(a) $PV = mRT$

$6000 \cdot 0.0035 = m \cdot 0.2870 \cdot (700 + 273.15)$

$m = 0.0252\ kg$

(b) $\frac{P_2}{P_1} = \left(\frac{v_1}{v_2}\right)^k$

$k = 1.364$ @ 700°C

$\frac{P_2}{6000} = \left(\frac{0.0035}{0.065}\right)^{1.364}$

$P_2 = 111.544\ kPa$

Isentropic $\Rightarrow (=PV^n,\ n=k)$

$W_b = \frac{P_2 V_2 - P_1 V_1}{1-n} = \frac{6000(0.0035) - (111.544)(0.065)}{1 - 1.364}$

$W_b = -37.77\ kJ$

$\eta_b = \frac{\text{actual}}{\text{isentropic}}$, isentropic < actual

$0.75 \cdot -37.77 = \text{actual}$

① → $\text{actual} = 28.3275\ kJ$

$Q_{in} + W_{in} + m(u + PE + KE)_{in} = Q_{out} + W_{out} + m(u + PE + KE)_{out}$

$-28.3275 = m(u_{out} - u_{in})$

$-28.3275 = m(c_v \Delta T)$

$-28.3275 = 0.0752\,(0.788)\,\Delta T$

$\Delta T = -478.04$

$T_2 = 700 + 273.15 - 478.04$

$T_2 = 495.11\ K$