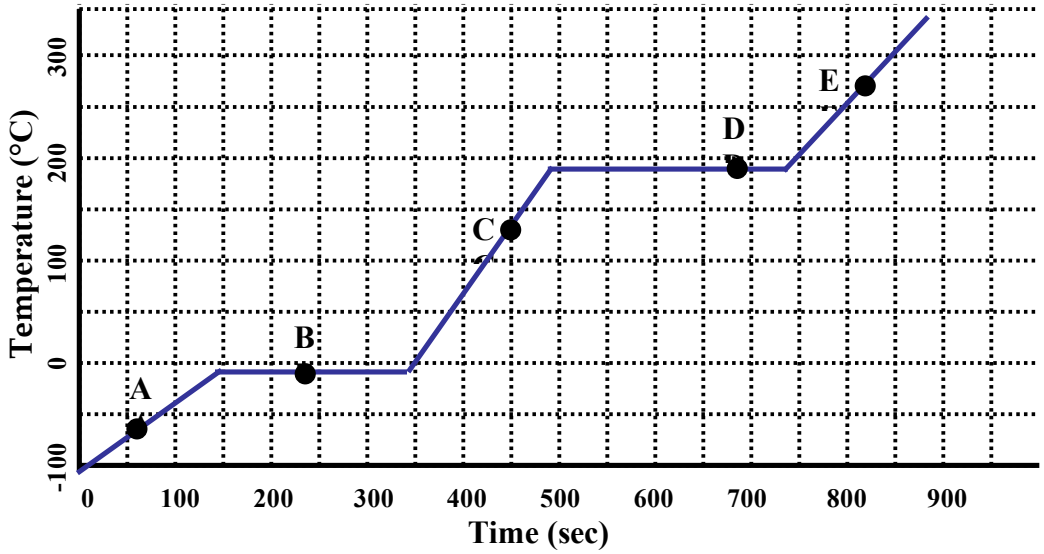
Heating Curve

Most substances can exist in three different states – a solid, a liquid and a gas state. Changes from one state to another commonly occur by heating or cooling a sample of the substance. **Melting** refers to the change of a sample from the solid to the liquid state at its melting point temperature. **Boiling** refers to the change of a sample from the liquid to the gaseous state at its boiling point temperature.

Consider a substance that is present in a sealed container in its solid state at a temperature well below its melting point. Over the course of about 15 minutes, the container is heated. At first, the application of heat causes the temperature of the substance to increase until it reaches its melting point temperature. At its melting point temperature. heat is continually added, causing the solid to transition to a liquid at a constant temperature. Once all the solid has melted, the substance is heated to its boiling point temperature. At its boiling point temperature, the addition of heat causes the liquid to transition to a gas at a constant temperature. Once all the liquid has boiled, the sample continues to be heated (cautiously), causing the temperature of the gas to increase. This process is depicted in **Figure 1**.

Figure 1



Questions:

1. According to **Figure 1**, at what temperature does the substance transition between the solid state and the liquid state?
   a. Approximately -65°C
   b. Approximately -7°C
   c. Approximately 135°C
   d. Approximately 190°C

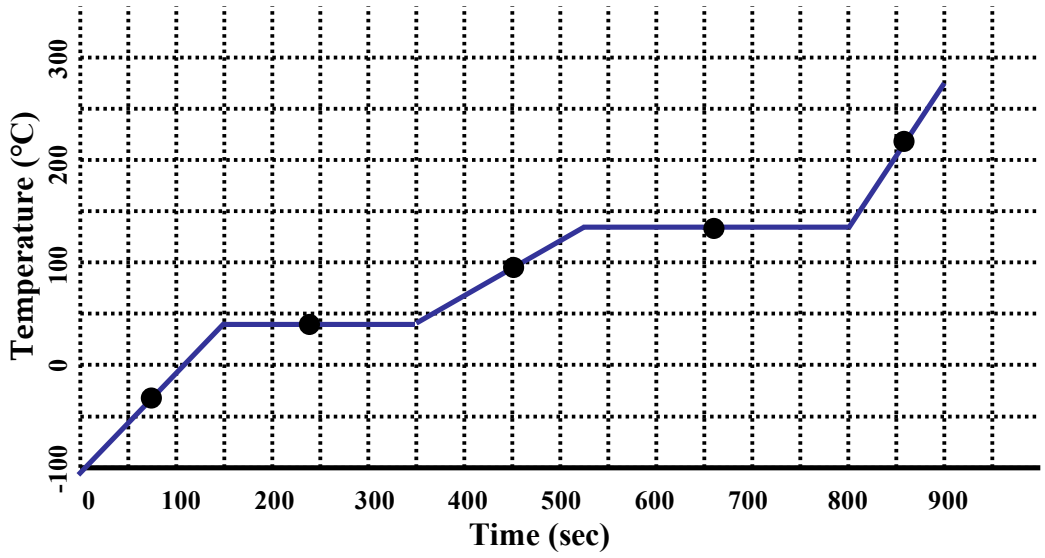
2. Which one of the following statements are true of the sample of matter described by **Figure 1**?
   a. As heat is added to the sample, its temperature always increases.
   b. The sample is melting between a temperature of about -100°C and -10°C.
   c. The liquid state would be observed in the sample at both 200 seconds and 400 seconds.
   d. The solid state would be observed in the sample at both 600 seconds and 800 seconds.

3. There are five labeled points on the line of the graph in **Figure 1**. What changes, in order, are observed in the sample of matter between **point A** and **point C**?
   a. First the sample melts; then its temperature stabilizes; then it boils.
   b. First the sample increases its temperature; then it melts; then its temperature increases.
   c. First the sample increases its temperature; then it melts; then its temperature stabilizes.
   d. First the sample increases its temperature; then it melts; then it stabilizes its temperature.

4. There are five labeled points on the line of the graph in **Figure 1**. At which of the labeled points is the sample a mixture of liquid and gas?
   a. The sample is a mixture of liquid and gas at **point C**.
   b. The sample is a mixture of liquid and gas at **point D**.
   c. The sample is a mixture of liquid and gas at **point E**.
   d. There could never be a mixture of both liquid and gas under these conditions.

5. Suppose that **Figure 1** represents the so-called *heating curve* for **Substance A**. **Figure 2** below represents the *heating curve* for **Substance B**.

Figure 2



What conclusion can be drawn regarding the melting points and boiling points of **Substance A** and **Substance B**?
   a. **Substance A** has a higher melting point and a higher boiling point than **Substance B**.
   b. **Substance B** has a higher melting point and a higher boiling point than **Substance A**.
   c. **Substance A** has the higher melting point but **Substance B** has the higher boiling point.
   d. **Substance B** has the higher melting point but **Substance A** has the higher boiling point.