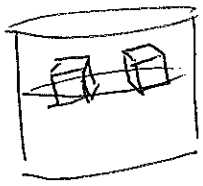
Physics 207 Week 13a, problem 4



$m_w = 0.06kg$ $T_{ow} = 50°C$ $C_w = 4200 J/kg \cdot K$ $L_{melt} = 3.3E5\ J/kg$

$m_i = 0.03kg$ $T_{oi} = -20°C$ $C_i = 2100 J/kg \cdot K$

a) $Q_i = -Q_w$

$m_i C_i \Delta T_i = -m_w C_w \Delta T_w$

$\Rightarrow \Delta T_w = -\left(\frac{m_i}{m_w}\right)\left(\frac{C_i}{C_w}\right)\Delta T_i$

$= -\left(\frac{0.03kg}{0.06kg}\right)\left(\frac{2100}{4200}\right)(0 - (-20°C))$

$= -5°C$

$\Rightarrow \boxed{T_{fw} = 45°C}$

b) $Q_i = -Q_w$

$m_i L_{melt} = -m_w C_w \Delta T_w$

$\Rightarrow \Delta T_w = \left(\frac{-m_i}{m_w}\right)\left(\frac{L_{melt}}{C_w}\right)$

$= \left(\frac{-0.03kg}{0.06kg}\right)\left(\frac{3.3E5\ J/kg}{4200\ J/kg \cdot K}\right)$

$= -39.3°K$

$\Rightarrow \Delta T_w = -39.3°C$

$\Rightarrow T_{fw} = 45°C - 39.3°C$

$\boxed{= 5.71°C}$