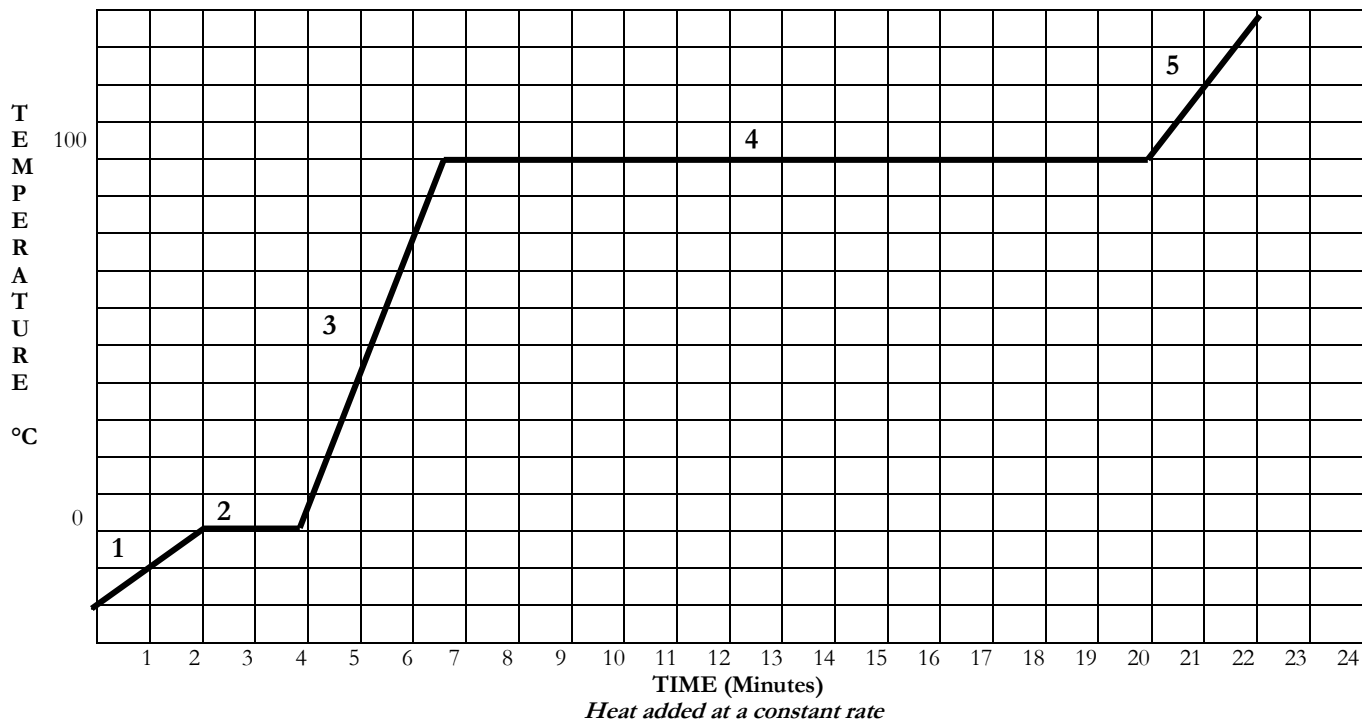


Heating/Cooling Curves

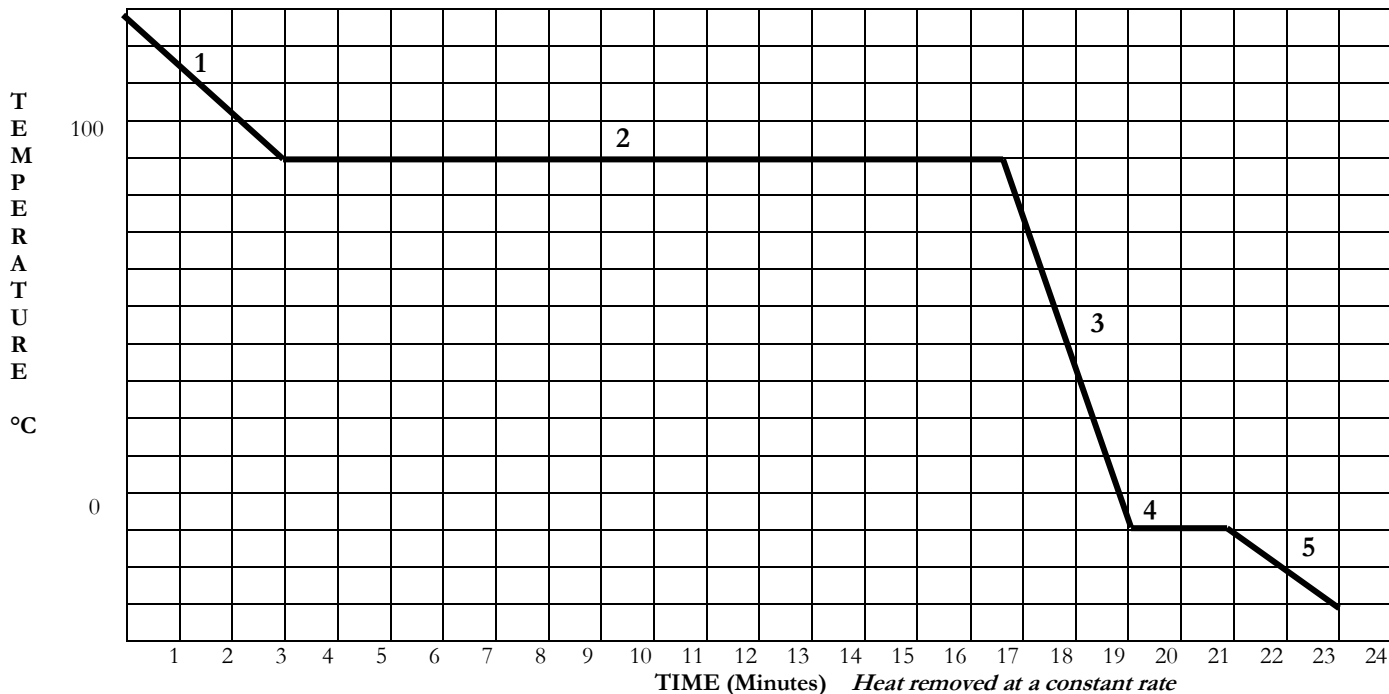
- A. The following graph is a *heating curve* showing the *addition* of heat at a constant rate of 500.0 joules/minute to a 3.00 gram sample of ice at -20.0°C . The final temperature of the vapor is 140.0°C .



Questions

1. During which segments is kinetic energy increasing? _____
2. During which segments does kinetic energy remain the same? _____
3. During which segments is potential energy increasing? _____
4. During which segments does potential energy remain the same? _____
5. During which segments is one phase only present? _____
6. During which segments are two phases present? _____
7. At what time does the liquid phase first appear? _____
8. At what time does the gas phase first appear? _____
9. At what time do the particles have the highest average kinetic energy? _____
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? _____

B. The following is a **cooling curve** showing the **release** of heat at a constant rate of 500.0 joules/minute from a 3.00 gram sample of water vapor at 140.0°C. The final temperature of the ice is -20.0°C.



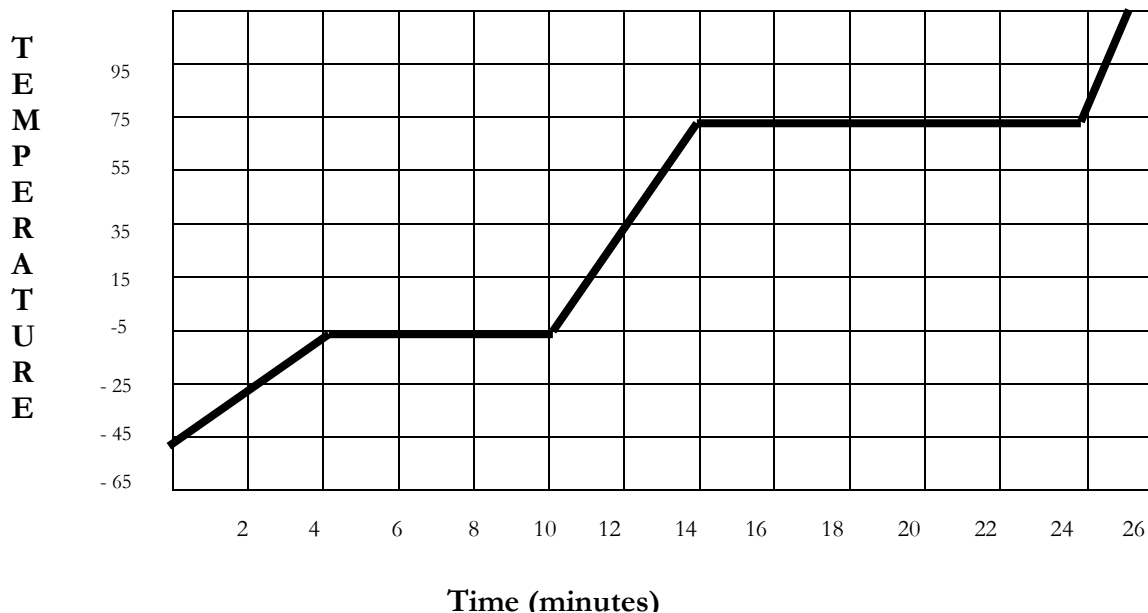
Questions

1. During which segments is kinetic energy decreasing? _____
2. During which segments does kinetic energy remain the same? _____
3. During which segments is potential energy decreasing? _____
4. During which segments does potential energy remain the same? _____
5. During which segments is one phase only present? _____
6. During which segments are two phases present? _____
7. At what time does the liquid phase first appear? _____
8. At what time does the solid phase first appear? _____
9. At what time do the particles have the highest average kinetic energy? _____
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 _____

Date _____

- 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.

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