SOLUCIONES FISICA I (24/I/14)

1er Problema

$[C] = L^2 M T^{-2}$

$[R] = L$

$[\omega] = T^{-1}$

$[\rho] = L^{-3} M$

$[\eta] = L^{-1} M T^{-1}$

$\Pi = C\, R^{a_1} \omega^{a_2} \rho^{a_3} \eta^{a_4} \rho^{a_5} = (L^2 M T^{-2})^{a_1} L^{a_2} (T^{-1})^{a_2} (L^{-3} M)^{a_3} (L^{-1} M T^{-1})^{a_4} = L^0 M^0 T^0$

$$\begin{cases} L: & 2a_1 + a_2 - 3a_3 - a_4 = 0 \\ M: & a_1 + a_3 + a_4 = 0 \\ T: & -2a_1 - a_4 = 0 \end{cases} \rightarrow \left(\begin{array}{cccc|c} 2 & 1 & 0 & -3 & -1 \\ 1 & 0 & 0 & 1 & 1 \\ -2 & 0 & -1 & 0 & -1 \end{array}\right) \begin{cases} h = 3 \\ i = n - h = 5 - 3 = 2 \end{cases}$$

$\neq 0$

2 MONOMIOS Π

haciendo $a_1 = 1$, $a_5 = 0$: $\begin{cases} a_2 = -5 \\ a_3 = -2 \\ a_4 = -1 \end{cases} \Rightarrow \Pi_1 = \dfrac{C}{\rho \omega^2 R^5}$

$a_1 = 0$, $a_5 = 1$: $\begin{cases} a_2 = -2 \\ a_3 = -1 \\ a_4 = -1 \end{cases} \Rightarrow \Pi_2 = \dfrac{\eta}{\rho \omega R^2}$

$F(\Pi_1, \Pi_2) = 0 \Rightarrow \Pi_1 = \varphi(\Pi_2) \rightarrow \dfrac{C}{\rho \omega^2 R^5} = \varphi\left(\dfrac{\eta}{\rho \omega R^2}\right) \Rightarrow \boxed{C = \rho \omega^2 R^5\, \varphi\left(\dfrac{\eta}{\rho \omega R^2}\right)}$ (1,8 p)

2º Problema

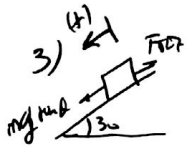
$\sin 30 = \dfrac{h}{1'6}$

1) $v_F^2 - v_i^2 = 2ae \rightarrow a = \dfrac{0 - 4^2}{2 \cdot 1'6} = -7'81\ (m/s^2)$ 0'5 p

2) $-Froz - mg \sin\theta = ma$

$Froz = -mg \sin\theta - ma = m|g \sin\theta - a| = 12\,|10 \tfrac{1}{2} - (-7'81)| = +33'72\ (N)$ (0'6 p)

$Froz = \mu_c N = \mu_c\, mg \cos\theta \Rightarrow \mu_c = \dfrac{Froz}{mg\cos\theta} = \dfrac{33'72}{12 \cdot 10 \cdot \sqrt{3}/2} = 0'324$



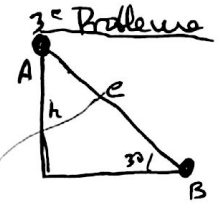
3) $mg \sin\theta - Froz = ma$

$12 \cdot 10 \cdot \tfrac{1}{2} - 33'72 = 12a \rightarrow a = 2'19\ (m/s^2)$ (0'8 p)

$v'_A = \sqrt{v_0^2 + 2ae} = \sqrt{0^2 + 2 \cdot 2'19 \cdot 1'6} = \sqrt{7} = 2'65\ (m/s)$

4) $\vec{p} = C\vec{T}E$ $\quad mv_A = (m+m) v_F \rightarrow v_F = \dfrac{v'_A}{2} = \dfrac{2'64}{2} = 1'33\ (m/s)$ (0'5 p)

3er Problema



$mg \sin\theta - Fr = ma$

$Froz \cdot R = \dfrac{2}{5} mR^2 \dfrac{a}{R}$ $\quad a = \alpha R$

$\begin{cases} Fr = \dfrac{2}{5} ma \\ mg \sin\alpha = ma + \dfrac{2}{5} ma \end{cases} \rightarrow a = 3'57\ m/s^2$ (0'7 p)

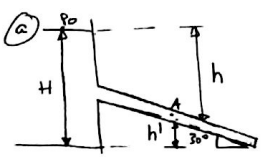
2) $Froz = \dfrac{2}{5} ma = \dfrac{2}{5} 7 \cdot 3'57 = 10'1\ N$ (0'3 p)

3) $v_B^2 = 2ae = 2 \cdot 3'57 \cdot 14 = 100 \rightarrow v_B = 10\ m/s$ (0'5 p)

$\omega = v_B / R = 10/0'5 = 20\ rad/s$

$\sin 30 = h/e \Rightarrow e = 7/0'5 = 14\ m$

4º Problema

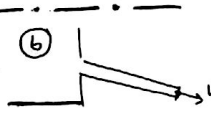


$P_A = p_0 + \rho_{H_2O} \cdot g \cdot h$

$h = H - h' = H - l \cdot \sin(30°)$

$P_A = 10^5 + 10^3 \times 10 \times 4{,}75 =$

$= 1{,}475 \times 10^5\ Pa$ (0'6 p)



Tma Torricelli: $v_B = \sqrt{2gH} = 10 m/s$

$S_A \cdot v_A = S_B \cdot v_B$, $S_A = S_B \Rightarrow v_A = v_B$

$Q = v_B S_B = 10 \times 9 \times 10^{-4} = 9 \times 10^{-3}\ m^3/s$

(A-B) Bernoulli: $P_A + \tfrac{1}{2}\rho v_A^2 + \rho g z_A = P_B + \tfrac{1}{2}\rho v_B^2 + \rho g z_B$

$P_B = p_{atm}$, $v_A = v_B$, $z_A = h'$, $z_B = 0$

$P_A = p_{atm} - \rho g h' = 9{,}75 \times 10^4\ Pa$ (1,2 p)