Heating/Cooling Curves

A. The following graph is a *heating curve* showing the *addition* of heat at a constant rate of 500.0 joules/minute to a 3.00 gram sample of ice at -20.0°C. The final temperature of the vapor is 140.0°C.



- 10. Phase changes that occur with an absorption of energy are ______thermic.
- 11. ______ (f______) and ______ are endothermic phase changes.
- 12. During which segment could the heat of fusion be determined?
- 13. During which segment could the heat of vaporization be determined?
- 14. How long does it take to completely melt the sample at its melting point?
- 15. How long does it take to completely vaporize the sample at its boiling point?
- 16. During which segment is the substance entirely in the solid state?
- 17. During which segment is the substance entirely in the gas state?
- 18. If 25.0 grams of ice at 0°C are heated at a constant rate of 400.0 joules/minute, calculate the time needed to melt the sample completely. SHOW WORK.
- 19. If 25.0 grams of water at 100°C are heated at a constant rate of 400.0 joules/minute, calculate the time needed to vaporize the sample completely. SHOW WORK.
- 20. Why is the time needed to vaporize the sample of water significantly greater than the time needed to melt the sample?

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B. The following is a *cooling curve* showing the *release* of heat at a constant rate of 500.0 joules/minute from a

Date _____

- At what time do the particles have the highest average kinetic energy? 9.
- 10. Phase changes that occur with a release of energy are _____
- 11. ________ and ______ are exothermic phase changes.
 12. During which segment could the heat of solidification be determined? _______
- 13. During which segment could the heat of condensation be determined?
- 14. How long does it take to completely freeze the sample at its freezing point?
- 15. How long does it take to completely condense the sample at its condensation point? _____
- 16. During which segment is the substance entirely in the solid state?
- 17. During which segment is the substance entirely in the liquid state?
- 18. During which segment is the substance entirely in the gas state?
- 19. During which segment is there an equilibrium between the solid and liquid states? The temperature of the sample at this point is ______ Kelvin.
- 20. During which segment is there an equilibrium between the liquid and gas states? The temperature of the sample at this point is _____ Kelvin.

Name



C. The following is a heating curve for substance X. 15.00 grams of substance X are heated at a constant rate of 500.0 joules/min.

For answers that require calculations, express using the correct number of significant figures and include units.

- 1. The melting point is _____. The boiling point is _____.
- 2. The time at which the liquid phase first appears is _____ minutes. The time at which the gas phase first appears is ______ minutes.
- 3. The sample is completely in the liquid phase between _____ and _____ minutes.
- 4. Determine the heat of fusion of this substance.
- 5. Determine the heat of vaporization of this substance.
- 6. Determine the specific heat of substance X (in the liquid state).
- 7. Compare the intermolecular forces present in substance X to those present in a sample of water. *Explain completely*.