Student Exploration: Phase Changes (Academic)

Gizmo Warm-up
In the Phase Changes Gizmo™, select the Micro view and set the Ice volume to 50 cc. Click Play (▶) and observe molecules in the solid (ice), liquid (water), and gas (air) phases.

1. In which phase(s) are the molecules held rigidly together? ________________________________
2. In which phase(s) do the molecules move freely? ________________________________

3. In which phase(s) are the molecules held in a defined shape? ________________________________
4. In which phase(s) do the molecules take the shape of their container? ________________________________

5. What is the primary difference between the molecules in different states? Give your answer in terms of Heat Energy in each molecule.

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________________________________________________________________________
________________________________________________________________________

Name: ________________________________ Date: ________________________________
Phase changes

Get the Gizmo ready:
- Click Reset (🗑️) and select Macro view.
- Set the Water temperature to 10 °C.
- Set the Ice volume to 0 cc.

Question: How is temperature related to phase changes?

1. Predict: Based on your prior knowledge, predict the following:
   A. At what temperature (°C) will water change from a liquid to a solid (freeze)? _______
   B. At what temperature (°C) will water change from a solid to a liquid (melt)? _______
   C. At what temperature (°C) will water change from a liquid to a gas (boil)? _______

2. Investigate: Use the Gizmo to explore phase changes. Use the Add/remove heat energy slider to control the water temperature. Record your observations in your notes, then answer the questions below:
   A. At what temperature does water freeze? _______ This is the freezing point.
   B. At what temperature does ice melt? _______ This is the melting point.
   C. At what temperature does water boil? _______ This is the boiling point.

3. Observe: Set up the Gizmo to observe freezing. What do you notice about the temperature while the water is in the process of freezing? _____________________________________

4. Explore: Use the Gizmo to investigate melting and boiling. Does the temperature change while either of these phase changes is occurring? _____________________________

5. Interpret: Select the GRAPH tab to see a graph of temperature vs. time. Click the “−” button until the whole graph is visible. What does the graph look like during a phase change? _____________________________________

6. Extend your thinking: Why do you think the temperature does not change much during a phase change? If possible, discuss your answer with your classmates and teacher.
   ___________________________________________________________________________
   ___________________________________________________________________________
Get the Gizmo ready:

- Click **Reset (◻️)** and select **Macro view**.
- Set the **Water temperature** to -10 °C.
- Set the **Ice volume** to 0 cc.
- Set the **Add/Remove Heat Energy** to 400 J/s

1. **Predict**: Based on your knowledge, what will happen to the water’s temperature as:

   a. The ice melts: ____________________________

   b. The water begins to boil: ____________________________

2. **Graph**: Click on run. **Observe the size of the ice and the water’s temperature.**
   Pause the Gizmo when the water’s temperature is approximately 10 °C. Click on the
   Graph tab and examine the graph (you may need to zoom in with the + button).
   Duplicate the graph shown below.

3. **Interpret**: What does the graph show happened to the water’s temperature before the
   ice melted?

   ___________________________________________

4. **Explain**: What happened to the heat energy that was being transferred into the water
   before the ice melted? Why did the water’s temperature behave the way it did? (use the
   back of the paper to answer)