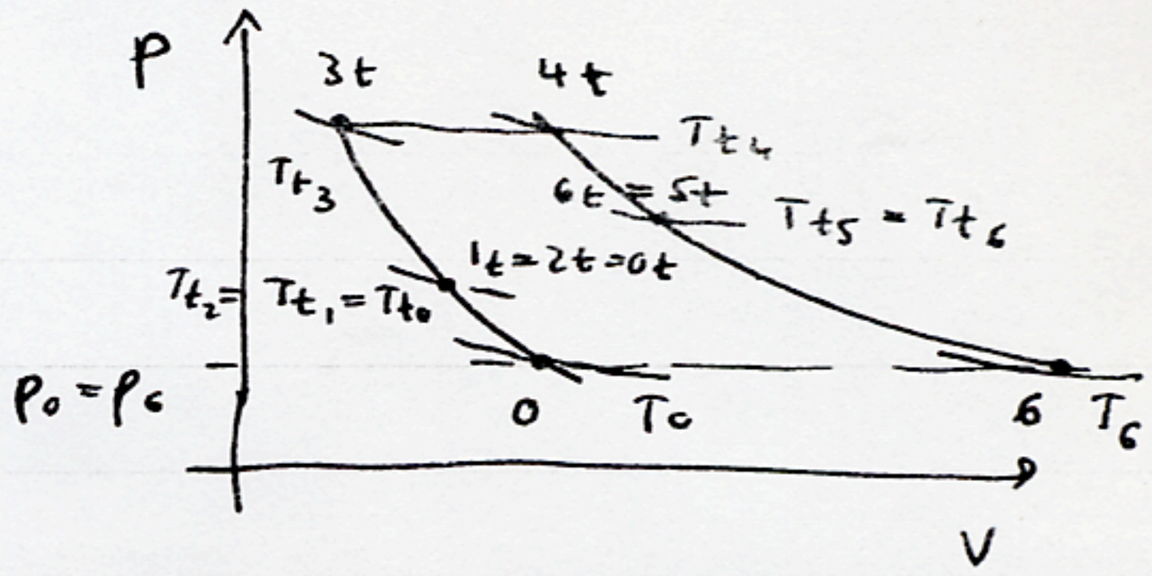
*

d) $\eta_{th} = \frac{W}{q_A} = 1 - \frac{q_R}{q_A}$



$$q_R = c_{pT}(T_6 - T_0)$$

$$q_A = c_{p\tau}(T_{t4} - T_{t3})$$

$$\eta_{th} = 1 - \frac{c_{pT}}{c_{p\tau}} \frac{(T_6 - T_0)}{(T_{t4} - T_{t3})} = 1 - \frac{T_0}{T_{t3}} \cdot \frac{\left(T_6/T_0 - 1\right)}{\left(T_{t4}/T_{t3} - 1\right)}$$

Note: adiabatic reversible process $\left.\begin{matrix} 4t \to 6 \\ 3t \to 0 \end{matrix}\right\}$ same pressure ratio

so $\frac{P_{t3}}{P_0} = \frac{P_{t4}}{P_6}$ and $\frac{P_{t4}}{P_6} = \left(\frac{T_{t4}}{T_6}\right)^{\gamma_T/\gamma_T - 1} = \left(\frac{T_{t3}}{T_0}\right)^{\gamma/\gamma - 1}$

so $T_6 = T_{t4} \cdot \left(\frac{T_0}{T_{t3}}\right)^{\frac{\gamma}{\gamma-1} \cdot \frac{\gamma_T - 1}{\gamma_T}}$ $\quad T_6 = 703K$

$$\eta_{th} = 1 - \frac{T_0}{T_{t3}} \frac{T_6/T_0 - 1}{T_{t4}/T_{t3} - 1} \qquad \eta_{th} = 0.457$$