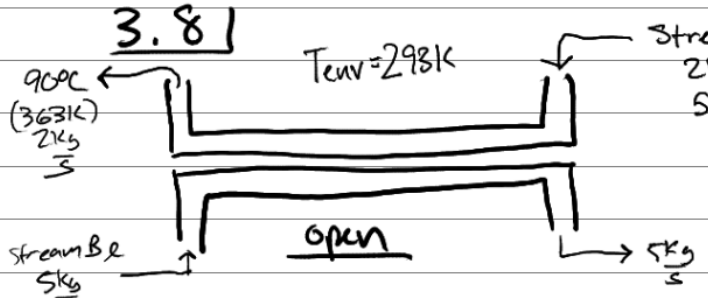
3.81



$C_{p_{A\ell}} = 3\frac{kJ}{kg\,K}$

$C_{p_{B\ell}} = 2\frac{kJ}{kg\,K}$

- No work done on system
- for this process to be possible $\Delta S_{universe}$ must be positive
- no accumulation (steady state)

$$\Delta S_{universe} = \cancel{\Delta S_{system}}^{\text{steady state}} + \Delta S_{env} + \sum_{leaving} \dot{m}\, \hat{S}_{out} - \sum_{entering} \dot{m}\, \hat{S}_{in}$$

$$\Delta S_{universe} = \Delta S_{env} + \sum_{\substack{leaving \\ streams}} \dot{m}\, \hat{S}_{out} - \sum_{\substack{entering \\ Streams}} \dot{m}\, \hat{S}_{in}$$

Stream A entering

$Q = \dot{m} C_p \Delta T$

$2\frac{kg}{s}\left(3\frac{kJ}{kg\,K}\right)278K = 1638\frac{kJ}{s}$

Stream A leaving

$2\frac{kg}{s}\left(3\frac{kJ}{kg\,K}\right)(363K) = 2178\frac{kJ}{s}$

$\Delta Q = 540\frac{kJ}{s}$ gained

Stream B Entering

$5\frac{kg}{s}\left(2\frac{kJ}{kg\,K}\right)(333K) = 3330\frac{kJ}{s}$

Stream B leaving

$5kg\left(\frac{2kJ}{kg\,K}\right)(T_f) = 3330\frac{kJ}{s} - 540\frac{kJ}{s}$

$T_f = 274K\ (6°C)$

$\dot{m}\hat{S}$ entering

Stream A: $\frac{1638kJ/s}{278K} = 5.89\frac{kJ/s}{K}$ $\quad t(1sec) = 5.89\frac{kJ}{K}$

Stream B: $\frac{3330kJ/s}{333K} = 10\frac{kJ}{K}$

$\Sigma \dot{m}S$ leaving

Stream A: $\frac{2178\ kJ/s}{363\ K} = 6\ \frac{kJ}{K}$

Stream B: $\frac{2740\ kJ/s}{274} = 10\ \frac{kJ}{K}$

$\Delta S_{universe} = \Delta S_{env} + \underset{leaving}{\Sigma \dot{m}S} - \underset{entering}{\Sigma \dot{m}S}$

$\Delta S_{universe} = \Delta S_{env} + \left(6\ \frac{kJ}{K} + 10\ \frac{kJ}{K}\right) - \left(5.98\ \frac{kJ}{K} + 10\ \frac{kJ}{K}\right)$

$\Delta S_{universe} = \Delta S_{env} + .02\ \frac{kJ}{K}$

???