Unit 9 Math of Heat

Read 14.3 (pp. 446-448) and define each of the following:

1.) Heat of Fusion (H_f):

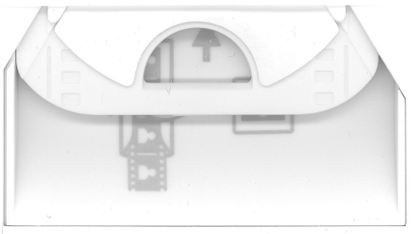
2.) Heat of Vaporization (H_v):

3.) Kinetic Energy:

4.) Freezing:

5.) Melting:

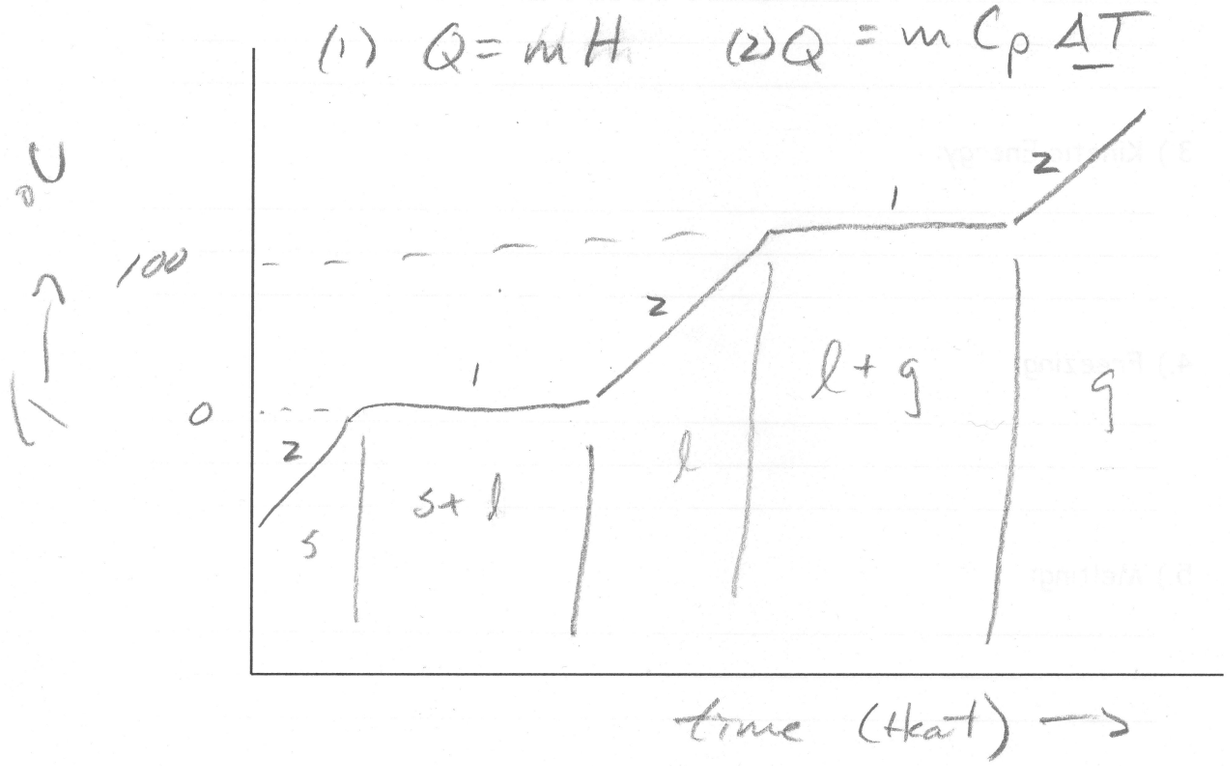
6.) Specific Heat:



Heat Values for water

Heat Value	Joules
H_f (heat of fusion)	334 J/g
H_v (heat of vaporization)	2260. J/g
Specific Heat Values	**Joules**
C_{ice}	2.06 J/g°C
C_{liquid}	4.184 J/g°C
C_{steam}	2.03 J/g°C

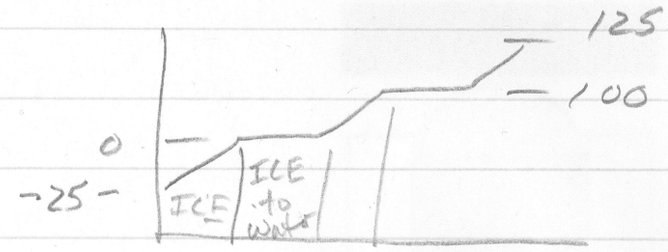
Draw a typical heating/cooling curve, label each phase, and write in the equation used in that section.



(1) How much heat energy in joules, is required to heat 50.0 g of water from -25.0°C to 125. °C?

(2) How much heat energy in joules, would be released when 50.0 g of water cools from 125.0°C to -25.0 °C?

(1)



$$Q_{ICE} = m\, C_{p_{ICE}}\, \Delta T$$

$m = 50.0\text{ g}$

$C_{p_{ICE}} = 2.06\ \text{J/g°C}$

$\Delta T = 25\text{°C}$

$$Q_{ICE} = \frac{50.0\text{ g} \,/\, 2.06\ \text{J} \,/\, 25\text{°C}}{\text{g°C}} = \boxed{2575\text{ J}}$$

$$Q(\text{melting}) = m\, H_f$$

$H_f = 334\ \text{J/g}$

$m = 50.0\text{ g}$

$$Q_{melt} = \frac{50.0\text{ g} \,/\, 334\ \text{J}}{\text{g}} = \boxed{16{,}700\text{ J}}$$

$$Q_{WATER} = m\, C_{p_{water}}\, \Delta T$$

$\Delta T = 100\text{°C}$

$m = 50.0\text{ g}$

$C_{p_{water}} = 4.184\ \text{J/g°C}$

$$Q_{water} = \frac{50.0\text{ g} \,/\, 4.184\ \text{J} \,/\, 100\text{°C}}{\text{g°C}}$$

$$= \boxed{20{,}920\text{ J}}$$

(1) $Q_{Boiling} = m H_v$ $\quad m = 50.0\,g$, $H_v = 2260.\,J/g$

$Q_{Boiling} = 50.0\,g \times 2260.\,J/g = \boxed{113{,}000\,J}$

$Q_{Steam} = m\, C_{p\,Steam}\, \Delta T$ $\quad \Delta T = 25°C$, $m = 50\,g$, C_p 2.03 J/g°C

$Q_{Steam} = 50.0\,g \times 2.03\,J/g\,°C \times 25°C = \boxed{2538\,J}$

Total Heat

Heating Ice	2575	J
Melting Ice	16,700	J
Heating Water	20,920	J
Boiling water	113,000	J
Heating Steam	2538	
Total	155733	J