How Low Can You Go?

In this experiment, you will first use a computer to find the normal melting temperature of ice. Then by adding salt to melting ice, you will see the effect of salt on the melting temperature of ice. You will next make and test a plan for reaching the coldest temperature using water, ice, and salt. Finally, you will have a contest to see which group can make their mixture reach the lowest temperature.

OBJECTIVES

In this experiment, you will

- Use a computer to measure temperature.
- Find the normal melting temperature of ice.
- See the effect of adding salt on ice’s melting temperature.
- Plan and test an experiment to find the salt and ice combination that will make the coldest temperature.
- Compete with other groups trying to reach the coldest temperature.
- Apply the results of the experiment.

MATERIALS

- computer
- Vernier computer interface
- Temperature Probe
- 250 mL beaker
- crushed ice
- salt
- balance

Figure 1
PROCEDURE

Part I  The Melting Temperature of Ice
1. Connect the Temperature Probe. Start the Vernier data-collection program and open the file “15 How Low Can You Go” from the *Middle School Science with Vernier* folder.

2. Put 100 mL of crushed ice into a 250 mL beaker.

3. Place the Temperature Probe into the ice, then click [Collect] to begin data collection.

4. Hold the beaker in one hand and the Temperature Probe with your other hand. Stir the ice until a steady temperature is reached. Record this temperature. It is the normal melting temperature of ice.

Part II  The Effect of Salt on Ice’s Melting Temperature
5. Add 5.0 grams of salt to the ice water and stir. Continue stirring until the temperature stops dropping.

6. Record the lowest temperature reached. Then click [Stop] to end data collection.

Part III  Finding the “Coldest” Mixture
7. Make and test a plan for finding the coldest possible temperature using 5.0 grams of salt and the materials used in Parts I and II. Outline your plan in the Contest Plan section on Page 15-3.

Part IV  The Coldest-Temperature Contest
8. Set up the equipment as in Part I.

9. Put the amounts of water and ice you found to be best in Step 7 into the 250 mL beaker. Note: All student groups should do this part of the experiment at the same time.

10. Get 5 grams of salt from your teacher. Add this salt to the water and ice. Place the Temperature Probe into the water, ice, and salt mixture and then click [Collect] to begin data collection.

11. Stir until your coldest temperature is reached. Then click [Stop] to end data collection.

DATA

<table>
<thead>
<tr>
<th>Normal melting temperature of ice</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coldest salt and ice-water temperature (Part II)</td>
<td>°C</td>
</tr>
</tbody>
</table>
CONTEST PLAN

PROCESSING THE DATA

1. How does the melting temperature of water (ice) compare with its freezing temperature?
   Hint: See your results for Experiment 14, “Freezing Temperature of Water.”

2. What is the effect of adding salt on ice’s melting temperature?

3. If you had a chance to repeat the contest, what would you do differently?

4. List some uses for the ideas studied in this experiment.
THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:

- Safety information
- Essential instructor background information
- Directions for preparing solutions
- Important tips for successfully doing these labs

This lab is intended for students ages 13 and older. For students ages 12 and under, we recommend that teachers perform the experiments as demonstrations.

The complete *Middle School Science with Vernier* lab manual includes 38 labs and essential teacher information. The full lab book is available for purchase at:

http://www.vernier.com/cmat/msv.html