ACTIVITY 4: WHAT AFFECTS THE MELTING RATE OF ICE?

Image Credit: Gary Abud, Jr.

The freezing point of water—pure water that is—at standard temperature and pressure conditions is 0˚C. But what happens if the water isn't pure? What if it has salt or some other impurity dissolved in it? Will it still melt or freeze at 0˚C? As we saw in the ice melting patterns activity, the salt caused some spots on the ice sheet to melt before others that had no salt. There must be something about salt that changes the temperature at which water freezes/melts; otherwise, the ice sheet spots with no salt would have melted at the same temperature. This process of affecting the liquid-solid phase change temperature of a substance is called **freezing point depression**. But are there other effects that salt or different conditions can have on melting ice? In this experiment, students will investigate the factors that affect the rate of ice melting.

Materials:

- Cool and warm water
- Ice (4-6 uniform size/shape cubes per group)
- Salt
- Liquid food coloring*
- Thermometers (digital are ideal for precision)
- Timer
- Stirring rod or wooden skewer
- Clear plastic 16oz cups or or 500mL beakers
- Colander or strainer

Procedure:

1. Student groups will each test different factors and report out results to the whole group
2. You can have students design their own experimental procedure or give them one
3. Each group should have two different containers in which to place 1 ice cube
4. Fill each container with the same amount of water but under different conditions according to what your group is testing:

- cold v. warm water
- saltwater v. freshwater
- still water v. flowing water

First, tell students they are going to compare how quickly ice melts under different conditions to determine which factors have the biggest effect on melting rate. Ask students to predict which factor they think will have the biggest effect and, individually, what will happen to the ice and resulting water temperature under each set of conditions. Predictions can be relative (e.g., "Ice will melt faster in condition A") or specific (e.g., "Ice will melt in X seconds in condition A").

Next, allow students time to plan their experimental procedure and what they will do in their test. For example, a group measuring how fast ice will melt under moving water conditions might run their ice cube under room temperature water inside a strainer with the faucet on full blast and measure the time it takes to melt as compared to how long it takes a cube sitting in room temperature water that is completely still to melt. Be sure to prompt them to maintain controlled conditions with their experiment and take measurements before, during and after the changes.

Then, allow them time to conduct their experiments and collect data. Have groups summarize their findings in a data table and with a diagram that explains what they observed happened in their experiment.

Last, have groups present their results to the everyone so that all the groups can hear about how all the different experimental conditions affected the melting rate of ice. Engage the whole group in a discussion of which factors had the most or least effect on the melting rate. Ask students to explain what they think was happening at the particle level as a basis for their reasoning of why different factors affected the melting rate as they did. Be sure to give the group who tested saltwater time to explain the how the temperature of their water changed as the ice melted in each of their containers.

**Note: liquid food coloring can be added to the liquid water in the containers to help make it easier to distinguish the ice cub from the water and see the size difference to observe melting.*