

## ACTIVITY 4: THE TEMPERATURE OF MELTING ICE

The purpose of this activity is for students to measure the temperature of a sample of water through phase changes and to graph the temperature over time in order to understand what happens to the temperature of water when it melts.

### Materials Needed:

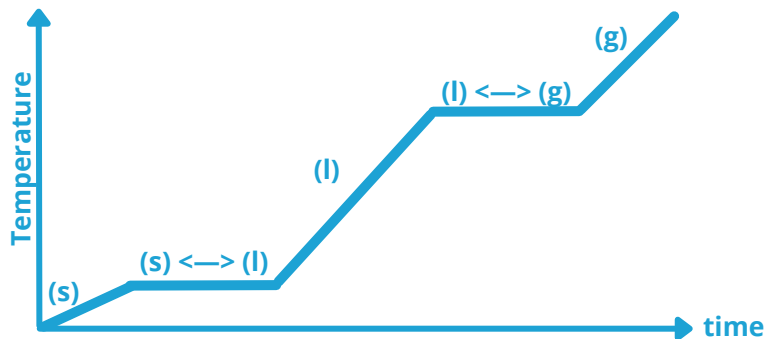
- 500mL beaker
- thermometer
- ice
- heating element (such as a hot plate)
- ring stand with thermometer clamp

First, inform students that they will be working with a group to measure the temperature of a sample of water as it is heated. The objective is for them to take frequent temperature readings (every 10 seconds) until all of the water has been completely heated (e.g., reaches a boil).

Then, have students fill their beakers with ice and place them on the hot plate. Have students position the thermometer in the ice so that it can read the temperature. Caution them not to let the thermometer touch the beaker so that they are measuring the temperature of the ice and not of the glass.

Next, have students turn on the heating element to high while the thermometer is positioned to measure the temperature of the ice. Have them continuously record measurements of the temperature at 10-second intervals while heating. They should continue recording temperature data until the water reaches a boil. Remind them to take some observations of what is going on at different points during the heating, including at what time it starts melting, finishes melting, boils, etc.

They should observe the water go from solid (s) to liquid (l) to gas, e.g., vapor, (g) phase.



*Image Credit: Gary Abud, Jr.*

Last, have the groups graph their data as a line graph of temperature versus time and annotate on their graph at different points what state(s) of matter were present in the water system (e.g., beaker).

Once they complete their lab and have their data graphed, engage the entire group in a discussion to analyze the physical meaning of the graph. In other words, what does the graph tell us about what was happening in the system over time—what story does this graph tell?

Help students to make connections between the graph, their observations, and what they think was happening at the particle level within the system during heating. You can have them draw particle diagrams and discuss with their groups how that relates to their data.

Ultimately, you'll want to help them to notice that even though they continued adding energy to the water system, there were times at which the energy caused changes in the motion of the particles (e.g., the particles moved around and kinetic energy changed, thus temperature changed) and other times where the energy added must have done something else, as evidenced by the relatively constant temperature, e.g., the energy went into overcoming attractive forces.