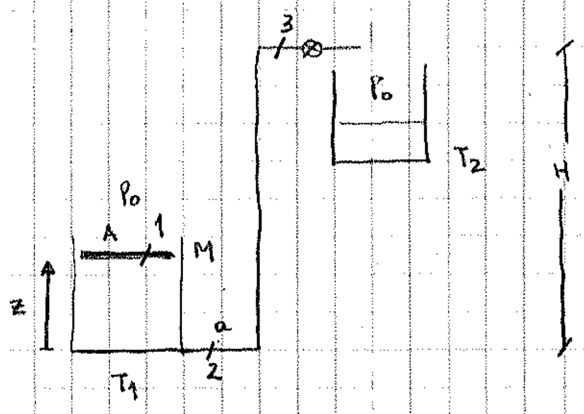
EX. 18/12/2014

PROB 1:



$A = 0{,}0075\ m^2 \quad a = \frac{A}{10}$

$H = 2{,}0\ m$

PARTE A: VÁLVULA CERRADA

$V_0 = 7{,}5\ l = 7{,}5 \times 10^{-3}\ m^3 \quad z_0 = 1{,}0\ m$

$$P_2 = P_1 + \rho g z_0 + \frac{Mg}{A} = P_{máx} \quad / \quad P_1 = P_0$$

$$M = \frac{(P_{máx} - P_0) A}{g} - \rho V_0 = 69\ Kg$$

PARTE B:

$$P_0 + \frac{Mg}{A} + \rho \frac{v_1^2}{2} + \rho g z = P_0 + \rho g H + \rho \frac{v_3^2}{2}$$

$$v_1 A = v_3 a \qquad v_3 = v_1 \frac{A}{a}$$

$$\frac{\rho}{2} v_1^2 \left(1 - \frac{A^2}{a^2}\right) = \rho g (H - z) - \frac{Mg}{A}$$

i) $$v_1^2 = \frac{2}{\rho} \left[\frac{Mg}{A} - \rho g (H - z)\right] \left(\frac{A^2}{a^2} - 1\right)^{-1}$$

ii) $$v_1 = 0 \longrightarrow M = \rho A (H - z) \quad / \quad z = \frac{(V_0 - V)}{A} = 0{,}4\ m$$

$M = 12\ Kg$

$V = 4{,}5\ l$

PARTE C:

$V_B = 3\ l \quad z_B = 0{,}4\ m \quad m_A = 3\ Kg$

$$E_B = (M z_B + m_A z_B/2)\, g$$

$$E_C = m_A H g + m_A \frac{v_3^2}{2}$$

$$\Delta E\ (mín) = m_A (H - z_B/2)\, g - M z_B\, g = 5{,}88\ J$$

$v_3 = 0$, $v_1 = 0$ → PROCESO CUASIESTÁTICO

PROB 2 : PARTE A

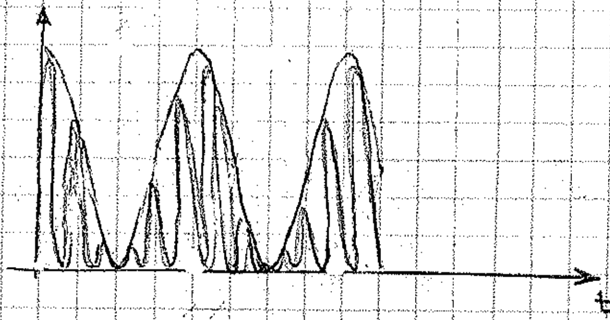
$$\operatorname{sen}\alpha + \operatorname{sen}\beta = 2\operatorname{sen}\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\left.\begin{array}{l} y_1(x,t) = y_0 \operatorname{sen}(k_1x - w_1t) \\ y_2(x,t) = y_0 \operatorname{sen}(k_2x - w_2t) \end{array}\right\rangle \quad y_T(x,t) = 2y_0 \operatorname{sen}(K_Ax - W_At)\cos(K_Bx - W_Bt)$$

$$K_A = \frac{K_1+K_2}{2} \quad W_A = \frac{W_1+W_2}{2} \quad K_B = \frac{K_1-K_2}{2} \quad W_B = \frac{W_1-W_2}{2}$$

$$I \propto y_T^2 = 4y_0^2 \operatorname{sen}^2(K_Ax - W_At)\cos^2(K_Bx - W_Bt)$$

$$I(x=0,t) \propto 4y_0^2 \operatorname{sen}^2(W_At)\cos^2(W_Bt) \quad / \quad \tau_A = \frac{2\pi}{W_A} << \frac{2\pi}{W_B} = \tau_B$$



— Envolvente : $4y_0^2 \cos^2 W_B t$

— Función : $\operatorname{sen}^2 W_A t$

$$\cos^2\alpha = \frac{1}{2}(1+\cos 2\alpha)$$

$$W_B = \frac{W_1-W_2}{2} \qquad 2W_B = W_1 - W_2$$

$$W_{BATIDO} = 2W_B$$

PARTE B

$$\operatorname{sen} KL = 0 \rightarrow KL = n\pi \rightarrow K = \frac{n\pi}{L}$$

EFECTO DOPPLER

$$f_0 = \frac{f_R}{(1 - v_R/v_S)}$$

$$f_0 = \frac{430}{1 - 3/343} = 434\ Hz$$

$$K_1 = \frac{\pi}{0{,}49} = 6{,}41\ m^{-1}$$

$$v = \frac{W_0}{K_1} = \frac{2\pi f_0}{K_1} = 425\ m/s = \sqrt{\frac{\tau}{\mu}}$$

$$\mu = 3{,}6\ gr/m$$

PARTE C

POR LA PARTE A :
$$f_{BAT} = f_0 - f_0' = \frac{1}{\tau_{BAT}} \rightarrow f_0' = f_0 \pm \frac{1}{\tau_{BAT}} = \begin{cases} 424\ Hz \\ 444\ Hz \end{cases}$$

$$f_0' = \frac{W_0'}{2\pi} = \frac{v_S K_{1F}}{2\pi} \rightarrow K_{1F} = \frac{2\pi f_0'}{v_S} = \frac{\pi}{L_F} \rightarrow L_F = \frac{v_S}{2f_0'} \begin{cases} 40{,}4\ cm \\ 38{,}6\ cm \end{cases}$$

PROB 3.

$$\frac{P_B}{P_A} = 12 = \frac{P_C}{P_D}$$

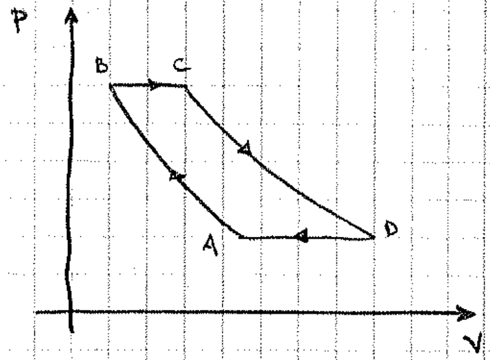
$T_C = 1250\,K$

$T_A = 300\,K$

$P V^\gamma = cte \quad \gamma = 7/5 \quad$ AIRE

$P_C V_C^\gamma = P_D V_D^\gamma \longrightarrow \frac{V_D}{V_C} = 12^{5/7}$

$P_A V_A^\gamma = P_B V_B^\gamma \longrightarrow \frac{V_A}{V_B} = 12^{5/7}$



$$nR = \frac{P_A V_A}{T_A} = \frac{P_B V_B}{T_B} \longrightarrow T_B = \frac{P_B}{P_A}\frac{V_B}{V_A} T_A = \frac{12}{12^{5/7}} T_A = 12^{2/7} T_A = 610\,K.$$

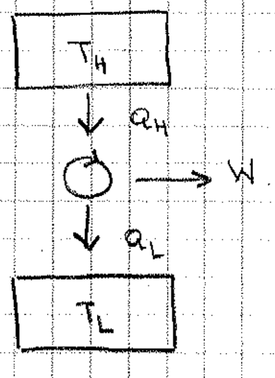
$$nR = \frac{P_D V_D}{T_D} = \frac{P_C V_C}{T_C} \longrightarrow T_D = \frac{1}{12^{2/7}} T_C = 614{,}6\,K.$$

Ⓐ $Q = n c_p (T_A - T_D) + n c_p (T_C - T_B) = 9{,}46\ KJ$ $\quad \Delta U = W + Q = 0$

$W = -Q = 9{,}46\ KJ$

$n = 1\ mol$
$R = 8{,}3145\ J/mol\,K$
$c_p = \frac{7}{2} R$

Ⓑ $\eta = \frac{W}{Q_H} = \frac{9{,}46\ KJ}{c_p (T_C - T_B)} = 50{,}8\%$.



Ⓒ $\Delta S_u = \Delta S_{ciclo} + \Delta S_H + \Delta S_L$.

$\Delta S_u = -\frac{Q_H}{T_H} + \frac{Q_L}{T_L} = -14{,}9 + 30{,}5$

$\Delta S_{ciclo} = 0$

$$\boxed{\Delta S_u = 15{,}6\ J/K}$$