At-Home Experiment

SLUSHY SCIENCE

Have you ever slurped a flavored slushy cup of ice before? Why doesn’t it freeze solid like an ice cube? Find out about freezing points — and how to change them — in this experiment!

QUESTION

Do both fresh water and salt water freeze in my freezer?

STUFF YOU’LL NEED

• two cups
• water
• salt
• tape
• pencil
• spoon

THINGS TO DO

1. Fill in the Question, Research, and Hypothesis sections of your lab report.
2. Fill both cups halfway with equal amounts of water.
3. Use a piece of tape and a pencil to label one of the cups “salt.” Dissolve several spoonfuls of salt in that cup. See Figure 1.
4. Set both cups in the freezer. See Figure 2.
5. Check the cups every 30 minutes for two hours and write your observations for each cup in the Data section. Then check the two cups the next morning when you get up and write any additional observations.
QUESTION
Find the question on the previous page and write it here.

RESEARCH
Look up melting point, freezing point, salt, and ice online or in the library. Write some facts you learned here.

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Book or Internet site(s) you used:

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HYPOTHESIS
Based on your research, do you think both the fresh and the salt water will freeze? Do you think they will freeze in the same way?

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PROCEDURE
Step-by-step, list what you did in this experiment. (Hint: Check out the Things To Do section.)

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DATA
Record any observations you made.

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MATERIALS
List what you used to perform this experiment.

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CONCLUSION

What is the answer to the question at the top of page 2?

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Going Further Repeat this experiment with something else besides salt. (For example, mix the water with milk, sugar, pepper, or confetti.) Try freezing it. Does it freeze?

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REAL WORLD EXAMPLE

Why do you think people put salt on the roads in areas where it snows and gets very cold at night?

EXTRA CREDIT

Repeat this experiment with distilled water and tap water. Check frequently on the cups and report which seems more frozen. You will see that the distilled water freezes even faster than tap water. Distilled water is pure whereas tap water has impurities (e.g., chlorine, fluoride, etc.) that interfere with the freezing process and slightly lower its freezing point.

This scientific phenomenon is exploited in old-fashioned ice cream makers that use rock salt. Ice cream ingredients include sugar and other ingredients so the freezing point of the entire “solution” of ingredients is below 0°C/32°F (approximately 27°F). Surrounding the ice cream solution with a solution of ice and rock salt allows the ice cream solution to cool rapidly and well below its required freezing point temperature. The rock salt solution is much colder than the ice cream solution because salt lowers the freezing point dramatically. Even though the ice cream solution itself is cold, heat flows to the rock salt solution because it is even colder. So, the ice cream solution freezes quickly at least than 0°C/32°F.
Question
The salt water never completely freezes — it just becomes slushy. The fresh (non-salty) water completely freezes into ice.

Going Further
You probably observed that water generally did not freeze completely when you added other things (e.g., milk, sugar, confetti, pepper, etc.).

Real World Example
Salt is dumped on the roads to prevent the snow from freezing into sheets of ice — particularly at night when the temperature drops considerably and residents often wake to find dangerous road conditions. (It is also true that salt creates more friction, which helps to prevent cars from skidding on the wet, snowy streets.) Other chemicals added to water (or snow) would also lower the freezing point, but salt is used because it is relatively inexpensive and easy to obtain.

Explaination
Salt lowers the freezing point of the water (now a salt water solution) so that it would have to be considerably colder than a home freezer in order to freeze. When fresh water freezes, the H₂O molecules link together in a crystalline, hexagonal position. The salt gets in the way of this linking, lowering the freezing point. The salt does not warm the water (salt does not have a heat source with which to do this). Salt simply lowers the freezing point so that the freezer cannot adequately freeze it. If you could turn down the temperature in your freezer, you would then see the salt water freeze.

When a solute is added to a solvent and the freezing point drops, it is called “freezing point depression.” Flavored slushy ice cups (such as Icee® and Slurpee®) do not freeze because the addition of their ingredients to the water lowers the freezing point of the water.