

$$M_1 = L/r \rightarrow 1^{\text{er}} \text{ MONOMIO } P_1$$

$$) \quad \eta = V^{a_1} P^{a_2} r^{a_3} \eta^{a_4} = (L T^{-1})^{a_1} (L^{-1} M T^{-2})^{a_2} L^{a_3} (L^{-1} M T^{-1})^{a_4} = L^{a_1 - a_2 + a_3 - a_4} M^{a_2 + a_4} T^{-a_1 - 2a_2 - a_4} = L^0 M^0 T^0$$

$$[V] = L T^{-1}$$

$$[P] = L^{-1} M T^{-2}$$

$$[r] = L$$

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

$$L: a_1 - a_2 + a_3 - a_4 = 0$$

$$M: a_2 + a_4 = 0$$

$$T: -a_1 - 2a_2 - a_4 = 0$$

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

$$h = 3; i = 4 - 3 = 1 \text{ MONOMIO } \eta$$

$$\text{si } a_1 = 1 \Rightarrow \begin{cases} a_2 = -1 \\ a_3 = -1 \\ a_4 = +1 \end{cases}$$

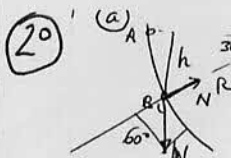
$$\eta_2 = V^1 P^{-1} r^{-1} \eta^{+1} = \frac{V}{P r} \rightarrow F(\eta_1, \eta_2) = 0 \rightarrow \eta_2 = \varphi(\eta_1) \rightarrow \frac{V}{P r} = \varphi(\eta_1) \rightarrow \boxed{V = \frac{P r}{1} \varphi(L/r)} \quad 1,2 p$$

MODELO	PROTOTIPO
r_M	$r_P = 5 r_M$
η_M	$\eta_P = 2 \eta_M$
$V_M = ?$	$V_P = 20 \text{ m/s}$
P_M	$P_P = 3 P_M$

$$\frac{V_M \eta_M}{P_M r_M} = \frac{V_P \eta_P}{P_P r_P}$$

CONDICION DE SIMILITUD TOTAL

$$\frac{V_M \eta_M}{P_M r_M} = \frac{20 \cdot 2 \eta_M}{3 P_M 5 r_M} \rightarrow \boxed{V_M = \frac{40}{15} = 2,67 \text{ m/s}} \quad 0,5 p$$



$$\boxed{V_B} = \sqrt{2gh} = \sqrt{2g \cdot R \cdot \sin(30^\circ)} = \sqrt{50} \text{ m/s}$$

$$\vec{F} = m \vec{a} \Rightarrow \sum F_n = m \cdot a_n \Rightarrow$$

$$N - W \cos(60^\circ) = m \cdot V_B^2 / R$$

$$\boxed{N = m \left[\frac{V_B^2}{R} + g \cos(60^\circ) \right] = 8400 \text{ N}} \quad 0,75 p$$

$$b) \quad V_C = \sqrt{2gR} = 10 \text{ m/s}$$

$$\vec{F} = m \vec{a} \quad -\mu_c \cdot W \cdot g = m a \Rightarrow a = -\mu_c g$$

$$N - W = 0 \quad V_f^2 = V_0^2 + 2as$$

$$V_D^2 = 100 + 2(-0,2 \times 10) \times 5 = 80 \Rightarrow \boxed{V_D = 8,9 \text{ m/s}} \quad 0,75 p$$

$$c) \quad m_1 \vec{v}_1 + m_2 \vec{v}_2 = m_1 \vec{v}_1' + m_2 \vec{v}_2'$$

$$40(8,9) + 60(-8,9) = 40v_1' + 40v_2'$$

$$\boxed{v_1' + v_2' = 0} \quad (1)$$

$$e = 0,3 = \frac{v_2' - v_1'}{v_1 - v_2} = \frac{v_2' - v_1'}{8,9 - (-8,9)} = \frac{v_2' - v_1'}{2 \cdot 8,9}$$

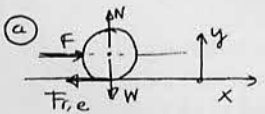
$$\boxed{v_2' - v_1' = 5,34} \quad (2) \quad \text{resolviendo (1) y (2)}$$

obtenemos

$$\boxed{v_2' = 2,67 \text{ m/s}} \quad 0,7$$

$$\boxed{v_1' = -2,67 \text{ m/s}}$$

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$$\sum F_x = F - f_{r,e} = M \cdot a_{cm}$$

$$\sum F_y = N - W = 0$$

$$M a_{cm} = R \cdot f_{r,e} = I \cdot \alpha$$

$$I = MR^2, \quad a_{cm} = \alpha R$$

$$\Rightarrow F = 2M a_{cm} \Rightarrow \boxed{a_{cm} = \frac{F}{2M} = \frac{15}{5} = 3 \text{ m/s}^2}$$

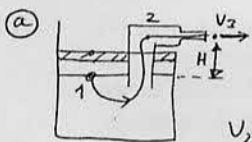
$$\boxed{f_{r,e} = M \cdot a_{cm} = 2,5 \times 3 = 7,5 \text{ N}} \quad 1 p$$

$$c) \quad E_c = \frac{1}{2} M v_{cm}^2 + \frac{1}{2} I_{cm} \omega^2 = \frac{1}{2} M v_{cm}^2 + \frac{1}{2} M R^2 \left(\frac{v_{cm}}{R} \right)^2$$

$$v_{cm} = v_0 + a_{cm} t = 3 \times 2 = 6 \text{ m/s}$$

$$\boxed{E_c = M v_{cm}^2 = 2,5 \times 6^2 = 90 \text{ J}} \quad 0,6$$

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$$Q = 150 \text{ l/min} = 150 \times \frac{10^{-3} \text{ m}^3}{60 \text{ s}} = 2,5 \times 10^{-3} \text{ m}^3/\text{s}$$

$$Q = V \cdot S \Rightarrow V_3 = \frac{2,5 \times 10^{-3}}{5 \times 10^{-4}} = 5 \text{ m/s}$$

$$V_2 \cdot S_2 = V_3 \cdot S_3 \Rightarrow V_2 = V_3 / 2 = 2,5 \text{ m/s}$$

$$\text{Bernoulli: } P_1 + \frac{1}{2} \rho V_1^2 + \rho g z_1 = P_3 + \frac{1}{2} \rho V_3^2 + \rho g z_3$$

$$P_1 = 1,2 \text{ atm} = 1,2 \times 10^5 \text{ Pa} \quad z_1 = 0, \quad z_3 = H, \quad V_1 \approx 0$$

$$P_3 = 1 \text{ atm} = 10^5 \text{ Pa}$$

$$0,2 \times 10^5 - \frac{1}{2} \times 10^3 \times 5^2 = 10^3 \times 10 \times H$$

$$\boxed{H = 0,75 \text{ m}} \quad 1,2 p$$

$$b) \quad P_2 + \frac{1}{2} \rho V_2^2 + \rho g z_2 = P_3 + \frac{1}{2} \rho V_3^2 + \rho g z_3$$

$$z_2 = z_3 \quad \boxed{P_2 = P_3 + \frac{1}{2} \rho (V_3^2 - V_2^2)} = 109,375 \text{ kPa}$$

0,5 p