait 30 seconds before standing on the next sole.



6. Repeat steps 4-5 for the other soles, recording results in Chart 1.

7. Based on your data for the four soles, rank the materials from 1 (warmest) to 4 (coldest) by writing the name of the material in the appropriate cell of the second row (Actual).
8. If you ranked two or more soles the same, compare the two by stepping on them at the same time in order to achieve a 1-4 ranking.
9. How do your predicted rankings compare with the actual performance ranking?



Compare your "thermal sense" to a temperature gun reading:

10. Place each sole on the ice again and step on it for 10 seconds, then step off
11. Using the temperature gun, point the laser at the ball of your foot (the padded portion of the sole between the toes and the arch).
12. Record the temperature for each sole material in the left column of Chart #1 and compare to your other data.

Extension: Try using different materials to test your own ideas!

Sole Template

