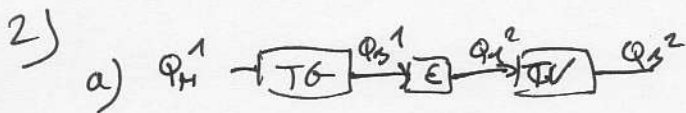


1) a - $\frac{\partial p}{\partial T} \Big|_V = \frac{L_V}{T(u_V - u_L)}$ si $v_L \ll v_V$
 $\left\{ \begin{array}{l} GP \Rightarrow v_V = \frac{RT}{M_P} \Rightarrow \frac{\partial p}{\partial T} \Big|_V = \frac{M_P \cdot L_V}{RT^2} \\ L_V = c \cdot b. \end{array} \right.$ d'où $\frac{dp}{p} = \frac{M_L V}{RT^2} \cdot dT \Rightarrow \ln p = \frac{c}{T} + \beta$

b - $d = -\frac{M_L V}{R} = -\frac{18 \cdot 10^{-3} \cdot 244231 \cdot 10^3}{8,314} = -5,4 \cdot 10^3$
 $\beta = \ln p_0 - \frac{c}{T_0} = \ln 3,1690 \cdot 10^3 + \frac{5,4 \cdot 10^3}{25+273,15} = +26,17$



$\eta_{TG} = \frac{Q_{H1} + Q_{E1}}{Q_{H1}}$; $\eta_{TV} = \frac{Q_{H2} + Q_{E2}}{Q_{H2}}$; $Q_{E2} = -E Q_{E1} \Rightarrow \eta_{TOT} = \frac{-W_{TG} - W_{TV}}{Q_{H1}}$

$\eta_{TOT} = \frac{Q_{H1} + Q_{E1} + Q_{H2} + Q_{E2}}{Q_{H1}} = \eta_{TG} + \frac{Q_{H2} + Q_{E2}}{Q_{H1}} = \eta_{TG} + \frac{Q_{H2} + Q_{E2}}{Q_{H2}} \cdot \frac{Q_{H2}}{Q_{H1}} = \eta_{TG} + \eta_{TV} \cdot \frac{Q_{H2}}{Q_{H1}}$
 $= \eta_{TG} - E \cdot \frac{Q_{E1}}{Q_{H1}} \eta_{TV} = \eta_{TG} - E (\eta_{TG} - 1) \eta_{TV}$

b) AN: $\eta_{TOT} = 0,3 + 0,87(1-0,3) \cdot 0,33 = 0,50$.

3) a) $q = \frac{h\nu}{h_0} \cdot \frac{e}{pe} = \epsilon \frac{e}{pe}$ $\epsilon = 0,622$

b). $q \approx \epsilon \frac{e}{p} \Rightarrow e = \frac{p \cdot q}{\epsilon} = \frac{101325 \times 5,75 \cdot 10^{-3}}{0,622} = 936,69 \text{ Pa}$

$\Rightarrow \eta_R = \frac{e}{e_{sat}} = \frac{936,69}{1170,8} = 80\%$

4) a) $\frac{dE}{dt} = \dot{Q} + \dot{W} + \sum_{i \in \mathcal{S}} \dot{m}_i (h + \frac{1}{2}v^2 + gz)_i$

en p $\Rightarrow \frac{dE}{dt} = 0$; $\dot{m}_e = -\dot{m}_s = \dot{m}$; adiabatique $\Rightarrow \dot{Q} = 0$; E_p négligeable $\Rightarrow (gz)_e = 0$; $v_e \ll v_s$.
 $\Rightarrow \dot{W} = \dot{m} (h_s - h_e) + \dot{m} \frac{1}{2} v_s^2$

b). $\Delta h = c_p \Delta T$ et $c_p = \frac{R \gamma}{\gamma(\gamma-1)} \Rightarrow \left\{ \begin{array}{l} \frac{\dot{W}}{\dot{m}} = \frac{R \gamma}{\gamma(\gamma-1)} (T_s - T_e) + \frac{1}{2} v_s^2 \\ \frac{\dot{W}}{\dot{m}} = 16077 \text{ kJ/kg} + 7,2 \text{ kJ/kg} = 167,97 \text{ kJ/kg} \end{array} \right.$

c) $W = P \cdot t \Rightarrow \frac{\dot{W}}{\dot{m}} \cong \frac{P \cdot t}{\dot{m}} \Rightarrow \dot{m} = P \cdot \left(\frac{\dot{W}}{\dot{m}} \right)^{-1} = \frac{3000}{167,97} = 17,86 \text{ kg/s}$