

How Low Can It Go?

OBJECTIVE

Students will investigate how salt and other dissolved solids can lower the freezing point of water.

BACKGROUND

Pure water freezes at 0°C (32°F). When substances, such as salt, dissolve in water, water molecules have difficulty locking together to freeze to a solid. Salt water freezes at a lower temperature, about -2.2°C (28°F). As this water freezes, the salt (sodium chloride) is pushed out. Solid ice is mostly fresh water. The remaining liquid water under ice becomes saltier as more water freezes.

MATERIALS

one set per student group:

- copy of *How Low Can It Go?* funsheet on page 11
- two plastic bowls
- two thermometers
- water
- salt
- measuring cup
- freezer



ACTION

1. Measure water to fill bowls three-quarters full. Record amount of water used.
2. Take the water temperature of each bowl. Record results.
3. For one bowl, mix in one tablespoon of salt per cup of water used. Stir to dissolve. (This will approximately equal the salt in ocean water.)
4. Record temperature again. It should have remained the same.
5. Place both bowls in the freezer side by side.
6. Observe the bowls every 15 minutes, noting if ice has formed across the top of the bowl. Also record water temperatures for each bowl. Be careful to place thermometer in the same location for each bowl. As the surface water freezes solid, use a blunt pencil to chip a small hole for the thermometer.
7. Repeat steps 1 through 6 again using sugar, baking soda, or cornstarch as the dissolved substance. Does this make a difference in the rate or degree of freezing?

DEEPER DEPTHS

Leave the bowls overnight in the freezer. Check the bowls in the morning. Do both bowls freeze solid? If not, why not? (Hint: let students taste the unfrozen water in the bottom of the bowl. Is it salty?) Ice floes can have pockets of liquid brine—super salty water.

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	water without salt	water with salt
amount of water		
initial temperature		
temperature after mixing		
temperature in freezer after		
15 minutes		
30 minutes		
45 minutes		
60 minutes		
75 minutes		
90 minutes		
105 minutes		
120 minutes		
temperature after 24 hours		