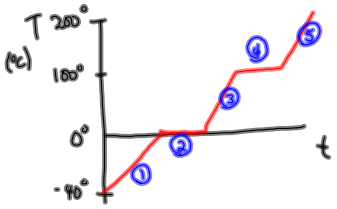
Putting it all Together ⇒ Changes in Temperature through Changes in State

Consider taking 50g of ice at -40°C and heating it to 200°C.



1. Heating of ice ($-40°C \rightarrow 0°C$) ($c_{ice} = 2.08 \frac{J}{g°C}$)
2. melting ice ($\Delta H^\circ_{fus} = 333 \frac{J}{g}$)
3. Heating water ($0°C \rightarrow 100°C$) ($c_{water} = 4.18 \frac{J}{g°C}$)
4. vaporization ($\Delta H^\circ_{vap} = 2260 \frac{J}{g}$)
5. Heating steam ($100°C \rightarrow 200°C$) ($c_{steam} = 1.87 \frac{J}{g°C}$)

1. Temperature change ($Q = mc\Delta T$)

$Q = mc\Delta T$

$Q = (50g)(2.08 \frac{J}{g°C})(40°C)$

$Q = 4160 J$

2. Melting ($Q = m\Delta H^\circ_{fus}$)

$Q = m\Delta H^\circ_{fus}$

$Q = (50g)(333 \frac{J}{g})$

$Q = 16650 J$

3. Temperature Change ($Q = mc\Delta T$)

$Q = mc\Delta T$

$Q = (50g)(4.18 \frac{J}{g°C})(100°C)$

$Q = 20900 J$

4. Vaporization ($Q = m\Delta H^\circ_{vap}$)

$Q = m\Delta H^\circ_{vap}$

$Q = (50g)(2260 \frac{J}{g})$

$Q = 113000 J$

5. Temperature Change ($Q = mc\Delta T$)

$Q = mc\Delta T$

$Q = (50g)(1.87 \frac{J}{g°C})(100°C)$

$Q = 9350 J$

TOTAL:

$4160 J$
$16650 J$
$20900 J$
$113000 J$ ← least precise place value
$+ \quad 9350 J$
$164060 J$

$\approx 1.6 \times 10^5 J$

* Be sure to sketch a heating or cooling curve.