

PAUTA P1 EJ 2

$$h = H - R \sin \theta; \quad y = R \sin \theta; \quad x = R \cos \theta$$

$$\theta_0 = \sin^{-1}(H/R) \approx 60^\circ = \pi/3; \quad dA = w R d\theta; \quad p = \rho g h$$

$$F_v = \int p dA_y = \int \rho g h dA \sin \theta = \int_0^{\theta_0} \rho g (H - R \sin \theta) \sin \theta w R d\theta$$

$$F_v = \rho g w R \int_0^{\theta_0} (H \sin \theta - R \sin^2 \theta) d\theta = \rho g w R \left[ -H \cos \theta - R \left( \frac{\theta}{2} - \frac{\sin 2\theta}{4} \right) \right] \Big|_0^{\theta_0}$$

$$= \rho g w R \left[ H(1 - \cos \theta_0) - R \left( \frac{\theta_0}{2} - \frac{\sin 2\theta_0}{4} \right) \right]$$

$$F_v = 999 \frac{\text{kg}}{\text{m}^3} \cdot 9,81 \frac{\text{m}}{\text{s}^2} \cdot 3,55 \text{ m} \cdot 0,75 \text{ m} \left[ 0,65 \text{ m} (1 - \cos 60^\circ) - 0,75 \text{ m} \left( \frac{\pi}{6} - \frac{\sin 120^\circ}{4} \right) \right]$$

$$F_v = 2470,5 \text{ [N]}$$

$$x' F_v = \int x dF_v$$

$$x' F_v = \rho g w R \int_0^{\theta_0} R \cos \theta (H \sin \theta - R \sin^2 \theta) d\theta$$

$$= \rho g w R^2 \int_0^{\theta_0} (H \sin \theta \cos \theta - R \sin^2 \theta \cos \theta) d\theta$$

$$x' F_v = \rho g w R^2 \left[ H \frac{\sin^2 \theta}{2} - R \frac{\sin^3 \theta}{3} \right] \Big|_0^{\theta_0}$$

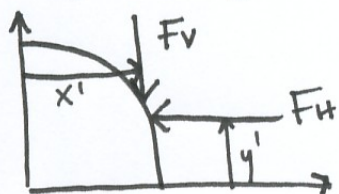
$$x' = \frac{\rho g w R^2}{F_v} \left[ \frac{H}{2} \sin^2 \theta_0 - \frac{R}{3} \sin^3 \theta_0 \right] = 0,644 \text{ [m]}$$

$$F_H = p_c A = \rho g h_c H W = \rho g \frac{H}{2} H W = \rho g \frac{H^2 W}{2}$$

$$= \frac{1}{2} \cdot 999 \cdot 9,81 \cdot (0,65)^2 \cdot 3,55 = 7349,5 \text{ [N]}$$

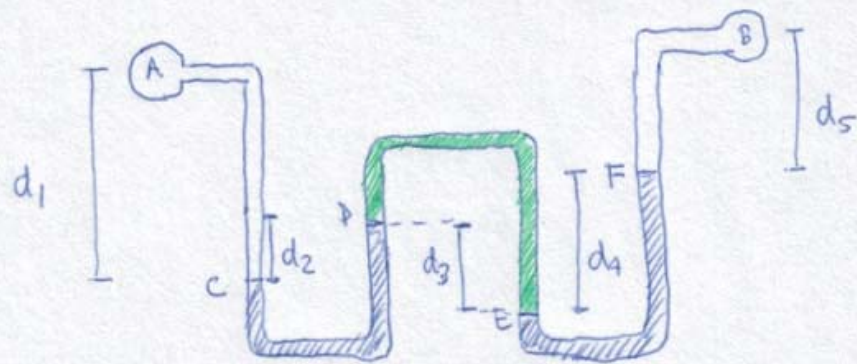
$$h' = h_c + \frac{I}{h_c A} = h_c + \frac{1}{12} \frac{W H^3}{h_c A} = \frac{H}{2} + \frac{1}{12} \frac{W H^3}{\frac{H}{2} \cdot H W} = \frac{H}{2} + \frac{H}{6} = \frac{2}{3} H$$

$$y' = H - h' = H - \frac{2}{3} H = \frac{1}{3} H = 0,217 \text{ [m]}$$





## PAUTA Problema 2, Ejercicio 2.



Las diferencias de presión entre puntos sucesivos son:

$$P_C - P_A = \rho_{H_2O} g d_1$$

$$P_D - P_C = -\rho_{H_2O} g d_2$$

$$P_E - P_D = \rho_{oil} g \cdot d_3$$

$$P_F - P_E = -\rho_{H_2O} g d_4$$

$$P_B - P_F = -\rho_{H_2O} g \cdot d_5$$

Multipliando todas las ecuaciones por  $-1$  y sumando se obtiene:

$$P_A - P_B = g \left( -\rho_{H_2O} d_1 + 13,6 \rho_{H_2O} d_2 - 0,88 \rho_{H_2O} d_3 + 13,6 \rho_{H_2O} d_4 + \rho_{H_2O} d_5 \right)$$

$$= g \cdot \rho_{H_2O} (-10 + 40,8 - 3,52 + 68 + 8) \text{ in}$$

$$= 32,2 \frac{\text{ft}}{\text{s}^2} \cdot 1,94 \frac{\text{slug}}{\text{ft}^3} \cdot 103,3 \text{ m} \cdot \frac{\text{ft}}{12 \text{ in}} \cdot \frac{\text{ft}^2}{144 \text{ in}^2} \cdot \frac{\text{lb}_f \cdot \text{s}^2}{\text{slug} \cdot \text{ft}}$$

$$\Rightarrow P_A - P_B = 3,73 \frac{\text{lb}_f}{\text{in}^2}$$