1. a) Given: specific heat = 0.85 cal/g·deg
   Wanted: Joules of heat, q,

   \[
   Heat, q, = \frac{0.85 \text{ cal}}{\text{g·deg}} \times \frac{4.18 J}{\text{cal}} \times 7.5 g \times (136-41) \text{ deg change} = +2.5 \times 10^3 J
   \]
   or 2.5 KJ

   b) Given: 83 mL of liquid water
   Wanted: Joules of heat, q

   Known value: 4.18 J/g·deg = specific heat of H_2O(l)

   \[
   Heat, q, = 83 \text{ mL} \times \frac{1.000 g}{\text{ML}} \times \frac{4.18 J}{\text{g·deg}} \times (28-63) \text{ deg} = -1.4 \times 10^4 J \equiv -14 \text{ KJ}
   \]

   c) Given: 150 g of ice
   Wanted: Joules of heat, q

   Known value:
   2.06 J/g·deg = specific heat of ice
   4.18 J/g·deg = specific heat of water
   1.99 J/g·deg = specific heat of steam
   333 J/g = heat of fusion of ice (at 0°C)
   2.25 KJ/g = heat of vaporization of water (at 100°C)

   \[
   \text{Heat, } q, = 150 g \text{ ice} \times \frac{2.06 J}{\text{g·deg}} \times (0-(-5))\text{deg} + 150 g \times \frac{333 J}{g} \text{ warming of ice}
   \]

   \[
   + 150 g \text{ water} \times \frac{4.18 J}{\text{g·deg}} \times (100-0)\text{deg} + 150 g \times \frac{2.25 KJ}{\text{g·deg}} \times 1000 \text{J} \text{ vaporization of water at 100°C}
   \]

   \[
   \text{= } 4.55 \times 10^5 J \text{ or 455 KJ} \text{ (if you use 4.18 J/g·deg as heat capacity of water)}
   \]

   note: the totals from each step above are: 1545, 49950, J

   \[
   \begin{align*}
   & + 62700, J \\
   & + 237500, J \\
   & + 2985, J \\
   \hline
   & + 454080, J
   \end{align*}
   \]
2) a) \[ \frac{J}{g \cdot deg} = \frac{0.869 J}{3.00g \text{ XMP}(l)} \times \frac{1}{(117.0 - 110.0) \text{ deg}} = 4.1 \times 10^{-2} \frac{J}{g \cdot deg} \]

(note two sig figs in final answer)

\[ \frac{J}{\text{mol} \cdot \text{deg}} = 0.869 J \times \frac{1}{3.00g \text{ XMP}(l)} \times \frac{96.0g \text{ XMP}(l)}{\text{mol XMP}} \times \frac{1}{7.0 \text{ deg}} = 4.0 \frac{J}{\text{mol} \cdot \text{deg}} \] molar heat capacity

b) \[ \frac{J}{\text{mol XMP}} = 60.0 J \times \frac{1}{3.00g \text{ XMP}(l)} \times \frac{96.0g \text{ XMP}(l)}{\text{mol XMP}} = 1.92 \times 10^{3} \frac{J}{\text{mol} \text{ (XMP)}} \]

c) \[ q(J) = 9.6g \text{ XMP} \times \frac{0.0415 J}{g \cdot deg} \times (31.0 - 51.0) \text{ deg} + 9.6g \text{ XMP} \times \frac{-4.10J}{g} = -80J \]

freezing \( \Delta H \) XMP at 31.0°C

-47 J

notice: in the problem, the heat of fusion is given as \( \Delta H_{\text{fus}} = +4.10 \frac{J}{g \text{ XMP}}. \) "Fusion" refers to the process of converting a solid to a liquid (melting). Since you are freezing liquid XMP to solid XMP, heat is being given off and the \( \Delta H \) value is negative.