

Changing the Freezing Point of Water with Salt

Grade Level - 4th to 6th

Objective(s):

- To teach fourth grade students that salt water freezes at a lower temperature than plain water
- To determine the temperature at which water freezes
- To understand why salt water freezes at a lower temperature than plain water
- To understand why the string sticks to the ice cube when salt is placed on the cube
- To compare student hypotheses with the actual results of the experiment

Kentucky Standards:

- SC-E-1.1.1 - Objects have many observable properties such as size, mass, shape, color, temperature, magnetism, and the ability to react with other substances. Some properties can be measured using tools such as metric rulers, balances, and thermometers

Materials:

Classroom graph
Glass
String
Water
ice cube
salt
thermometers

Activity:

Each student will receive a cup with ice and a piece of string. Float the ice cube on water filled to near the top of the cup. Place the string across the ice cube, and then give each student a teaspoon of salt to pour on the ice cube and string. Each student will determine if the string freezes, sinks, does nothing or disappears.

Give each student a cup containing ice and water with about 2/3 ice and 1/3 water. Then gently stir with a thermometer and record the temperature every 2 minutes for about 6-8 minutes. Then add one teaspoon of salt and repeat the process. Add one more teaspoon of salt and repeat the process one final time.

Performance Assessment:

Have twenty students read and discuss material about the weather, particularly cold weather, snow and ice. Give students a pretest asking them to predict the outcome of what will happen to the strings when salt is placed on the ice cubes and what will happen when the salt is added to the ice-water mixture. Next the students do the two experiments. Give a post-test to the students after the experiments are finished. Chart all students' results from the second activity on a class graph. Discuss the graph with the class focusing on mathematical concepts.

Conclusions:

The majority of the students should understand the concept of water freezing at 32 degrees Fahrenheit (0 degrees C). When salt is sprinkled on the ice cube, it lowers the freezing point to below 32 F. Since the ice cube cannot get any colder than it already is the surface starts to melt. The string lies in the puddle of melted salt water. As the salt water is diluted by further melting of the ice cube, the freezing point rises. The water refreezes attaching the string to the ice cube. This "depression" by salt of the freezing point of water is also seen in the second activity. A mixture of plain water and ice is in "equilibrium" at 32 degrees F, but addition of salt lowers the equilibrium temperature (as seen with the ice cube experiment). Within limits the more salt is added to the ice-water mixture, the lower the equilibrium temperature. This principle underlies the use of salt to melt ice on roads during the winter and also the use of ice and salt in an old-fashioned ice cream maker.