30/7/2015

1)

a) $W_{A\to C} = -\Delta V_{A\to C} \cdot q$

$$V(\vec{r}) = \int \frac{k\,dq'}{|\vec{r}-\vec{r}'|} \Rightarrow V(-L) = \int_0^L \frac{k\lambda\,dx'}{|-L-x'|} = \int_0^L \frac{k\lambda\,dx'}{L+x'} = k\lambda \ln\left(\frac{L+L}{L}\right)$$

$$= k\lambda \ln(2)$$

$$\Rightarrow V(3L) = \int_0^L \frac{k\lambda\,dx'}{|3L-x'|} =$$

$$= k\lambda\left(-\ln(3L-x')\right)\Big|_0^L$$

$$= k\lambda \ln\left(\frac{3L}{2L}\right) = k\lambda \ln\left(\frac{3}{2}\right)$$

$$\Rightarrow \Delta V_{A\to C} = V(C) - V(A) = k\lambda \ln(2) - k\lambda \ln(3/2)$$

$$\Rightarrow W_{A\to C} = \left(k\lambda \ln(3/2) - k\lambda \ln(2)\right) q$$

$$\boxed{W_{A\to C} = kq\lambda \ln(3/4)}$$

b) $$\iint \vec{E}\,d\vec{S} = \frac{q_{enc}}{\varepsilon_0} = \frac{\lambda L}{\varepsilon_0} \Rightarrow \boxed{\phi_E = \frac{\lambda L}{\varepsilon_0}}$$

b) $\iint \vec{E}\, d\vec{S} = \frac{q_{enc}}{\varepsilon_0} \Rightarrow \left[\phi_E = \frac{\lambda L}{\varepsilon_0} \right]$

2) RESONANCIA $\rightarrow \omega = \frac{1}{\sqrt{LC}} = 5000$

$|V_G| = 200V$

$R = 100\Omega$ $\qquad L = 20.10^{-3} H$

$C = 2.10^{-6} F$

a) $\begin{cases} |V_1| = \sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2}\, |i| \rightarrow |V_1| = 141{,}42\,\Omega\, |i| \\ |V_2| = \sqrt{R^2 + (\omega L)^2}\, |i| \rightarrow |V_2| = 141{,}42\,\Omega\, |i| \\ V_G = \sqrt{V_1^2 + V_2^2} \longrightarrow 40000 = V_1^2 + V_2^2 \end{cases}$

se ve que $|V_1| = |V_2| \Rightarrow 4000 = 2V_1^2$

$\left[\mathbb{I}(t) = 1A e^{j\omega t} \right]$ $\qquad \left[V_1 = 141{,}42\, V = V_2 \right]$

b) $|i| = 1A \Rightarrow i(t) = 1A \cos(\omega t)$

$V_G = 200V \cos(\omega t) \rightarrow \left[\mathbb{V}_G = 200\, e^{j\omega t} \right]$

$\left[\mathbb{V}_R = 200\Omega .\, 1A e^{j\omega t} = 200 e^{j\omega t} \right]$

$\left[\mathbb{V}_L = (5000.20.10^{-3}) e^{j\pi/2} .\, 1A e^{j\omega t} = 100 e^{j(\omega t + \pi/2)} \right]$

$\left[\mathbb{V}_C = \left(\frac{1}{5000.2.10^{-6}} \right) e^{-j\pi/2} .\, 1A e^{j\omega t} = 100 e^{j(\omega t - \pi/2)} \right]$

$$\mathbb{V}_1 = \left(100 - j\frac{1}{5000 \cdot 2 \cdot 10^{-6}}\right) \cdot 1A\, e^{j\omega t}$$

$$= 141{,}42\, e^{-j45°} \cdot 1A \cdot e^{j\omega t}$$

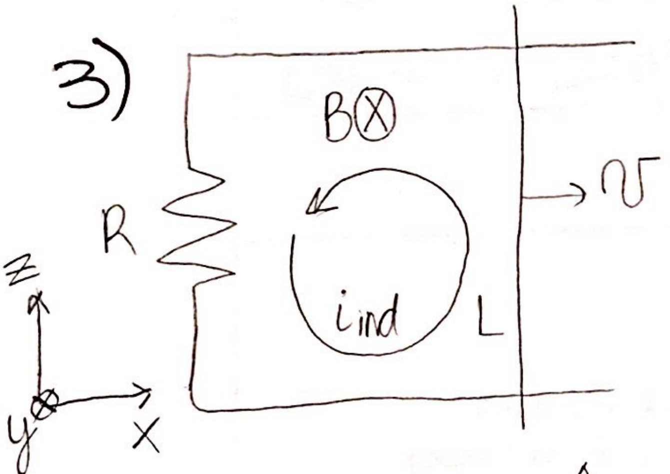
$$\Rightarrow \boxed{\mathbb{V}_1 = 141{,}42\, V e^{j(\omega t - 45°)}}$$

$$\mathbb{V}_2 = (100 + j\,5000 \cdot 20 \cdot 10^{-3}) \cdot 1A\, e^{j\omega t}$$

$$= 141{,}42\, e^{j45°} \cdot 1A\, e^{j\omega t}$$

$$\Rightarrow \boxed{\mathbb{V}_2 = 141{,}42\, e^{j(\omega t + 45°)}}$$

3)



$$\varnothing = \iint \vec{B}\, d\vec{S} = B v t L$$

$$\mathcal{E}_{ind} = -\frac{d\varnothing}{dt} = -BLv$$

$$i_{ind} = \frac{-BLv}{R}$$

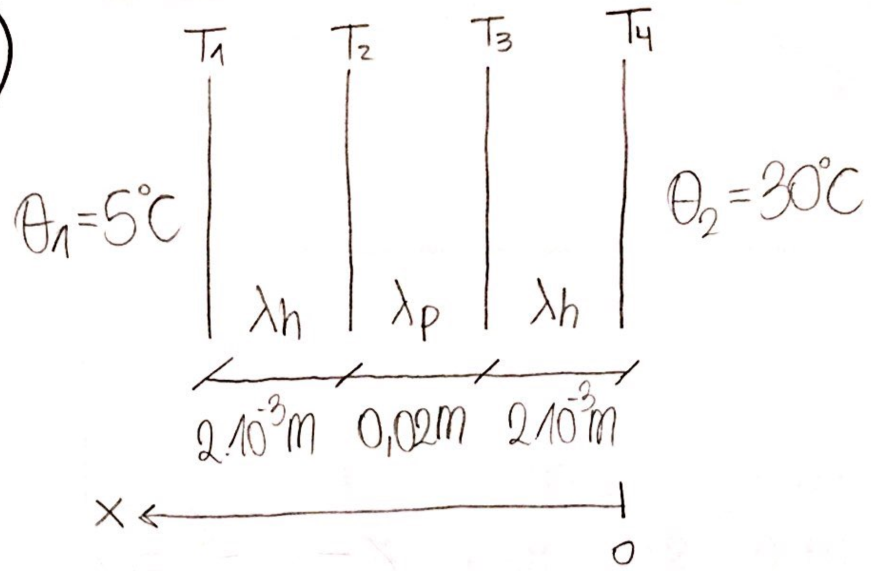
$$\vec{F}_{LENZ} = \frac{BLv}{R} \cdot L\hat{k} \times B\hat{j}$$

$$= \frac{B^2L^2v}{R}(-\hat{i}) \Rightarrow \boxed{\vec{F}_{MANO} = \frac{B^2L^2v}{R}\hat{i}}$$

b) $$Pot_R = \frac{B^2L^2v^2}{R}$$

$$Pot_{AG.\,EXT.} = \frac{B^2L^2v^2}{R}$$

4)



$A = 6 m^2$
$h = 40 W/m^2 °C$
$\lambda_h = 80 W/m°C$
$\lambda_p = 0{,}04 W/m°C$

a)

$$\dot{Q}_1 = hA(\theta_2 - T_4) = 40 \cdot 6 (30 - T_4)$$

$$\dot{Q}_2 = \frac{\lambda_h A (T_4 - T_3)}{d_1} = \frac{80 \cdot 6 (T_4 - T_3)}{2 \cdot 10^{-3}}$$

$$\dot{Q}_3 = \frac{\lambda_p A (T_3 - T_2)}{d_2} = \frac{0{,}04 \cdot 6 (T_3 - T_2)}{0{,}02}$$

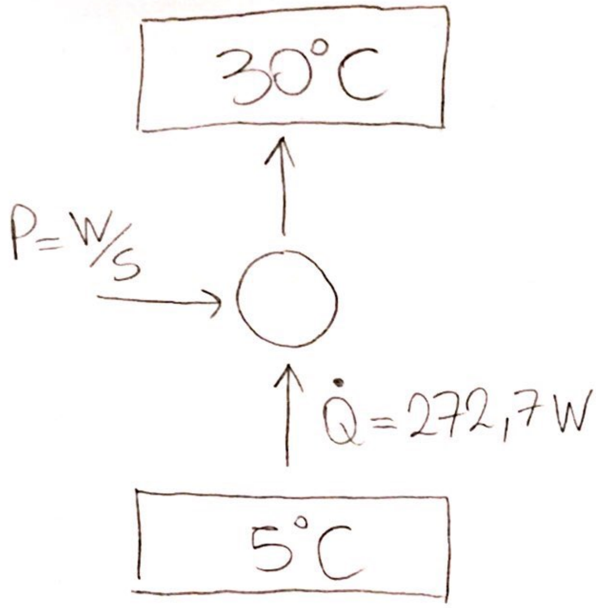
$$\dot{Q}_4 = \frac{\lambda_h A (T_2 - T_1)}{d_3} = \frac{80 \cdot 6 (T_2 - T_1)}{2 \cdot 10^{-3}}$$

$$\dot{Q}_5 = hA(T_1 - \theta_1) = 40 \cdot 6 (T_1 - 5)$$

$$\Rightarrow \dot{Q}\left(\frac{1}{40 \cdot 6} + \frac{2 \cdot 10^{-3}}{80 \cdot 6} + \frac{0{,}02}{0{,}04 \cdot 6} + \frac{2 \cdot 10^{-3}}{80 \cdot 6} + \frac{1}{40 \cdot 6} \right) = 30 - 5 = 25$$

$$\Rightarrow \boxed{\dot{Q} = 272{,}7 W}$$

b)



$$\varepsilon_C = \frac{1}{\frac{30}{5} - 1} = 0{,}2$$

$$20\% \rightarrow \varepsilon = 0{,}04$$

$$\Rightarrow \varepsilon = \frac{Q_{ABS}}{W_{neto}} \Rightarrow 0{,}04 = \frac{\dot{Q}_{ABS}}{P_{neta}} = \frac{272{,}7\,W}{P_{neta}}$$

$$\Rightarrow \boxed{P_{neta} = 6817{,}5\,W}$$

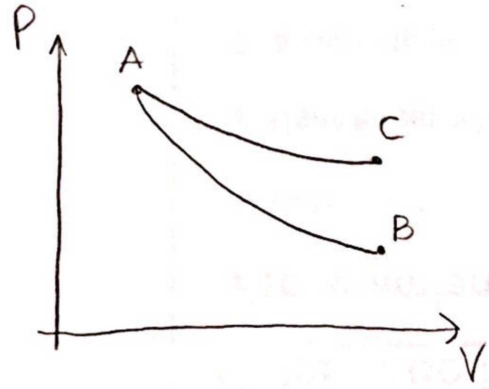
5) 1 mol

$$C_v = \frac{3R}{2}, \quad C_p = \frac{5R}{2} \qquad T_A = 238\,K$$

$$V_B = \frac{V_A}{2}$$

AB: ADIABATICO

AC: ISOTERMA



$$\underline{\underline{AB}}: \; W = -nC_v\Delta T$$

$$T_A V_A^{\gamma-1} = T_B V_B^{\gamma-1}$$

$$238 \cdot V_A^{2/3} = T_B \left(\frac{V_A}{2}\right)^{2/3}$$

$$238\,K = \frac{T_B}{2^{2/3}} \Rightarrow T_B = 377{,}8\,K$$

$$\boxed{W = -1742{,}61\,J} \Leftarrow W = -\frac{3}{2} \cdot 8{,}31\,(377{,}8 - 238)$$

$\underline{AC}$: $W = nRT \ln(V_F/V_i)$

$$= 8{,}31 \cdot 238 \cdot \ln\left(\frac{V_A/2}{V_A}\right)$$

$$= 8{,}31 \cdot 238 \cdot \ln(1/2)$$

$$\Rightarrow \boxed{W = -1370{,}89\ \text{J}}$$

b) $\boxed{\Delta S_{AB} = S_B - S_A = \int \frac{\partial Q}{T} = 0}$

$$\Delta S_{AC} = S_C - S_A = \int \frac{\partial Q}{T} = \int \frac{nR\cancel{T}}{V\cancel{T}}\,dV$$

$$= nR \ln(V_F/V_i)$$

$$= 8{,}31 \ln(1/2)$$

$$\Rightarrow \boxed{\Delta S_{AC} = -5{,}76\ \text{J/K}}$$

$$\Delta S_{BC} = \int \frac{\partial Q}{T} = \int \frac{nC_V\,dT}{T} = nC_V \ln(T_F/T_i)$$

$$= \frac{3}{2} \cdot 8{,}31 \ln\left(\frac{238}{377{,}8}\right)$$

$$\Rightarrow \boxed{\Delta S_{BC} = -5{,}76\ \text{J/K}}$$

$$\Rightarrow \boxed{\Delta S_{AB} + \Delta S_{BC} + \Delta S_{CA} = 0}$$