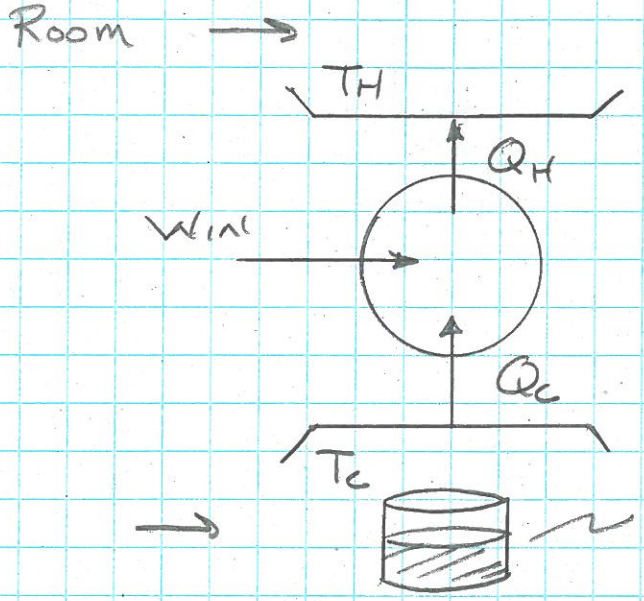

$K = 4.0$

$V = 100 mL$ ($10^{-4} m^3$) water at $T_i = +15°C$

$Q_c =$ | heat removed from to lower temp to 0°C
+ heat to freeze water at 0°C
+ heat removed from ice to lower temp to -15°C |

$= | M c_w (0° - 15°) - M L_f + M c_i (-15° - 0°C) |$

$c_w = 4186 \frac{J}{kg\,°C}$ $\quad L_f = 3.33 \times 10^5 J/kg$

$c_i = 2090 \frac{J}{kg\,°C}$ $\quad M = \rho_w V = (1000 kg)(10^{-4} m^3)$
$= 0.1 kg.$

So: $Q_c = -42,714 J$

Now: $K = \frac{Q_c}{W_{in}} \Rightarrow W_{in} = \frac{Q_c}{K} = 10,679 J.$

and,

$Q_H = Q_c + W_{in} = \underline{5.34 \times 10^4 J}$