Name:_____Date:_____Class:_____

Student Worksheet—Pre-lab
(answers in red)
Nanotechnology Invention and Design:Phase Changes, Energy, and Crystals

Read the lab handout and your notes to complete the following questions before the lab day.

1. What are the 3 purposes of this laboratory experiment?

   To investigate how and why an SMA called Nitinol responds to energy changes by determining the transition temperature; to predict its crystal structure; to become nanotechnology inventors by creating, designing, and then testing a potential use for the smart material.

2. What are the 4 safety concerns of this lab?

   Eye safety requiring the use of goggles when working with glass and wire; proper disposal during clean up requiring the use of solid waste containers; caution used when handling hot items by using beaker tongs or forceps; awareness that Nitinol wire may spring back at you.

3.

Heating Curve for Water with Constant Rate of Energy Input
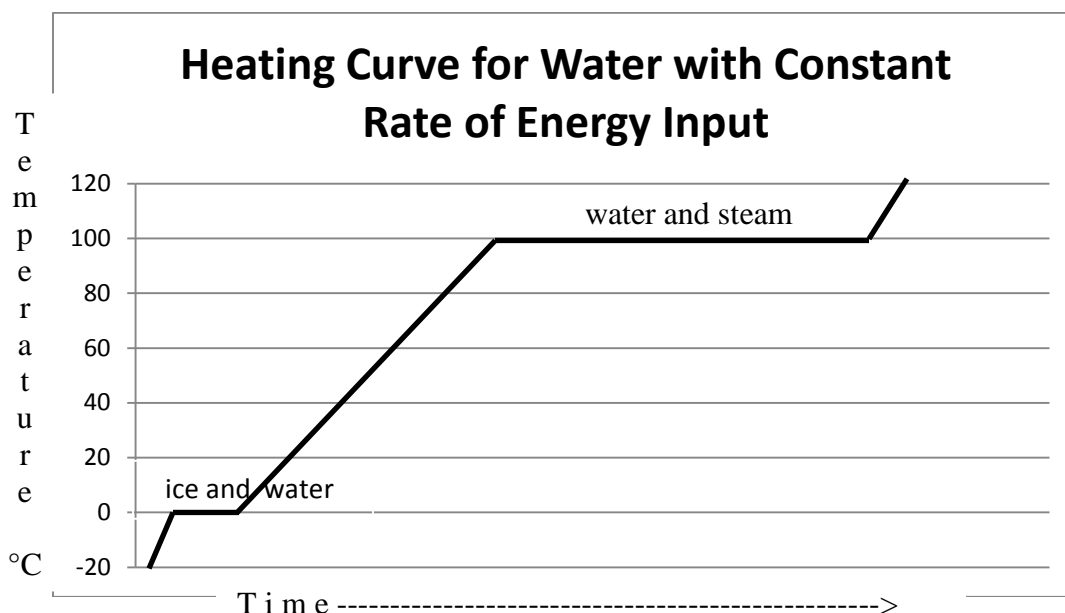
Need a quick review? Before completing Question 3, review the basics of Heating and Cooling Curves at http://www.kentchemistry.com/links/Matter/HeatingCurve.htm (Mr. Kent's Chemistry Page). Then, on the graph on the previous page:

a) Label the heating curve—solid, liquid, gas, melting, condensation, solidification, vaporization.

b) Draw particle pictures of how the particles behave in a solid, liquid, and gas on the graph. Use arrows to represent movement and circles as particles.

a) What is special about the plateau on the graph?

There is no temperature change. It represents the latent heat of phase change, where the potential energy is changing the position of the particles.

4. How do you know if a phase change is a chemical or physical change?

It is a physical change because no new substance is being formed and there are no indicators of a chemical reaction.

5. If a 5.63 g metal alloy sample was originally at room temperature, 22.9 °C, and the specific heat capacity of the alloy is 0.27 J/g°C , how much energy must be absorbed before the metal can change phase at 37.1°C? Show all work below.

q = heat energy

m = mass

c = specific heat

ΔT = change in temperature

q = (5.63 g)x(0.27 J/g·°C)[(37.1 °C - 22.9 °C)]

q = (5.63 g)x(0.27 J/g·°C)x(14.2 °C)

q = 21.6 J

6. What area on the graph represents when energy is being absorbed for the phase change—the sloped area or the plateau? Explain your answer.

The plateau represents this value because the energy is not increasing the temperature. A phase change happens as the potential energy increases and the atoms are rearranged.