

Ⓐ For a reversible isothermic process ($T = \text{const}$)

$R_{\text{max}} = -\Delta F$. Since for an ideal gas in isothermic processes $E = \text{const}$ [why?]

$$\Delta F = \Delta(E - TS) = -T\Delta S \Rightarrow R_{\text{max}} = T\Delta S$$

$$R_{\text{max}}^{T=\text{const}} = N_A T \left[N_1 \ln \frac{V_1 + V_2}{V_1} + N_2 \ln \frac{V_1 + V_2}{V_2} \right] \approx \frac{1.8 \text{ kJ}}{(1.8 \cdot 10^{20} \text{ eg})}$$

$\begin{array}{c} \uparrow \\ (RT \ln SS) \end{array}$

Ⓑ For a reversible adiabatic process ($dQ = 0$)

$R_{\text{max}} = -\Delta E$. This process is isentropic. Therefore $S = \text{const}$ leads to

$$(N_1 C_{v1} + N_2 C_{v2}) \ln \left(\frac{T_f}{T} \right) + \frac{R_{\text{max}}^{T=\text{const}}}{T} = 0 \Rightarrow \underline{T_f \approx 225 \text{ K}}$$

$$R_{\text{max}}^{S=\text{const}} = E(T) - E(T_f) = (N_1 C_{v1} + N_2 C_{v2}^*) (T - T_f) =$$

$$= \frac{T - T_f}{T} \ln \frac{T}{T_f} \cdot R_{\text{max}}^{T=\text{const}} \approx \frac{T + T_f}{2T} R_{\text{max}}^{T=\text{const}} \approx \underline{1.6 \text{ kJ}}$$