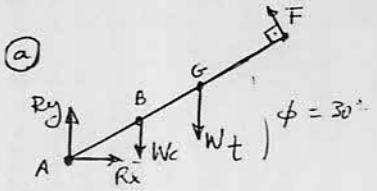
SOLUCIONES FISICA I (PLAN 2002) - 1-II-2012

1º



(a) $\Sigma \vec{M}_A = 0$

$F \cdot \ell - W_t \cdot \frac{\ell}{2} \cos 30° - W_c \overline{AB} \cos 30° = 0$

$F = \left(w_t \cdot \frac{\ell}{2} + w_c \cdot \overline{AB} \right) g \frac{\cos 30°}{\ell}$

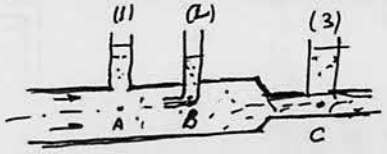
$\overline{F} = \frac{(5 \times 1.5 + 60 \times 0.8) \times 10 \times \sqrt{3}/2}{3} = \overline{160.2\ N}$

(b) $\Sigma \vec{F}_{ext} = 0 \Rightarrow \begin{cases} R_x - F_x = 0 \\ R_y + F_y - W_c - W_t = 0 \Rightarrow R_y = -F \cos 30° + W_{c+t} \end{cases}$

$\overline{R_x} = F_x = F \operatorname{Sen} 30° = \overline{80.1\ N}$

$\boxed{R_y = 511.2\ N}$

4º



CONTINUIDAD $g \simeq 10\ m/s^2$

$S_1 v_A = S_2 v_C = 5 \cdot 10^{-3}\ m^3/s$

$v_A = \frac{5 \cdot 10^{-3}}{40 \cdot 10^{-4}} = 1'25\ m/s$; $v_C = \frac{5 \cdot 10^{-3}}{10 \cdot 10^{-4}} = 5\ m/s$

(A-C) BERNOULLI

$p_A + \frac{1}{2} \rho v_A^2 + \rho g z_A = p_C + \frac{1}{2} \rho v_C^2 + \rho g z_C \Rightarrow p_A - p_C = \frac{1}{2} \rho (v_C^2 - v_A^2)$

$z_A = z_C$ $\quad p_A = p_0 + \rho g h_1$ $\quad p_0 - p_C = \rho g (h_1 - h_3) = \frac{1}{2} \rho (v_C^2 - v_A^2)$

p_0: p. atmosférica $\quad p_C = p_0 + \rho g h_3$

$\boxed{h_1 - h_3 = \frac{v_C^2 - v_A^2}{2g} = \frac{18'75}{16}\ m = 1'09\ m}$

(A-D) BERNOULLI

$p_A + \frac{1}{2} \rho v_A^2 + \rho g z_A = p_D + \frac{1}{2} \rho v_D^2 + \rho g z_D \Rightarrow p_B - p_A = \frac{1}{2} \rho v_A^2 = \rho g (h_2 - h_1)$

$z_A = z_B$ $\quad v_D = 0$ $\quad p_A = p_B + \rho g h_1$ $\quad p_B = p_D + \rho g h_2$ $\quad p_D - p_A = \rho g (h_2 - h_1)$ $\Rightarrow h_2 - h_1 = \frac{v_A^2}{2g} = 1'8\ cm$

1º

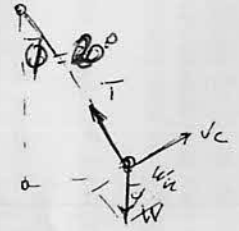
(a) $v_{F,A} = \sqrt{2gh} = \sqrt{2g\ell(1 - \cos\phi)} =$

$= \left[2 \times 10 \times 10 \left(1 - 1/2 \right) \right]^{1/2} = \overline{10\ m/s}$

Luego $\beta = cte \Rightarrow \mu_A \cdot v_{F,A} = (\mu_A + \mu_S) \cdot v_F$

$\boxed{v_F = \frac{\mu_A}{\mu_A + \mu_S} v_{F,A} = \frac{1}{2} v_{AA} = 5\ m/s}$

(b)



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

$T - W_n = m \frac{v_c^2}{\ell}$

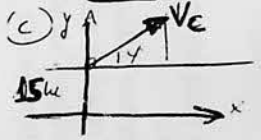
$T = m \left(g \cos\phi + \frac{v_c^2}{\ell} \right) = 2'70 \left(10 \cos 20° + \frac{36}{10} \right) = 1'497\ N$

Para hallar v_c, $E_m = cte \Rightarrow$

$\Rightarrow \frac{1}{2} (m_A + m_B) v_F^2 = (m_A + m_B) g h + \frac{1}{2} (m_A + m_B) v_c^2$

$\boxed{v_c^2 = v_F^2 - 2gh = v_F^2 - 2g\ell(1 - \cos\phi) = \overline{3'6\ m/s}}$

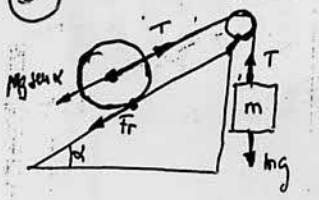
(c)



$y = y_0 + v_{0y} t + \frac{1}{2} g t^2 = 15 + 1'23 t - 5 t^2 = 0$

$\Rightarrow \begin{cases} \overline{t = 1'86\ s} \\ t < 0 \text{ (no sirve)} \end{cases}$

3º



Aplicando la 2ª ley de Newton de la Traslación y de la Rotación

$T - F_r - Mg \operatorname{sen}\alpha = Ma$

$mg - T = ma$

$F_r \cdot R = I\alpha = \frac{1}{2} MR^2 \frac{a}{R}$

Resolviendo sacamos:

$F_r = \frac{1}{2} Ma$

$a = \frac{g(m - M \operatorname{sen}\alpha)}{\frac{3}{2} M + m}$

$T = m(g - a)$.

Numéricamente

sen α = 0'5 $\quad m = 20\ kg$

$M = 5\ kg$

$\boxed{a = \frac{10(20 - 5 \cdot 1/2)}{\frac{3}{2} 5 + 20} = \frac{350}{65} = \overline{5'38\ m/s^2}}$; $\boxed{T = 20(10 - 5'38) = 87'4\ N}$

$\boxed{F_{roz} = \frac{1}{2} Ma = \frac{1}{2} 50 \cdot \left(\frac{350}{65} \right) = \overline{13'46\ N}}$