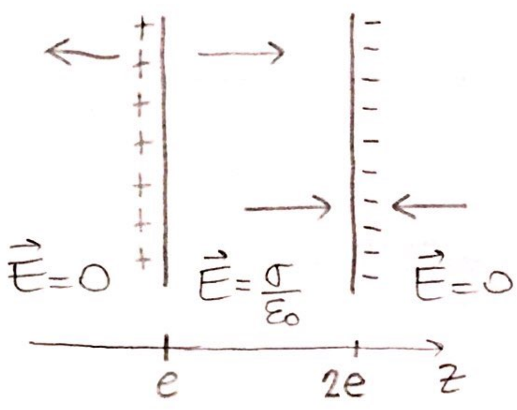
FINAL 7/7/16

1)



$$\int_0^{2e} \vec{E}\,d\vec{z} = \int_e^{2e} \vec{E}\,d\vec{z} = \int_e^{2e} \frac{\sigma}{\varepsilon_0}\hat{k}\hat{k}\,dz$$

$$-\Delta V = \left[\frac{\sigma}{\varepsilon_0} e\right]$$

$$\Delta V_{0\to 2e} = V(2e) - V(e)$$

$$= -V_0 - 0 = -V_0$$

$\int_0^{2e} \vec{E}\,d\vec{z}$ es la diferencia de potencial entre el punto $z=0$ y $z=2e$

$$\Rightarrow V_0 = \frac{\sigma}{\varepsilon_0} e$$

$$\Rightarrow \sigma = \frac{V_0 \varepsilon_0}{e}$$

$\Rightarrow$ $\underline{z<e}$ $\rightarrow \vec{E}=0$

$\underline{e<z<2e}$ $\rightarrow \vec{E} = \frac{V_0}{e}\hat{k}$

$\underline{z>2e}$ $\rightarrow \vec{E}=0$

$$\sigma = \frac{q}{A} \Rightarrow \left[q = \frac{V_0 \varepsilon_0}{e} \cdot A\right]$$

2) $V_{0_{ef}} = 200V$

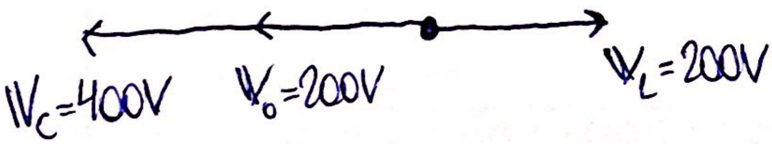
$F = 50Hz \rightarrow \omega = 100\pi$

$$A \begin{cases} |V_{1ef}| = 200V = \omega L_{eq} |i| \\ \left.\begin{array}{l} L_{eq} = L + L - 2M \\ M = K\sqrt{LL} = KL \end{array}\right\} L_{eq} = 2L - 2KL \\ |V_0| = 200V = \left(\omega L_{eq} - \dfrac{1}{\omega C}\right) |i| \end{cases}$$

$$200V = R\,|i|$$

$$\omega_r L = \frac{1}{\omega_r C}$$

$\Rightarrow$ esto daría un $V_C = 0 \Rightarrow$ imposible



3) $I(t) = Kt$

$$RC = 10^{-6}\,s$$

$$R = 10^{6}\,\Omega$$

$$\vec{B}_{hilo} = \frac{\mu_0 K t}{2\pi x}\hat{k}$$

$$\Rightarrow C = 10^{-12}\,F$$

$$\phi = \iint \vec{B}\,\vec{ds} = \frac{\mu_0 K t}{2\pi} b \ln\left(\frac{a+b}{a}\right)$$

$$\boxed{\mathcal{E}_{ind} = -\frac{\mu_0 K b}{2\pi}\ln\left(\frac{a+b}{a}\right)}$$

$$-\frac{\mu_0 K b}{2\pi}\ln\left(\frac{a+b}{a}\right) = \frac{q(t)}{C} + \underbrace{R\,i(t)}_{R\frac{dq(t)}{dt}}$$

$$-\frac{\mu_0 K b}{2\pi}\ln\left(\frac{a+b}{a}\right) = \frac{10^{-12}\left(1-e^{-t/RC}\right)}{C} + \frac{\cancel{R}\,10^{-12}e^{-t/RC}}{\cancel{R}C}$$

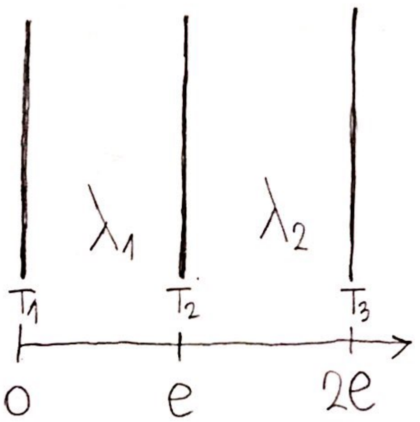
$$= \frac{10^{-12}}{C} = 1$$

$$\Rightarrow K = \frac{2\pi}{\mu_0 b \ln\left(\frac{a+b}{a}\right)} \Rightarrow \boxed{\mathcal{E}_{ind} = 1V}$$

b) I(t) del hilo va para abajo ya que genera un campo saliente en el circuito, aumentando el flujo. Esto hará que se genere una fem en el circuito que se opone a este cambio de flujo, es decir, tratará de disminuir el aumento de flujo. Se genera un campo inducido entrante y una corriente inducida en sentido horario.

$$\boxed{I(t) = \frac{2\pi\, t}{\mu_0\, b \ln\left(\frac{a+b}{a}\right)}}$$

4)



T_1

$T_2 = T_1 + 40°C$

$T_3 = T_1 + 60°C$

$$\frac{\dot{Q}}{S} = -K\vec{\nabla}T \qquad 1)\ \dot{Q} = \frac{S\lambda_2(T_3 - T_2)}{e} = \frac{S\lambda_2 20°C}{e}$$

$$2)\ \dot{Q} = \frac{S\lambda_1(T_2 - T_1)}{e} = \frac{S\lambda_1 40°C}{e}$$

$$\frac{1)}{2)} \Rightarrow 1 = \frac{\lambda_2}{\lambda_1}\frac{1}{2}$$

$$\Rightarrow \boxed{\frac{\lambda_1}{\lambda_2} = 0{,}5} \rightarrow \lambda_1 = \frac{1}{2}\lambda_2$$

$$* \Rightarrow \boxed{\lambda_{eq} = \frac{2}{3}\lambda_2}$$

$$\dot{Q}\left(\frac{e}{S\lambda_2} + \frac{e2}{S\lambda_2}\right) = 60°C$$

$$\dot{Q}\cdot\left(\frac{3e}{S\lambda_2}\right) = 60°C \quad \text{debe quedar} \quad \dot{Q}\left(\frac{2e}{SK\lambda_2}\right) = 60°C$$

$$\frac{3\cancel{e}}{\cancel{S}\lambda_2} = \frac{2\cancel{e}}{\cancel{S}K\lambda_2} \rightarrow \frac{3}{\lambda_2} = \frac{2}{K\lambda_2} \rightarrow K = \frac{2}{3} \rightarrow *$$

5) 1 mol

$C_p = \frac{5}{2}R$, $C_v = \frac{3}{2}R$

1) ABDA
2) ABCDA

A) $P = 2aV_0$ $V = V_0$ $T = \frac{2aV_0^2}{R}$

B) $P = 2aV_0$ $V = 2V_0$ $T = \frac{4aV_0^2}{R}$

C) $P = aV_0$ $V = 2V_0$ $T = \frac{2aV_0^2}{R}$

D) $P = aV_0$ $V = V_0$ $T = \frac{aV_0^2}{R}$

AB $Q = nC_p\Delta T = \frac{5}{2}\cancel{R}\left(\frac{4aV_0^2 - 2aV_0^2}{\cancel{R}}\right) = 5aV_0^2$

$W = P\Delta V = 2aV_0(2V_0 - V_0) = 2aV_0^2$

BC $Q = nC_v\Delta T = \frac{3}{2}\cancel{R}\left(\frac{2aV_0^2 - 4aV_0^2}{\cancel{R}}\right) = -3aV_0^2$

$W = 0$

CD $Q = nC_p\Delta T = \frac{5}{2}\cancel{R}\left(\frac{aV_0^2 - 2aV_0^2}{\cancel{R}}\right) = -\frac{5}{2}aV_0^2$

$W = P\Delta V = aV_0(V_0 - 2V_0) = -aV_0^2$

$\underline{\underline{DA}}$ $Q = nC_v\Delta T = \frac{3}{2}\cancel{R}\left(\frac{2aV_0^2 - aV_0^2}{\cancel{R}}\right) = \frac{3}{2}aV_0^2$

$W = 0$

$\underline{\underline{BD}}$ $Q = \Delta U + W = -\frac{9}{2}aV_0^2 - \frac{3}{2}aV_0^2 = -6aV_0^2$

$W = \int P dV = \int aV dV = \frac{a}{2}(V_D^2 - V_B^2) = \frac{a}{2}(V_0^2 - 4V_0^2)$

$= -\frac{3}{2}aV_0^2$

$\Delta U = -\Delta U_{AB} - \Delta U_{DA} = -nC_v(T_B - T_A) - nC_v(T_A - T_D)$

$= -\frac{3}{\cancel{2}}\cancel{R}\left(\frac{\cancel{2}aV_0^2}{\cancel{R}}\right) - \frac{3}{2}\cancel{R}\left(\frac{aV_0^2}{\cancel{R}}\right)$

se puede hacer

$\Delta U = nC_v(T_D - T_B)$

$= -3aV_0^2 - \frac{3}{2}aV_0^2 = -\frac{9}{2}aV_0^2$

$$\boxed{\eta_1 = \frac{W_{neto}}{\sum Q_{abs}} = \frac{2aV_0^2 - \frac{3}{2}aV_0^2 + 0}{5aV_0^2 + \frac{3}{2}aV_0^2} = \frac{\frac{1}{2}aV_0^2}{\frac{13}{2}aV_0^2} = \frac{1}{13}}$$

$$\boxed{\eta_2 = \frac{W_{neto}}{\sum Q_{abs}} = \frac{2aV_0^2 + 0 - aV_0^2 + 0}{5aV_0^2 + \frac{3}{2}aV_0^2} = \frac{aV_0^2}{\frac{13}{2}aV_0^2} = \frac{2}{13}}$$

$$\Rightarrow \boxed{\eta_2 = 2\eta_1}$$

b) $\Delta S_{BD} = \int \frac{\partial Q_{BD}}{T} = \int \frac{(\partial Q_{BA} + \partial Q_{AD})}{T} =$

$= \int_B^A \frac{nC_p\,dT}{T} + \int_A^D \frac{nC_v\,dT}{T} =$

$= nC_p \ln\left(T_A/T_B\right) + nC_v \ln\left(T_D/T_A\right) =$

$= n\frac{5}{2}R \ln\left(1/2\right) + n\frac{3}{2}R \ln\left(1/2\right) =$

$= 4nR \ln\left(1/2\right)$

Como da negativa significa que el sistema disminuyó su entropía, disminuyendo el grado de desorden del mismo.