

# Hands-On Activity

## Solutions on Ice

### Objective:

Students will investigate whether the presence of salt affects the temperature of chilled water.

Estimated time to complete: 15 minutes

### Materials:

For each pair of students:

- graduated cylinder (100 mL)
- ice cubes (8)
- marker
- plastic spoons (2)
- Styrofoam cups (8 oz) (2)
- thermometer
- table salt
- water

### Procedure:

Use the marker to label the cups as follows: “water” and “salt solution.” Add 100 mL water to each cup. Place the thermometer in the cup labeled “water” and allow it to sit undisturbed for a few minutes. In the meantime, add 2 spoonfuls of salt to the cup labeled “salt solution” and stir to dissolve. Read the temperature of the water sample and record it in a data table like the one shown below. Take an initial temperature reading of the salt solution and record it also.

Sample	Initial Temperature	Temperature After Ice Addition
water		
salt solution		

Place 4 ice cubes in each sample and stir with the spoons. Be sure that students do not use thermometers to stir and that they use separate spoons for stirring the two solutions to avoid cross-contaminating the samples. Continue stirring for a few minutes to allow temperatures to equilibrate. Then measure the temperature of the water sample and record the result in the data table. Measure the temperature of the salt solution and record the result.

Ask students to think about the following questions:

- *What final temperature do you predict for the water + ice?*
- *What final temperature do you predict for the salt solution + ice?*
- *Were your predictions correct?*
- *What can account for the differences in the temperatures of the samples on ice?*
- *How do the results of your investigation explain why it is useful to sprinkle salt on an icy sidewalk in winter?*

Sample data:

Sample	Initial Temperature	Temperature After Ice Addition
water	20 °C	1 °C
salt solution	20 °C	-2 °C

### **Inquiry and Nature of Science Skills in this Activity:**

- Identify Questions
  - Develop a question that:
    - Asks a question about a specific science concept or process
- Design Investigations
  - Design and conduct investigations using:
    - Control (control group) – used for comparison in which the independent variable is not changed
- Gather Data
  - Use tools and the SI (metric) system to accurately measure:
    - Temperature
  - Choose appropriate tools to conduct an investigation:
    - Thermometer
  - Use senses to observe:
    - Seeing (color, shape, size, texture, motion)
  - Use the appropriate format to record data:
    - Table
- Interpret Data
  - Identify and interpret patterns using:
    - Analysis of data collected during an investigation
- Evaluate Evidence
  - Draw and support a conclusion by:
    - Using data to determine the cause-effect relationship observed in the investigation
    - Reporting trends and patterns in data
    - Formulating scientific explanations/arguments
- Patterns and Systems
  - Patterns and Change:
    - Some changes are very slow and some are very fast and that some of these changes may be hard to see and/or record.
    - Some small changes can be detected by taking measurements.
    - Things that change may do so in steady, repetitive or irregular ways.
- Scientific Investigation
  - Scientific Investigation:
    - Scientific investigation results in things we know and things we don't know.
    - Scientific investigation leads to more questions.
    - Scientific investigations lead to the development of scientific explanations.
  - Scientific Data and Outcomes:

- Collecting and analyzing data is the best way to understand a changing pattern.
- Comparisons of data are not accurate when some of the conditions are not kept the same.