FLINN SCIENTIFIC

Name________________________________

It's Just a Phase

Data Table

Unknown Organic Solid			
Cooling Curve (Part A)		Heating Curve (Part B)	
Time	Temperature (°C)	Time	Temperature (°C)
0 sec		0 sec	
30 sec		30 sec	
1 min		1 min	
1 min 30 sec		1 min 30 sec	
2 min		2 min	
2 min 30 sec		2 min 30 sec	
3 min		3 min	
3 min 30 sec		3 min 30 sec	
4 min		4 min	
4 min 30 sec		4 min 30 sec	
5 min		5 min	
5 min 30 sec		5 min 30 sec	
6 min		6 min	
6 min 30 sec		6 min 30 sec	
7 min		7 min	
7 min 30 sec		7 min 30 sec	
8 min		8 min	
8 min 30 sec		8 min 30 sec	
9 min		9 min	
9 min 30 sec		9 min 30 sec	
10 min		10 min	

Post-Lab Questions *(Use a separate sheet of paper to answer the following questions.)*

1. Prepare a graph of temperature on the *y*-axis versus time on the *x*-axis. Plot the data from Parts A and B as two series of points, using different color pencils or different shapes to mark the points for Part A versus Part B. Draw a smooth (continuous) curve through the plotted points for each series of data.
2. Label the following regions (A–C) on the *cooling curve:* A, only liquid is present; B, liquid and solid are present together; C, only solid is present.
3. What happens to the temperature of a pure substance while it is freezing or melting? Estimate the freezing point and the melting point of the unknown organic solid from the cooling curve and the heating curve, respectively. Does the freezing point/melting point depend on the direction in which the phase change takes place?
4. Use the following information to identify the unknown organic solid. Record the identity of the unknown in the data table.

Cetyl alcohol, $C_{16}H_{33}OH$, mp 54–56 °C

Lauric acid, $C_{11}H_{23}CO_2H$, mp 43–44 °C

Stearic acid, $C_{15}H_{33}CO_2H$, mp 67–69°C

5. Which set of data (the cooling curve or the heating curve) provided a more accurate or a more precise estimate of the melting point? What variables in the design of the experiment might account for any difference in the results?
6. *Circle the correct choices:* Freezing is an (exothermic/endothermic) process—the liquid (absorbs/releases) heat from or to its surroundings. At the freezing point, the average (kinetic energy/potential energy) of the molecules (increases/decreases) and the liquid solidifies.
7. Answer *increases*, *decreases*, or *no change* to predict how doubling the amount of solid would change the results in Part B:

   a. The rate at which the temperature of the solid increases. ____________________

   b. The temperature at which the solid melts. ____________________

   c. The amount of heat absorbed by the sample as it melts. ____________________

8. *(Optional)* Lauric and stearic acid are fatty acids (components of fats and oils) that are used to make soap. What factor might explain the regular increase in the melting point of the following fatty acids as the number of carbon atoms increases?

Lauric acid, $CH_3(CH_2)_{10}CO_2H$, mp 43.2 °C

Myristic acid, $CH_3(CH_2)_{12}CO_2H$, mp 54.0 °C

Palmitic acid, $CH_3(CH_2)_{14}CO_2H$, mp 61.8 °C

Stearic acid, $CH_3(CH_2)_{16}CO_2H$, mp 68.8 °C