4 Freezing

You can change the freezing point of pure substances by adding other substances to them.

When water changes from a liquid to a solid we say it **FREEZES**. Pure water freezes at 0°C.

When water freezes it turns into a solid – ice.

Mixing substances changes the freezing point

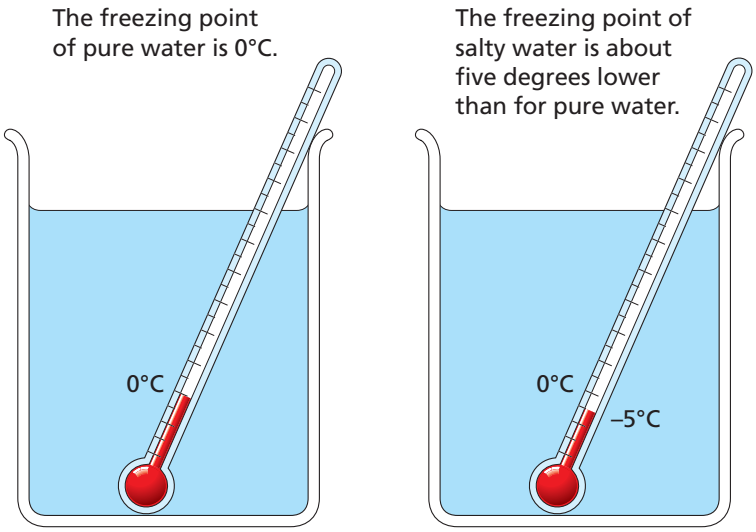
FREEZING POINTS of pure substances always stay the same. For example, pure water will always freeze at 0°C. But if we add substances to water to make a mixture, we can change its freezing point.

One easy way that we can change the temperature at which ice freezes is by adding salt (Picture 1). Once the salt has dissolved in the water, the mixture freezes at a much lower temperature than pure water. This is an important result. In winter, temperatures are often just below freezing, so roads become icy. But by spreading salt on the roads, so it combines with water, the freezing point of the mixture can be lowered to about 5 degrees below freezing. This makes it less likely that the roads will ice over (Picture 2).

Salt is just one substance that changes the freezing point of water. Other substances change it even more dramatically. Special liquids called antifreezes are added to the water in cars, so the water will stay liquid in all but the coldest weather.

(Picture 2) Salt can be used to keep roads free of ice so they are safer to drive on.

(Picture 1) The freezing point of water can be lowered by adding salt or some other impurity. (In each case the liquid was stirred with the thermometer before the reading was made.)



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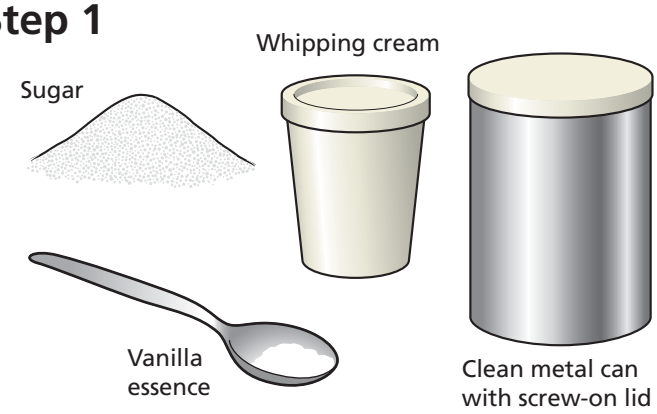
▼ **(Picture 3) Making ice cream.**

Note: you must use a metal can, not a plastic or glass one for the ice cream because we want the cream to exchange its heat with the ice around it. Metal carries heat easily, whereas plastic and glass do not.

Step 1



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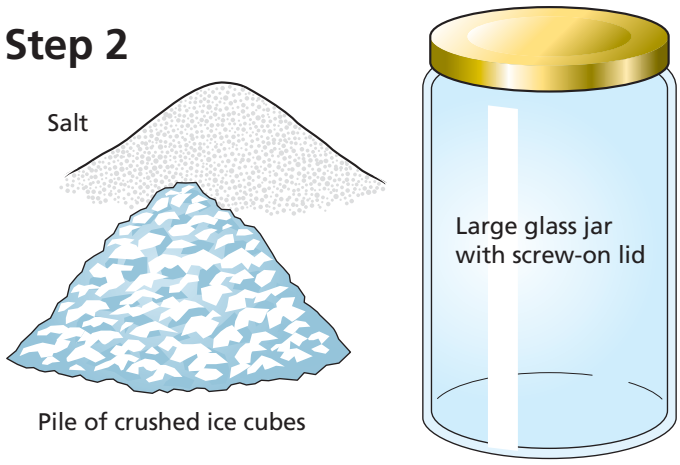
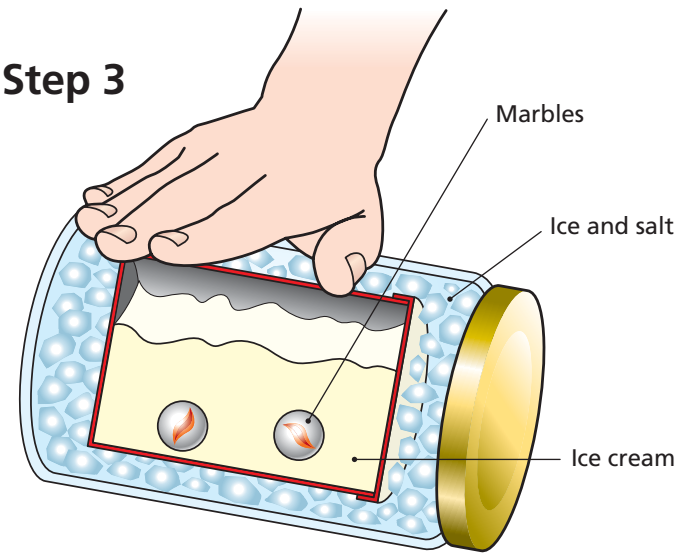


Step 3



Using freezing points to make ice cream

We can make use of freezing points to make real ice cream at ordinary room temperature! Start with a cup of whipping cream, a quarter of a cup of sugar, and half a teaspoonful of vanilla essence (Picture 3). Put this in a clean *metal* can with a screw-on lid and stir well. Add a few (clean) marbles to the mixture to help do this. Screw on the lid. Now, crush about six cups of ice and mix in half a cup of salt. Put the sealed can in a big jar with a screw-on lid and pack the space in between the can and the jar with the crushed ice and salt. Screw on the lid. Now roll the jar on the floor. The marbles will move about as you shake or roll the jar and will help to mix the ingredients together. After about 10 minutes, stop rolling or shaking and open your ice cream.

By mixing ice and salt we have made a mixture that will begin to melt at a temperature well below 0°C. We use this to bring down the temperature of the cream below its freezing point and turn it into ice cream.

Once the cream has turned to a solid, take out the marbles, and enjoy eating the ice cream.

Summary

- **Every substance has its own freezing point.**
- **We can lower the freezing point of a pure substance by mixing another substance with it.**

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