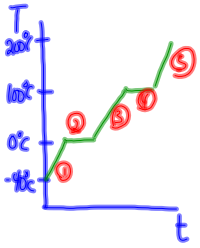
Putting it ALL Together

How much energy is required to change ice at -40°C to steam at 200°C? (50g is mass)



① heating ice (-40°c → 0°c) 2.
② melting ice ($\Delta H_{fus} = 333 J/g$)
③ heating water (0°c → 100°c) 4.
④ evaporation ($\Delta H_{vap} = 226$
⑤ heating steam (100°c → 200°c) 1.8

Step 1 (temp change) $Q = mc\Delta T$

$Q = (50g)\left(2.08\frac{J}{g°c}\right)(40°$

$Q_1 = 4160 J$

Step 2 (melting) $Q = m\Delta H^\circ_{fus}$

$Q = (50g)(333 J/g)$

$Q_2 = 16650 J$

Step 3 (temp change) $Q = mc\Delta T$

$Q = (50g)\left(4.18\frac{J}{g°c}\right)(1$

$Q_3 = 20900 J$

Step 4 (evaporation) $Q = m\Delta H^\circ_{vap}$

$Q = (50g)(2260 J/g$

$Q_4 = 113000 J$

Step 5 (temp change) $Q = mc\Delta T$

$Q = (50g)\left(1.87\frac{J}{g°c}\right)$

$Q_5 = 9350 J$

TOTAL:

$$\begin{array}{r} 4160 J \\ 16650 J \\ 20900 J \\ 113000 J \\ +\ 9350 J \\ \hline 164060 J \end{array} \quad 1.6 \times 1$$

$\Rightarrow 1.6 \times 10^5 J$

HINT: Be sure to sketch a heating