LATEX PRACTICE

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(6)
$m_1 = 0.650$ kg
$T_{i1} = 352 + 273 = 625$ K
$m_2 = 0.650$ kg
$T_{i2} = 704 + 273 = 977$ K
$C_{fe} = 450.0 \frac{\text{J}}{\text{kg K}}$

a. Find T_f in °C and K
$Q = mC\Delta T$
$0 = Q_1 + Q_2 = m_1 C_{fe} (T_f - T_{i1}) + m_2 C_{fe} (T_f - T_{i2})$
$m_1 C_{fe} T_{i1} + m_2 C_{fe} T_{i2} = m_1 C_{fe} T_f + m_2 C_{fe} T_f$
$m_1 C_{fe} T_{i1} + m_2 C_{fe} T_{i2} = T_f (m_1 C_{fe} + m_2 C_{fe})$
$T_f = \frac{m_1 C_{fe} T_{i1} + m_2 C_{fe} T_{i2}}{m_1 C_{fe} + m_2 C_{fe}}$
$T_f = \frac{T_{i1} + T_{i2}}{2} = \frac{(625+977)\text{ K}}{2} = 801\text{ K} = 528\text{ °C}$

b. Find ΔS
$\Delta S_{tot} = \Delta S_1 + \Delta S_2 = m_1 C_{fe} \ln\left(\frac{T_f}{T_{i1}}\right) + m_2 C_{fe} \ln\left(\frac{T_f}{T_{i2}}\right)$
$\Delta S_{tot} = mC\left(\ln\left(\frac{T_f}{T_{i1}}\right) + \ln\left(\frac{T_f}{T_{i2}}\right)\right) = mC \ln\left(\frac{T_f}{T_{i1}} \times \frac{T_f}{T_{i2}}\right)$
$\Delta S_{tot} = mC \ln\left(\frac{T_f^2}{T_{i1} \times T_{i2}}\right) = (0.650\text{ kg})\left(450.0 \frac{\text{J}}{\text{kg K}}\right) \ln\left(\frac{(801\text{ K})^2}{625\text{ K} \times 977\text{ K}}\right)$
$\Delta S_{tot} = 14.47 \frac{\text{J}}{K}$

c. Find ΔS_{env}
$\Delta S_{env} = 0 \frac{\text{J}}{K}$

d. Find ΔS_{uni}
$\Delta S_{uni} = \Delta S_{sys} + \Delta S_{env} = 14.47 \frac{\text{J}}{K} + 0 \frac{\text{J}}{K} = 14.47 \frac{\text{J}}{K}$
The process is irreversible.