(3)

$\dot{n} = 10 \frac{kmol}{hr}$

$C_p = 7/2 R$

Assume ideal

Assume isochoric

$$\frac{\Delta S}{R} = \int_{T_0}^{T} \frac{C_p^{ig}}{R} \frac{dT}{T} - \ln \frac{P}{P_0}$$

$P_1 V_1 = n R T_1$

$P_2 V_2 = n R T_2$

$$\frac{\Delta S}{R} = \int_{T_0}^{T} \frac{7/2 R}{R} \frac{dT}{T} - \ln \frac{P}{P_0}$$

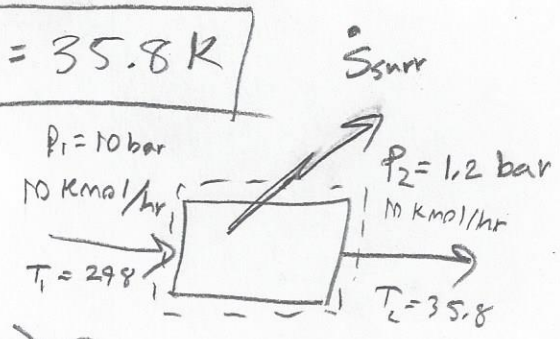
a) $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$\frac{10 \text{ bar}}{298 K} = \frac{1.2 \text{ bar}}{T_2}$

$$\frac{\Delta S}{8.314} = 7/2 \ln\left(\frac{35.8}{298}\right) - \ln\left(\frac{1.2}{10}\right)$$

$\boxed{T_2 = 35.8 K}$

b) $\boxed{\Delta \tilde{S} = -44.0 \ J/kmol}$



c) $\Delta(\dot{m}\hat{S})_{fs} + \frac{d(mS)}{dt} + \frac{dS_{surr}}{dt} = \dot{S}_{Gen} \geq 0$

$\dot{n}\tilde{S}_{out} - \dot{n}\tilde{S}_{in} + \frac{dS_{surr}}{dt} = \dot{S}_{gen}$

$\frac{dS_{surr}}{dt} = -\sum_j \frac{\dot{Q}_j}{T_{\sigma,j}}$

$\dot{n}(\Delta\tilde{S}) + \frac{dS_{surr}}{dt} = \dot{S}_{gen}$

$10 \frac{kmol}{hr}\left(\frac{-44 J}{kmol}\right)\left(\frac{1000 mol}{kmol}\right) + \frac{dS_{surr}}{dt} = \dot{S}_{gen}$