

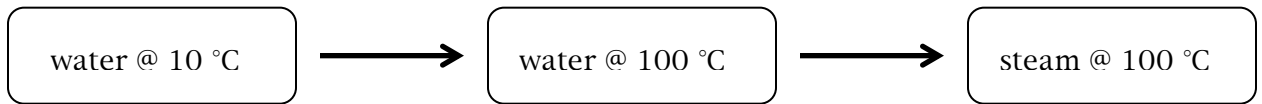
Boiling water

If you have 1.0 kg of water at a temperature of 10°C, how much heat energy needs to be added for it all to become steam?

($c_{\text{water}} = 4200 \text{ J.kg}^{-1}\text{K}^{-1}$, $L_V = 2.3 \times 10^6 \text{ J.kg}^{-1}$)

Solution

There are two separate processes:



Calculate the heat required for each of these in turn: to turn cold water into hot water, we need

$$Q_1 = mc_{\text{water}}\Delta T = (1.0)(4200)(90) = 3.78 \times 10^5 \text{ J}$$

and to turn hot water into steam we need

$$Q_2 = mL_V = (1.0)(2.3 \times 10^6) = 2.3 \times 10^6 \text{ J}$$

So the total heat required is

$$Q_{\text{tot}} = Q_1 + Q_2 = 3.78 \times 10^5 + 2.3 \times 10^6 = 2.678 \times 10^6 \approx 2.7 \times 10^6 \text{ J}$$