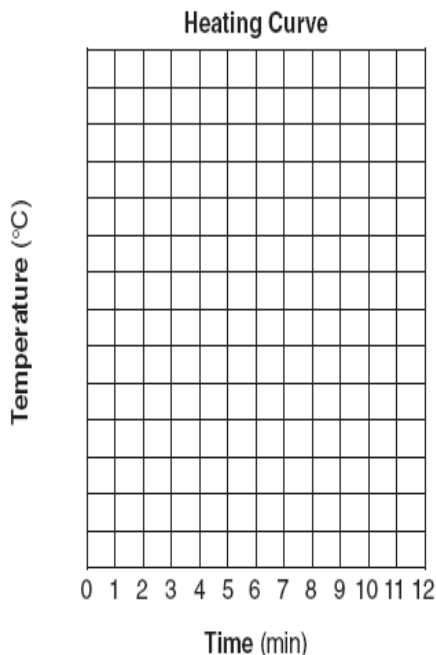


A substance is a solid at 15 °C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

| | | | | | | | | | | | | | |
|------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Time (minutes) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Temperature (°C) | 15 | 32 | 46 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 60 | 65 |

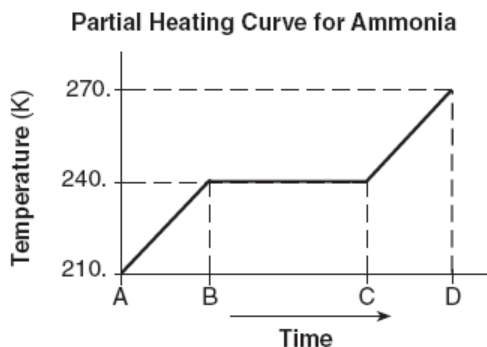
On the graph provided, mark an appropriate scale on the axis labeled Temperature (°C). Plot the data and connect the data points with a smooth line point to point.



1. Based on the data table, what is the melting point of this substance? _____

2. What is the evidence that the average kinetic energy of the particles of this substance is increasing during the first three minutes?

A 5.00 gram sample of a liquid ammonia is originally at 210. K. the diagram of the partial heating curve below represents the vaporization of the sample of ammonia at standard pressure due to the addition of heat. The heat is NOT added at a constant rate.



3. Describe what is happening to BOTH the potential energy and the average kinetic energy of the molecules in the ammonia sample during time interval BC.

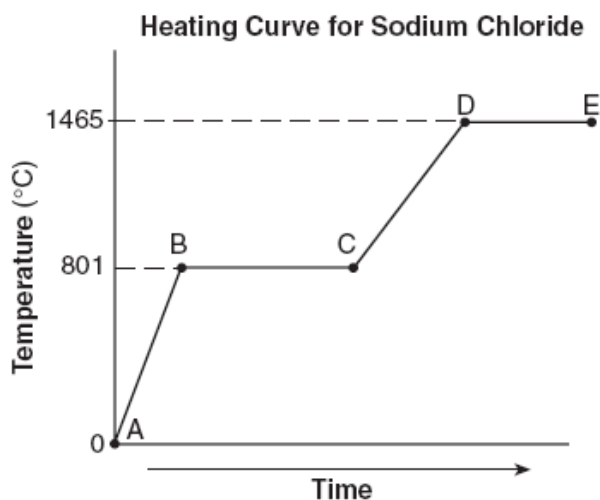
A 150. gram liquid sample of stearic acid, $C_{17}H_{35}COOH$, is cooled at a constant rate. The temperature of the sample is recorded at 2 minutes intervals in the data table below.

Cooling Data for Stearic Acid

| Time (min) | Temperature ($^{\circ}C$) |
|------------|-----------------------------|
| 0 | 75.0 |
| 2 | 72.0 |
| 4 | 69.3 |
| 6 | 69.3 |
| 8 | 69.3 |
| 10. | 69.3 |
| 12 | 65.0 |

4. Identify the physical change occurring during the time interval from 4 minutes to 10 minutes. _____

A 100.0 gram sample of $NaCl(s)$ has an initial temperature of $0^{\circ}C$. A chemist measures the temperature of the sample as it is heated. Heat is not added at a constant rate. The heating curve for the sample is shown below.

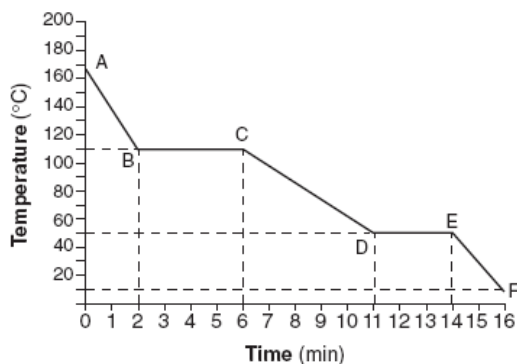


5. Determine the temperature range over which the entire $NaCl$ sample is a liquid.

6. Identify one line segment on the curve where the average kinetic energy of the particles of the $NaCl$ sample is changing. _____

7. Identify one line segment on the curve where the $NaCl$ sample is in a single phase. _____

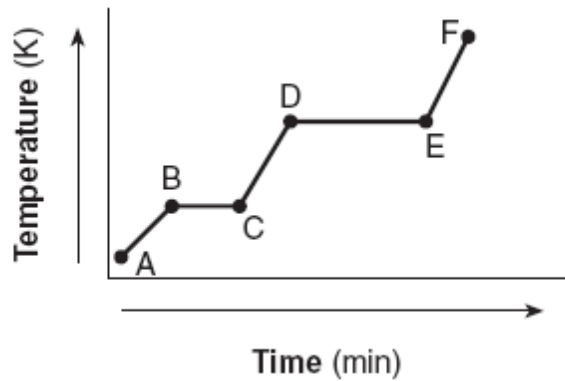
Base your answers to questions 8-9 on the graph below, which represents the cooling of a substance starting at a temperature above its boiling point.



8. What is the melting point of this substance? _____

9. Which segment of the graph represents the gas phase only? _____

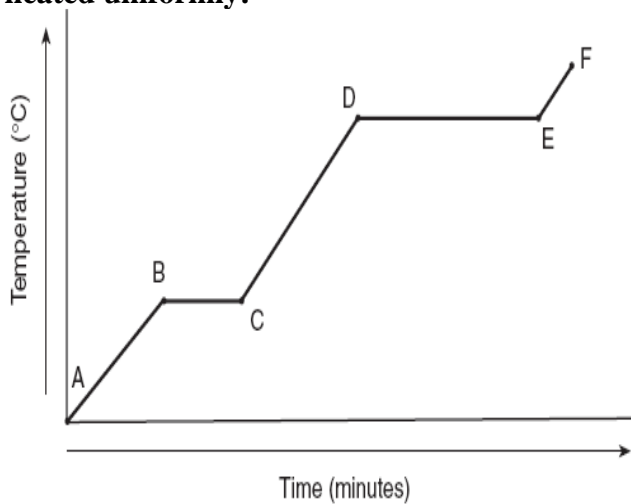
Base your answers to questions 10 and 11 on the heating curve below, which represents a substance starting as a solid below its melting point and being heated at a constant rate over a period of time.



10. What is happening to the average kinetic energy of the particles during segment BC?

11. How does this heating curve illustrate that changing from a liquid to a gas takes more energy than changing from a solid to a gas?

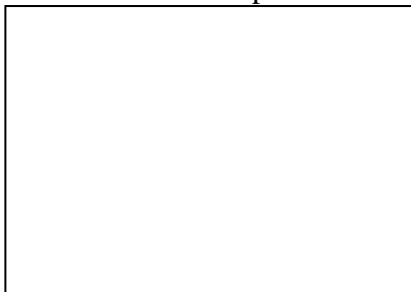
Given the heating curve where substance X starts as a solid below its melting point and is heated uniformly:



12. Identify the process that takes place during line segment DE of the heating curve. _____

13. Identify a line segment in which the average kinetic energy is increasing. _____

14. Using (•) to represent particles of substance X, draw at least five particles as they would appear in the substance at point F. Use the box provided in the space below.



15. Describe, in terms of *particle behavior or energy*, what is happening to substance X during line segment BC.
