SOLUCIONES EXAMEN FISICA I 13/XI/12 Mar 2002

$[P] = L^2MT^{-3}$
$[\rho] = L^{-3}M$
$[v] = LT^{-1}$
$[A] = L^2$

$\Pi = L^0M^0T^0 = (L^2MT^{-3})^{a_1}(L^{-3}M)^{a_2}(LT^{-1})^{a_3}(L^2)^{a_4}$

L: $2a_1 - 3a_2 + a_3 + 2a_4 = 0$
M: $a_1 + a_2 = 0$
T: $-3a_1 + a_3 = 0$

$$\begin{pmatrix} 2 & -3 & 1 & 2 \\ 1 & 1 & 0 & 0 \\ -3 & 0 & -1 & 0 \end{pmatrix} \neq 0$$

$h = 3 \rightarrow i = 4-3 = 1$ MONOPIO Π

haciendo $a_1 = 1 \Rightarrow$ resolviendo obtenemos $a_2 = -1$, $a_3 = -3$ $a_4 = -1$

$\Pi = CTE = K = \frac{P}{\rho v^3 A} \Rightarrow \boxed{P = K\rho v^3 A}$

MODELO	PROTOTIPO
ρ_M	$\rho_P = \rho_M$
A_M	$A_P = 50^2 A_M$
$v_M = 2v_P$	v_P
P_M	P_{PROT}

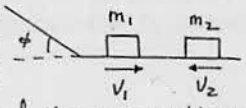
$\Pi_M = \Pi_P \rightarrow$ SIMILITUD COMPLETA

$$\frac{P_M}{\rho_M v_M^3 A_M} = \frac{P_P}{\rho_P v_P^3 A_P} \rightarrow \boxed{P_M = \left(\frac{v_M}{v_P}\right)^3 \left(\frac{A_M}{A_P}\right) P_P} = \left(\frac{2v_P}{v_P}\right)^3 \left(\frac{A_M}{2500 A_M}\right) 75000 = \boxed{240\,W}$$

2º Dos partículas de masa $m_1 = 2$ kg y $m_2 = 3$ kg se mueven inicialmente con las velocidades que se indican en la figura sobre un plano horizontal sin rozamiento. Hallar:

a.) La energía mecánica que se pierde en el choque, si el coeficiente de restitución vale 0.8.

b) La altura máxima alcanzada por el bloque 1 y el tiempo que invierte en subir por el plano inclinado, sabiendo que el coeficiente de rozamiento con este plano vale 0.3.



Datos: $V_1 = 2\,m/s$, $V_2 = 3\,m/s$, $\phi = 30°$

a)

$\boxed{E_{m,i}} = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}\times 2\times 2^2 + \frac{1}{2}\times 3\times 3^2 = \boxed{17.5\,J}$

$E_{m,F} = \frac{1}{2}m_1v_{1,F}^2 + \frac{1}{2}m_2v_{2,F}^2$

Cálculo de v_{1F}, v_{2F}:

$P = cte \Rightarrow m_1v_1 + m_2v_2 = m_1v_{1F} + m_2v_{2F}$

$(\longrightarrow v>0)$ $2\times 2 + 3\times(-3) = m_1v_{1F} + m_2v_{2F}$

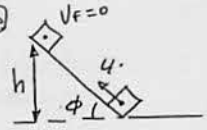
$e = -\frac{(v_{2F} - v_{1F})}{v_{2i} - v_{1i}} = 0.8 \Rightarrow -\frac{(v_{2F} - v_{1F})}{-3-2} = 0.8$ $\Rightarrow$

$\Rightarrow \begin{cases} v_{1F} = -3.4\,m/s & (\longleftarrow v_{1F} \text{ es hacia la izda}) \\ v_{2F} = 0.6\,m/s & (\longrightarrow v_{2F} \text{ " " " dcha}) \end{cases}$

$\boxed{E_{m,F}} = \frac{1}{2}\times 2\times(-3.4)^2 + \frac{1}{2}\times 3\times 0.6^2 = \boxed{12.1\,J}$

$\boxed{\Delta E_m} = E_{m,F} - E_{m,i} = \boxed{-5.4\,J}$

b)



$\vec{\Sigma F} = m\cdot\vec{a} \Rightarrow \begin{cases} -W_t - F_{rc} = m\cdot a \\ W_n - N = 0 \end{cases}$

$a = -\frac{(mg\,sen\phi + \mu mg\cos\phi)}{m}$

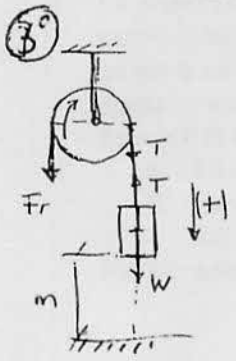
$\boxed{a} = -g(sen\phi + \mu\cos\phi) = -10(1/2 + 0.3\sqrt{3}/2) = \boxed{-7.6\,m/s}$

$v_F^{\cancel{2}} = v_0^2 + 2as$ $\quad s = -\frac{v_0^2}{2a} = \frac{(3.4)^2}{2\times 7.6} = 0.76\,m$

$\boxed{h} = s\cdot sen\phi = 0.76\times\frac{1}{2} = \boxed{0.38\,m}$

$v_F^{\cancel{0}} = v_0 + a\cdot t \Rightarrow \boxed{t} = -\frac{v_0}{a} = \frac{3.4}{7.6} = \boxed{0.45\,s}$

3º



$W - T = m\cdot a$

$T\cdot R - F_t\cdot R = I\cdot\alpha$

$a = \alpha\cdot R$

$I = \frac{1}{2}m_{polea}\cdot R^2$

$W - F_t = a(m + \frac{1}{2}m_p)$

$a = \frac{200\times 10 - 900}{200 + 70} = 4'07\,(m/s^2)$

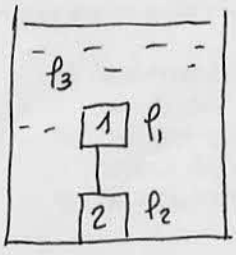
Cabina: $\boxed{E_c} = \frac{1}{2}mv^2 = \boxed{1628\,J}$

$v^2 = \cancel{v_0^2} + 2as = 2\times 4{,}07\times 2 = 16{,}28\,(m/s)$

Polea: $\boxed{E_c} = \frac{1}{2}I\omega^2 = \frac{1}{2}\cdot\frac{1}{2}m_p\cdot R^2\cdot\left(\frac{v}{R}\right)^2 = \frac{1}{4}m_p\cdot v^2$

$= \frac{1}{4}\times 140\times 16{,}28 = \boxed{569{,}8\,J}$

4º



1)

$E_1 - m_1g - T = m_1a$

$E_2 - m_2g + T = m_2a$

$E_1 + E_2 - (m_1 + m_2)g = (m_1 + m_2)a$

$\rho_3gV + \rho_3gV - (\rho_1V + \rho_2V)g = (\rho_1V + \rho_2V)a$

$a = \frac{(2\rho_3g - (\rho_1 + \rho_2)g)\cancel{V}}{(\rho_1 + \rho_2)\cancel{V}} = \frac{(2\rho_3 - \rho_1 - \rho_2)}{\rho_1 + \rho_2}g = \frac{2 - 0'4 - 0'8}{0'4 + 0'8}g$ (*)

$\Rightarrow a = \frac{0'8}{1'2}g = \frac{2}{3}g = \boxed{6'54\,m/s^2 = a}$

$V_1 = V_2 = V$

(*) $\frac{2\cdot 1000 - 400 - 800}{400 + 800} = \frac{800}{1200} = \frac{2}{3}$

2) $T = m_2a - E_2 + m_2g = \rho_2Va - \rho_3Vg + \rho_2$
$= 800\cdot 5\cdot 10^{-3}\,6'54 - 1000\cdot 5\cdot 10^{-3}\,9'8 + 800\cdot 5\cdot 10^{-3}$
$= 16'35\,N\,10^{-3} = 0'0163\,5\,N$

3) $H = \cancel{v_0t}^{\,0} + \frac{1}{2}at^2 = \frac{1}{2}\frac{2}{3}gt^2 = 10$

$\Rightarrow t = \sqrt{\frac{3H}{g}} = \sqrt{\frac{30}{9'8}} \simeq 1'75\,s$