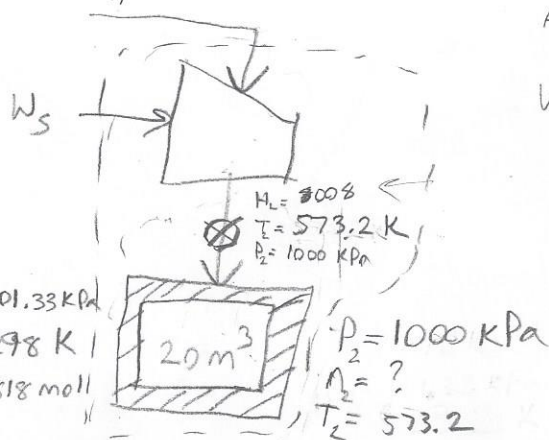


①

$$H_f = 0$$

$$T_f = 298 \text{ K}$$

$$P_f = 101.33 \text{ kPa}$$



Adiabatic, ideal gas, isentropic

$$W_s = ?$$

$$\dot{W}_s = \dot{n}_{in} \Delta \tilde{H}$$

$$W_s = n_{in} \Delta \tilde{H}$$

Reference state
air @ 25°C,
101.33 kPa

$$P_1 V_1 = n_1 R T_1$$

$$(101.33 \times 10^3)(20) = n_1 (8.314)(298)$$

$$n_1 = 818 \text{ mole}$$

$$P_2 V_2 = n_2 R T_2$$

$$P_1 V_1 = n_1 R T_1$$

$$(1000 \times 10^3)(20) = n_2 (8.314)(573.2)$$

$$n_2 = 4196.7 \text{ mole}$$

$$\Delta S = R \int_{T_1}^{T_2} \frac{\frac{7}{2} R}{R} \frac{dT}{T} - R \ln \frac{P_2}{P_1}$$

$$\Delta S = \frac{7}{2} R \ln \frac{T_2}{298} - R \ln \left(\frac{1000}{101.33} \right)$$

$$\ln \left(\frac{1000}{101.33} \right) = \frac{7}{2} \ln \frac{T_2}{298} \quad T = 573.2 \text{ K}$$

$$\frac{d(n\tilde{u})}{dt} = \dot{n}_{in} \tilde{H}_{in} + \dot{Q} + \dot{W}_s$$

$$\frac{d(n\tilde{u})}{dt} = \dot{n}_{in} (\tilde{u}_{in} + R T_{in}) + \dot{W}_s \quad \frac{dn}{dt} = \dot{n}_{in}$$

$$\tilde{u}_2 - \tilde{u}_1 = C_V (T_2 - T_1)$$

$$(n_1 + n_{in}) \tilde{u}_2 - n_1 \tilde{u}_1 = n_{in} (\tilde{u}_{in} + R T_{in}) + W_s$$

$$PV = nRT$$

$$W_s = n_2 \tilde{u}_2 - n_1 \tilde{u}_1 - (n_2 - n_1) (\tilde{u}_{in} + R T_{in})$$

$$W_s = n_2 (\tilde{u}_2 - \tilde{u}_{in} - R T_{in}) - n_1 (\tilde{u}_1 - \tilde{u}_{in} - R T_{in})$$

$$W_s = n_2 [C_V (T_2 - T_{in}) - R T_{in}] - n_1 [C_V (T_1 - T_{in}) - R T_{in}]$$

$$W_s = 4196.7 [2.5(8.314)(573.2 - 298) - 8.314(298)] - 818 [-8.314(298)]$$

$$= 1.563 \times 10^7 \text{ J}$$

$$W_s = 15,634 \text{ kJ}$$