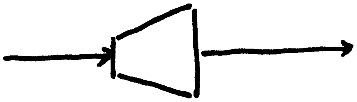
6-51:



$p_1 = 50\,psia.$ $\quad p_2 = 14.5\,psia$ $\quad C_p = 1.01\,kJ/kg\cdot K$

$T_1 = 1200F$ $\quad \Delta s = 0$

$\dot{m} = 8.10\,lbm/s$ $\quad W = ?$

$$\Delta s = C_p \ln\frac{T_2}{T_1} - R\ln\frac{p_2}{p_1} = 0$$

$$\Rightarrow \ln\frac{T_2}{T_1} = \frac{R}{C_p}\cdot\ln\frac{p_2}{p_1} = \frac{8.314}{1.01}\ln\frac{14.5}{50}$$

$$\Rightarrow T_2 = T_1 * 3.75E10^{-5}$$

$$T_1 = \frac{5}{9}(1200-32) + 273.15 = 922K.$$

$$\Rightarrow T_2 = 0.0346\,K$$

$$W = ~~\dot{m}~~\cdot C_p \cdot \Delta T \quad = ~~8.10\,lbm/s~~ * 1.01\,kJ/kg\cdot K * (922-0.0346)K$$

~~8.10 * [illegible] lbm~~

$$= \frac{1.01*(922-0.0346)}{1\cdot kg * \cdot \frac{1bm}{0.45kg}} = 2069\,kJ/lbm$$

6:90)

a:) $S_2 - S_1 = C_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1}$

C_p : 0.919 KJ/kg·K

R : 8.314 KJ/Kmol·k.

$\Delta S = 0.919 \cdot \ln \frac{(25+273.15)K}{(60+273.15)K} - 8.314 \ln \frac{125}{250}$

$= 5.66 > 0.$

b:) We assume $\Delta S = 0$

$0.919 \ln \frac{T_2}{333.15} = 8.314 \ln \frac{125}{250}$

$\Rightarrow T_2 = 0.63K$

c:) Maximum T is 60°C.

6.93)

a) $Q_{in} - W_{out} = \dot{m} \cdot C_p \cdot \Delta T$

$Q_{in} - 80 KW = 1.4 kg/s \cdot 1.01 KJ/kg \cdot K \cdot 70 K$

$Q_{in} - 80 KW = 98.98 KJ/s$

$Q_{in} = 98.98 KJ/s + 80 KJ/s = 178.98 KJ/s$

$Q_{in} (/kg) = 178.98 \frac{KJ}{s \cdot \frac{1.4 kg}{s}} = 127.84 KJ/kg$

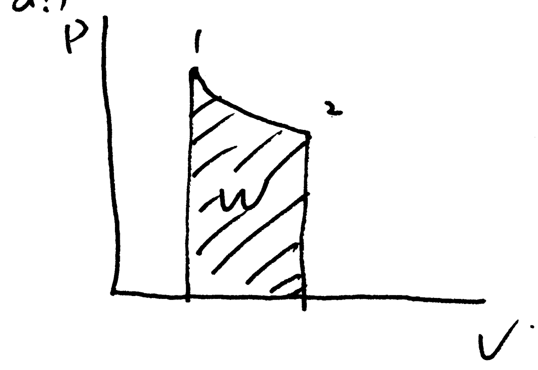
b) $\Delta S = C_p \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1}$

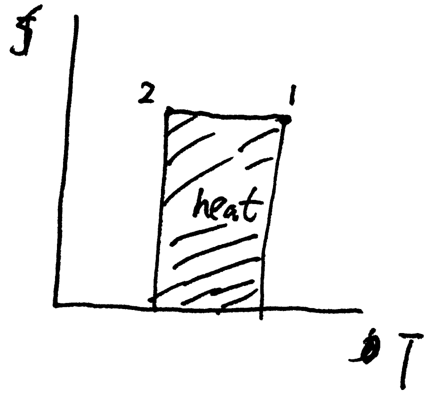
$= 1.01 \ln \frac{273.15 + 50}{273.15 + 120} - 8.314 \ln \frac{100}{300}$

$= -0.198 + 9.314 = 8.94 KJ/kg \cdot K$

6-96:)

a:)





b)

~~$W = \int_0 P\,dV$~~

~~Q_{in}~~ $- W_{out} = \dot{m}(\Delta h)$

$W_{out} = -\dot{m} \cdot C_p \cdot \Delta T$ ——————— (1)

$C_p = 1.01\ KJ/kg \cdot K.$ $C_v = 0.718\ KJ/kg \cdot K$

$\gamma = C_p/C_v = 1.29$

$T_1 P_1^{\frac{1-1.29}{1.29}} = T_2 P_2^{\frac{1-1.29}{1.29}}$ $\Rightarrow T_2 = \dfrac{(115+273.15)(200kPa)^{\frac{-0.29}{1.29}}}{(70kPa)^{\frac{-0.29}{1.29}}}$

$= 308\ K$ ——————— (2)

$W_{out} = -\dot{m} \cdot C_p \cdot (-80) = +\rho \cdot (60 \frac{m}{s} \cdot \frac{35}{10000} m^2) \cdot 1.01 \frac{KJ}{kg \cdot K} \cdot (+80)$

$= \frac{1}{110.15\ m^3/kg} \left(\frac{60 \times 35}{10000} \frac{m^3}{s} \right) \cdot \frac{1.01\ KJ}{kg \cdot K} \cdot 80$

$= 0.154\ KJ/s = 0.154\ KW$