



Sticky Ice

30 minutes

Concepts: Salt changes the freezing temperature of water, making ice melt more quickly.

Learning Objectives: Demonstrate that salt changes the way ice acts.

Materials:

Ice
Water
Bowl
String
Salt (1 small container)

Process:

- Get a bowl of water with an ice cube in it.
- Look at the bowl and make observations about the ice cube.
- Grab a piece of string and try to pick up the ice. Only the string can be touching the ice (no hands!). Work on this for a while, but realize that this is a pretty impossible task, so don't let this step go on so long that you get frustrated.
- When you are ready, it's time to bring out the secret ingredient: salt! Grab a small container of salt (hint: it works better on the ice than in the water). Now try again.
- As you're working, here is some help towards the salty solution: lay the string gently across the ice and put salt over the ice cube. Slowly count to 10 and presto the ice will stick to the string.

Background Information:

Salt melts ice. The chemical principles behind the use of salt are: matter and equilibrium.

Everything is made up of atoms. Combining several atoms, for example two hydrogen atoms and one oxygen atom, gives one molecule of water. A beaker of water is made up of millions of molecules. These molecules move around. When they are cooled down (freezing, below 0°C) they move slower until a seed crystal is formed and this crystal increases in size as it captures more slow moving molecules, until all the water is frozen. If this ice is then placed on a plate at room temperature, the molecules at the surface begin to move faster, creating a layer of water on the surface of the ice. More water is formed as the molecules in the ice come in contact with the liquid and begin to move faster, until all the ice has melted.

Equilibrium is the preservation of balance between two systems. For example: water and ice. The balance between water and ice is maintained at 0°C , the temperature at which water melts. Heating or cooling the ice/water mixture above or below this temperature upsets the balance and causes a change in the equilibrium (melting or freezing). The addition of a foreign substance such as salt will also disrupt the equilibrium. The foreign molecules dissolve in the water but do not pack easily into the tight structure of the solid. This means that the rate of freezing is slower as the total number of water molecules captured by the ice per second goes down. The rate of melting does not change in the presence of foreign molecules, and so melting occurs faster than freezing. This is why salt melts ice.

Also, adding salt lowers the temperature at which water freezes. Freshwater freezes at 0°C (32°F). The saltier the water is, the colder it has to be to freeze. The freezing point of seawater is around -1.9°C , although the freezing point changes at different concentrations of salt. The more salt, the lower/colder the freezing point. Other substances, such as different chemicals we put on roads and sidewalks to prevent them from freezing, also cause the freezing point of water to get lower.