What is the final state (solid, liquid, gas or some combination) and temperature (in Kelvin) if 9.50 x 10^4 J of heat is added to a 0.150 kg block of ice initially at -15.0°C?

\[ C_{\text{ice}} = 2220 \text{ J/kg.K} = 2220 \text{ J/kg°C} \]
\[ C_{\text{water}} = 4190 \text{ J/kg.C°} \]
\[ \Delta T = 333 \times 10^3 \text{ J/kg} \]
\[ \Delta T = 2256 \times 10^3 \text{ J/kg} \]

\[ \Rightarrow \text{Heat to change ice at -15.0°C into ice at 0°C} \]
\[ Q = m \cdot c \cdot \Delta T \]
\[ = (0.150 \text{ kg}) (2220 \text{ J/kg°C}) (15.0°C) \]
\[ = 5.00 \times 10^3 \text{ J} \]

\[ \Rightarrow \text{Heat to change ice at 0°C into water at 0°C} \]
\[ Q = m \cdot \Delta T \]
\[ = (0.150 \text{ Kg}) (333 \times 10^3 \text{ J/kg}) \]
\[ = 5.00 \times 10^4 \text{ J} \]

\[ \Rightarrow \text{Heat to change water at 0°C into water at 100.0°C} \]
\[ Q = m \cdot c \cdot \Delta T \]
\[ Q = (0.150 \text{ kg}) (4190 \text{ J/kg} \cdot \text{C}) (100.0 \text{ C}) \]
\[ = 6.29 \times 10^4 \text{ J} \]

\[ 5.00 \times 10^3 \text{ J} + 5.00 \times 10^4 \text{ J} + 6.29 \times 10^4 \text{ J} > 9.50 \times 10^4 \text{ J} \]

\[ Q_{\text{available}} = 9.50 \times 10^4 \text{ J} - 5.00 \times 10^3 \text{ J} - 5.00 \times 10^4 \text{ J} \]
\[ = 4.0 \times 10^4 \text{ J} \]

\[ Q = mc \Delta T \]

\[ \Delta T = \frac{Q}{mc} = \frac{4.0 \times 10^4 \text{ J}}{(0.150 \text{ kg})(4190 \text{ J/kg} \cdot \text{C})} = \frac{63.7 \text{ C}}{T_f} \]

\[ T_k = T_c + 273.15 \]
\[ = 63.7 \text{ C} + 273.15 \]

\[ T = 337 \text{ K} \quad \rightarrow \quad \text{water at 337 K} \]