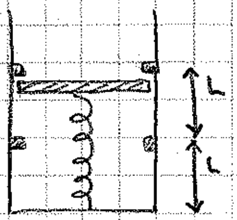
EXAMEN 12/02/2015 FÍSICA 2

PROB. 1 –



n- moles gas ideal diatómico $c_V = \frac{5}{2}R$, $c_p = \frac{7}{2}R$; $P_0 = 100\ KPa$

$\begin{cases} k = 2000\ N/m \quad L = 0{,}2\ m, \quad A = 5\times10^{-3}\ m^2 \\ l_0 = 0 \end{cases}$; $T_0 = 300\ K$.

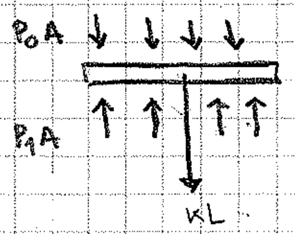
$T_F = 3600\ K$

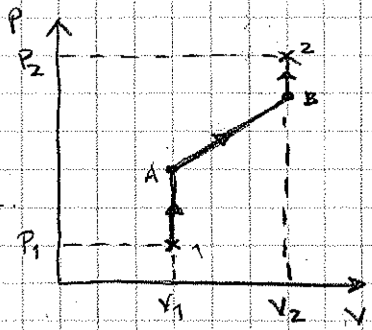
ESTADO INICIAL : $P_1 = 50\ KPa \longrightarrow V_1 = LA = 1\times10^{-3}\ m^3$ porque la ec de equilibrio del pistón indica que está apoyado en los topes que ejercen una fuerza normal de:

$T_1 = 300\ K \qquad P_1V_1 = nRT_1.$

$nR = \frac{P_1V_1}{T_1} = \frac{1}{6}\ J/K$

$N = P_0A + kL - P_1A > 0$





ESTADO FINAL : $\left.\begin{array}{l} T_2 = 3600 K \\ V_2 = 2\times10^{-3}\ m^3 \end{array}\right\} P_2 = \frac{nRT_2}{V_2} = 300\ KPa$

EXISTEN DOS ESTADOS INTERMEDIOS IMPORTANTES:

(A) $N = P_0A + kL - P_A A = 0 \longrightarrow \left.\begin{array}{l} P_A = P_0 + \frac{kL}{A} = 180\ KPa \\ V_A = LA \end{array}\right\} T_A = \frac{P_A V_A}{nR} = 1080\ K$

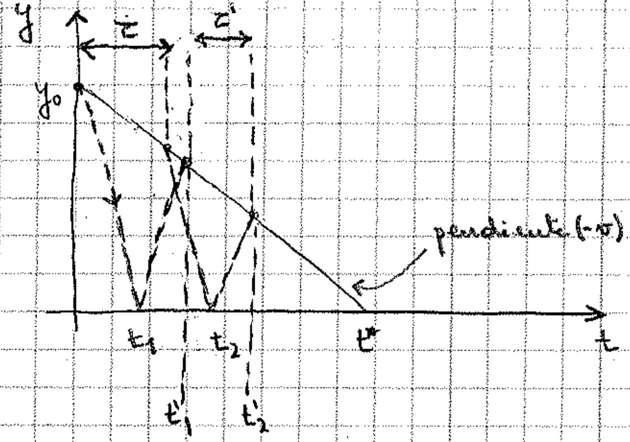
(B) $N = P_0A + 2kL - P_B A = 0 \longrightarrow \left.\begin{array}{l} P_B = P_0 + \frac{2kL}{A} = 260\ KPa \\ V_B = 2LA \end{array}\right\} T_B = \frac{P_B V_B}{nR} = 3120\ K.$

(b) $W = -\int_1^2 P(V)\,dV = \frac{(P_A+P_B)}{2}(V_2 - V_1) = -220\ J$

$Q = \Delta U - W = \frac{5}{2}nR(T_2 - T_1) + 220\ J = 1595\ J$

(c) $\Delta S_u = \Delta S_g + \Delta S_F = \frac{5}{2}nR\ln\left(\frac{T_2}{T_1}\right) + nR\ln\left(\frac{V_2}{V_1}\right) - \frac{Q}{T_F} = 0{,}7\ J/K.$

PROB. 2



$v_s = 1450$ m/s $\quad t'_1 = 1{,}3$ s

$y_v(t) = -vt + y_0$ (VEHÍCULO).

(1) $t_1: \; y_s(t) = -v_s t_1 + y_{01} = 0 \;/\; y_{01} = y_0$

$t_1 = \dfrac{y_0}{v_s}$

(2) $t_2: \; y_s(t_2) = -v_s t_2 + y_{02} = 0 \;/$

$y_{02} = y_v(t=\tau) = -v\tau + y_0$

$t_2 = \dfrac{(v_s - v)\tau + y_0}{v_s}$

$\tau' = t'_2 - t'_1$

(1') $y_s(t) = v_s(t - t_1)$

$y_s(t'_1) = y_v(t'_1)$

$v_s(t'_1 - t_1) = -vt'_1 + y_0 \longrightarrow t'_1 = \dfrac{2y_0}{v_s + v}$

(2') $y_s(t) = v_s(t - t_2)$

$y_s(t'_2) = y_v(t'_2)$

$v_s(t - t_2) = -vt'_2 + y_0 \longrightarrow t'_2 = \dfrac{(v_s - v)\tau + 2y_0}{v_s + v}$

$\tau' = \dfrac{(v_s - v)}{(v_s + v)}\tau$

$$\boxed{f' = \frac{(v_s + v)}{(v_s - v)} f}$$

PARTE B: $\quad (v_s - v) f' = (v_s + v) f \longrightarrow v = \dfrac{v_s (f' - f)}{f' + f} = 14{,}36$ m/s

$t^* = \dfrac{y_0}{v} \;/\; y_0 = \dfrac{(v_s + v) t'_1}{2} \longrightarrow y_0 = 952$ m ; $t^* = 66{,}3$ s

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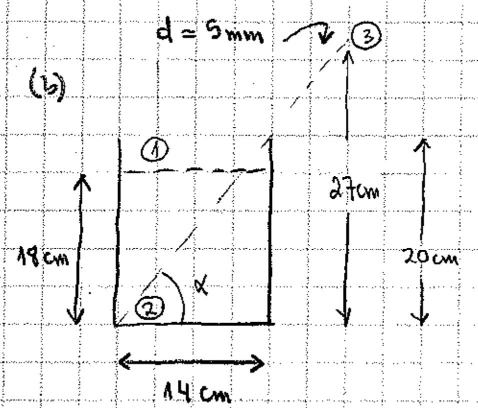
PROB 3 $\quad$ (a) $F_{FLOT} = mg \rightarrow \frac{2}{3}\rho_0 g V_T = \rho g V_T \rightarrow \boxed{\rho = \frac{2}{3}\rho_0}$

(b)



$P_0 + \rho g h_1 + \rho \dfrac{v_1^2}{2} = P_3 + \rho g h_3 + \rho \dfrac{v_3^2}{2}$

$P_3 = P_0 - \Delta P \;/\; \Delta P = 3$ kPa $\qquad h_3 - h_1 = 9$ cm

$v_1 \dfrac{\pi D^2}{4} = v_3 \dfrac{\pi d^2}{4} \longrightarrow v_3 = 784\, v_1 \gg v_1$

$v_3^2 \cong 2\left(\dfrac{\Delta P}{\rho_0} - g(h_3 - h_1)\right)$; $\dot{V} = \dfrac{\pi d^2}{4} v_3 = 40{,}4$ cm³/s

(c) TUBO ABIERTO - ABIERTO $\quad \Delta P(x=0, t) = 0$
$\Delta P(x=L, t) = 0$

$k_n = \dfrac{n\pi}{L} = \dfrac{2\pi f_n}{v} \rightarrow f_n = \dfrac{nv}{2L}$

$\tg \alpha = \dfrac{20}{14} = \dfrac{27}{14 + a} \longrightarrow a = 4{,}9$ cm $\longrightarrow L = (18{,}9^2 + 27^2)^{1/2} = 33$ cm

$f_1 = 519{,}7$ Hz ; $f_2 = 1039{,}4$ Hz $\dashrightarrow f_{38} = 19748$ Hz