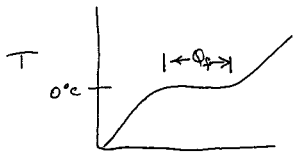
Latent Heat of Fusion

Solid → liquid requires energy to break molecular bonds. e.g. heat up ice



Heat applied

$Q = m L_f$

Q positive: Heat in melting

Q negative: heat out freezing

Water $L_f = 334\ kJ/kg$

Latent Heat of Vaporization

$L_v = 2.49 \times 10^3\ kJ/kg$

$Q = m L_v$

Q positive: heat in (boiling)

Q negative: heat out (condensing)

e.g. Partially frozen can of coke (12 oz)
at $T = 0°C$ 50% frozen 340 g

Human hand ~ 1 lb 16 oz
454 g

$Q_{out\ of\ hand} = Q_{into\ coke}$

$m_H C \Delta T = m_{FC} L_f + m_c C \Delta T$

$0.454\,kg \cdot 3.5\,kJ/kg\cdot K\ (37° - T_f)$

$= 334\,kJ/kg \cdot 0.170\,kg$
$+ 0.340\,kg \cdot 4.186\,kJ/kg\cdot K$
$(T_f - 0°C)$

$58.8\,kJ - 1.59\,kJ/K \cdot T_f$

$= 56.8\,kJ + 1.423\,kJ/K\ T_f$

$3.01\,T_f = 58.8 - 56.8\ K$

$\underline{T_f = 0.67\,C}$ Your hand gets cold!

Of course this is not really what happens. The blood circulating through your hand brings fresh heat and your body adjusts fuel to keep your T and your hand is at 37C