



### Something Different is Happening in Each of the 5 Zones

Each of the 5 zones shown above have their own unique formulas for calculating heats. Note that zones I, III, and V are all zones where you have only one phase present and the temperature is changing. The slopes of the curve are NOT zero in these 3 zones. As a matter of fact, the slopes of the heating curve lines ARE the inverse of the specific heats of those phases. Although the diagram is not drawn to scale, it does attempt to show that the slope is larger for ice and steam (smaller  $C_s$ 's) than it is for water. Figure 6.26 in your book attempts to show this curve more to scale although the quantities shown on the book's heating curve are molar quantities.

### Specific Heats are per gram and use $\Delta T$ , $\Delta H$ of transition do NOT use $\Delta T$

Note that  $C_s$  is the specific heat for each of the phases (solid, liquid, and gas). Specific heats are written and used in a "per gram" way. For that reason, m must be the mass in grams for each of the phases. Also note that the specific heats for each phase are different. The  $\Delta H$ 's are enthalpies of phase transition. The lower one is the enthalpy of fusion (melting) and the upper one is the enthalpy of vaporization. Notice how there is no  $\Delta T$  to be used for phase transitions. The temperature is constant during phase transitions for pure substances.

### Water is shown above but ALL substances follow the same TYPE of curve

Realize that all substances have this same basic curve set up. The differences are going to be the transition temperatures, and what the values of the  $C_s$ 's and  $\Delta H$ 's are. In many problems you don't even need to know the exact transition temperatures in that you can always reference from them with  $\Delta T$ . Like you start at  $10^\circ\text{C}$  below the melting point of a metal and then increase the temperature to  $25^\circ\text{C}$  above the melting point. You don't need to know the melting point to calculate the heats involved in this. Just use the  $\Delta T$ 's that are given.

One transition that is not shown above is sublimation (solid to gas with no liquid in between). Realize though that the curve would still look similar to half the curve shown above. You would heat the solid to the sublimation temperature, then sublime the solid to gas, and finally heat the gas. There would only be 3 zones for that type substance and you would need a  $\Delta H$  of sublimation for the transition.