



Universidad Tecnológica Nacional

►► **Facultad Regional Buenos Aires**

Resueltos

Materia

Física I

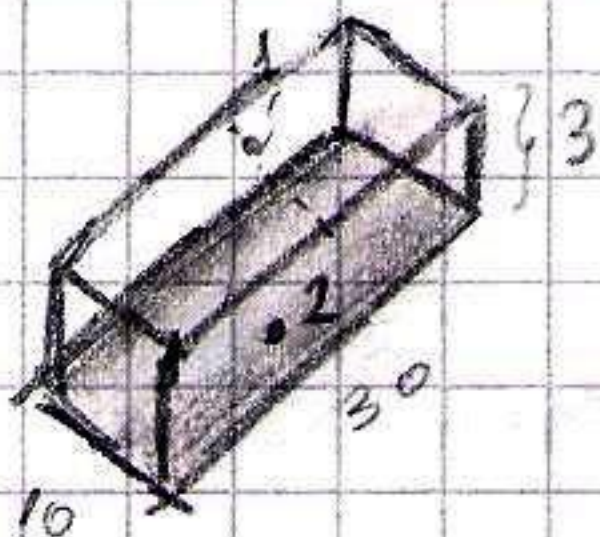
Autor

Rodrigo Maranzana

Tema

Fluidos

1)



2)

$$p' = p + \rho g (y' - y)$$

$$p = 101300 + 1000 \cdot 10 (3)$$

$$p = 131300 \text{ Pa}$$

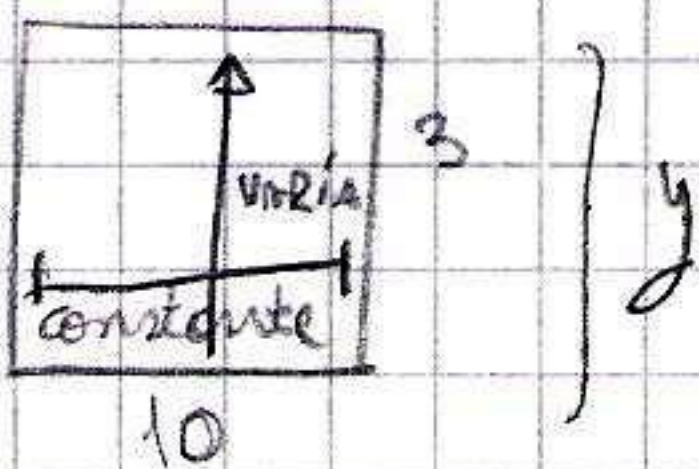
$$\rho_{\text{agua}} = 1000 \text{ kg/m}^3 = 1000 \text{ kg/m}^3$$

$$p = \frac{F}{A}$$

$$131300 \cdot (10 \cdot 30) = F$$

$$3,94 \times 10^7$$

b) • Presión no constante



$$\int p dA = F$$

$$p = p_{\text{sup}} + \rho g h$$

$$\int (p_{\text{sup}} + \rho g h) dA = F$$

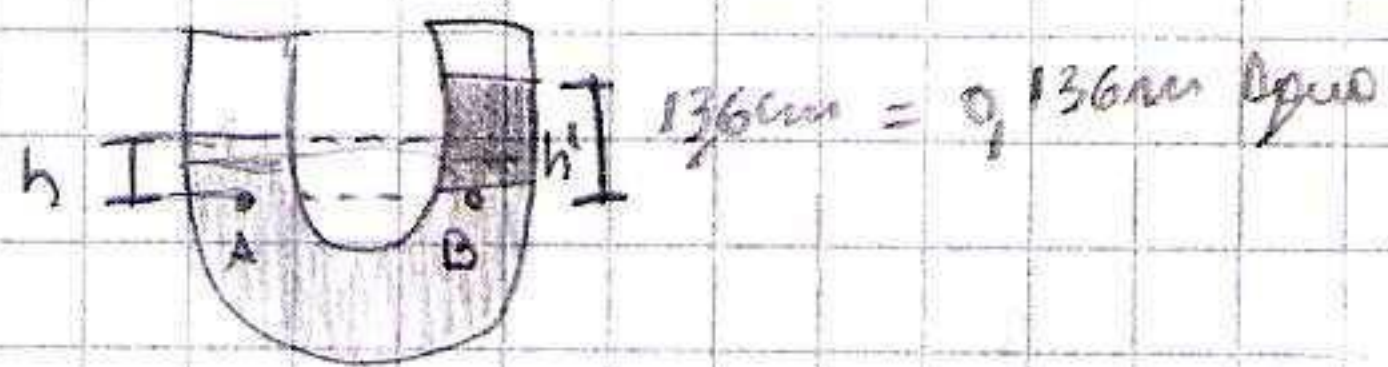
$$\int_0^3 [p_{\text{atm}} + 1000 \cdot 10 y] (dy) = F$$

$$\left[p_{\text{atm}} y + \frac{10000 y^2}{2} \right]_0^3$$

$$F = 3 p_{\text{atm}} + \frac{1000 \cdot 3^2}{2}$$

$$F = 3,1 \times 10^6 \text{ N}$$

2)



$$\rho_{\text{merc}} = 13530 \text{ kg/m}^3$$

$$p_A = p_B$$

$$p_{\text{atm}} + \rho_{\text{Hg}} \cdot g \cdot h_1 = p_{\text{atm}} + \rho_{\text{agua}} \cdot g \cdot h_2$$

$$13530 \cdot h_1 = 1000 \cdot (0,136)$$

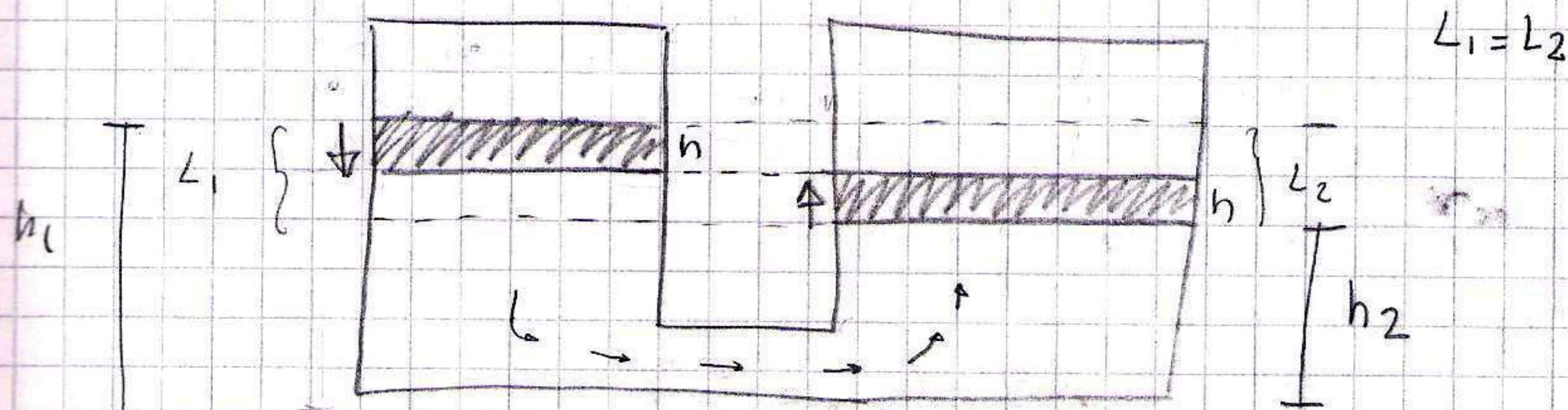
$$h_1 = 2 \cdot h_0$$

$$0,5 \text{ cm} = h_0$$

$$h_1 = 0,01$$

3)

$$\rho = ?$$



$$F \cdot \Delta r = L_p$$

$$P \cdot \left(\frac{h_1 - h_2}{2} \right) = L_p$$

$$\rho \cdot V \cdot g \cdot \left(\frac{h_1 - h_2}{2} \right) = L_p$$

$$\rho \cdot g \cdot A \cdot \left(\frac{h_1 - h_2}{2} \right) \cdot \left(\frac{h_1 - h_2}{2} \right) = L_p$$

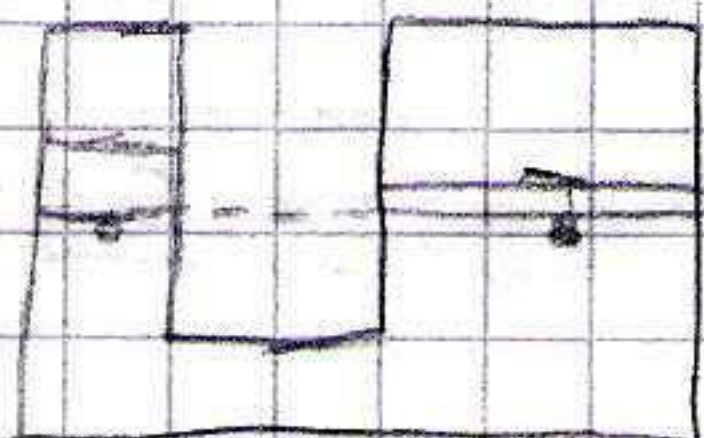
$$A \cdot \rho \cdot g \cdot \left(\frac{h_1 - h_2}{4} \right)^2 = L_p$$

4) a) $p_1 = p_2$

$$\frac{F}{A} = \frac{f}{a} \Rightarrow F = \frac{f}{a} A$$

b) $\frac{F \cdot a}{A} = F$

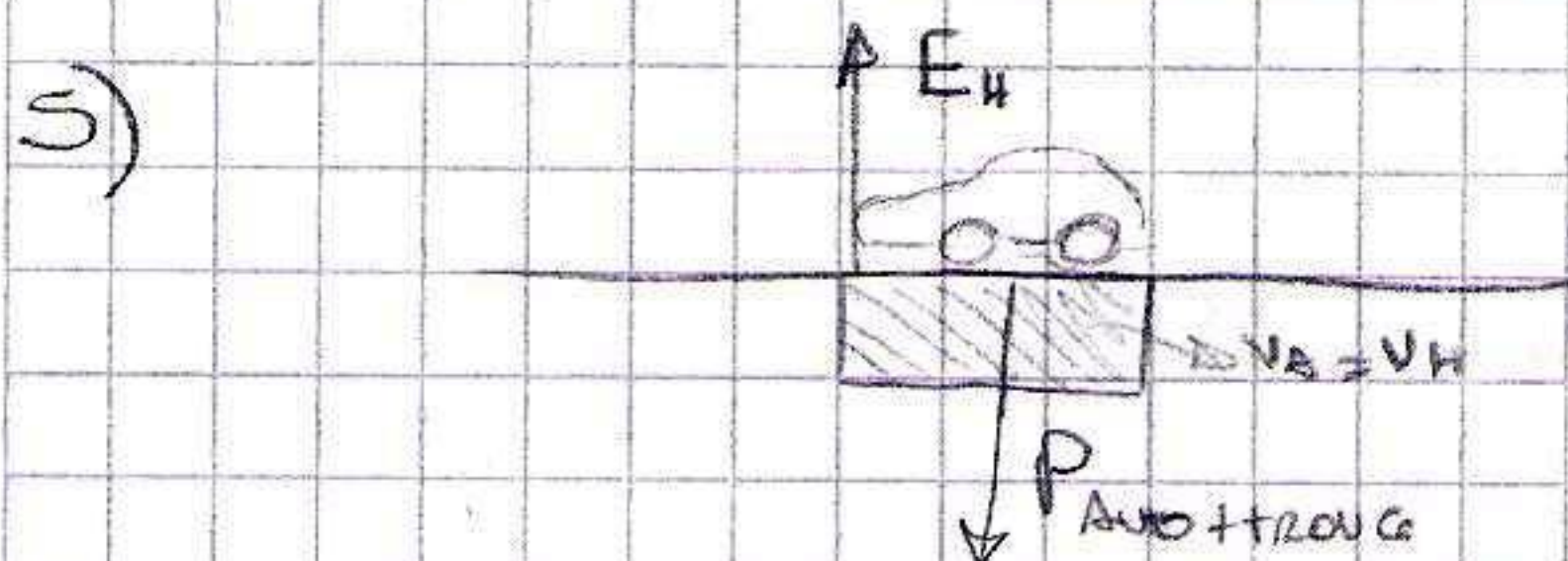
$$\frac{2000 \text{ kg} \cdot \frac{\pi d^2}{4}}{\frac{\pi D^2}{4}} = \frac{2000 \text{ kg} \cdot 0,05^2}{0,6^2} = 13,89 \text{ kg}$$



$$V_A = V_B$$

$$\pi (0,05)^2 \cdot 0,3 = \pi \cdot h \cdot 0,6^2$$

$$h = 2,1 \times 10^{-3} \text{ m} \Rightarrow 0,21 \text{ cm}$$



$$E = P$$

$$\rho = 900 \text{ kg/m}^3$$

$$\rho = \frac{P}{g \cdot V}$$

$$E_{\text{agua}} = P_{\text{H}_2\text{O}} + P_{\text{Auto}}$$

$$\sum \rho \cdot g \cdot V_{\text{sum}} = \sum \rho \cdot g \cdot V_{\text{H}_2\text{O}} + P_{\text{Auto}}$$

$$1000 \cdot V_{\text{sum}} = 900 \text{ N/m}^3 \cdot V_{\text{H}_2\text{O}} + 12000 \text{ N}$$

$$1000 \cdot V_{\text{sum}} = 12000 \text{ N}$$

$$V = 12 \text{ m}^3$$

Para que sea mínimo
tiene que estar totalmente
sumergido. Es decir $V_{\text{H}_2\text{O}} = V_{\text{agua sumergido}}$

$$\rho_{\text{agua}} = 1000 \text{ kg/m}^3$$

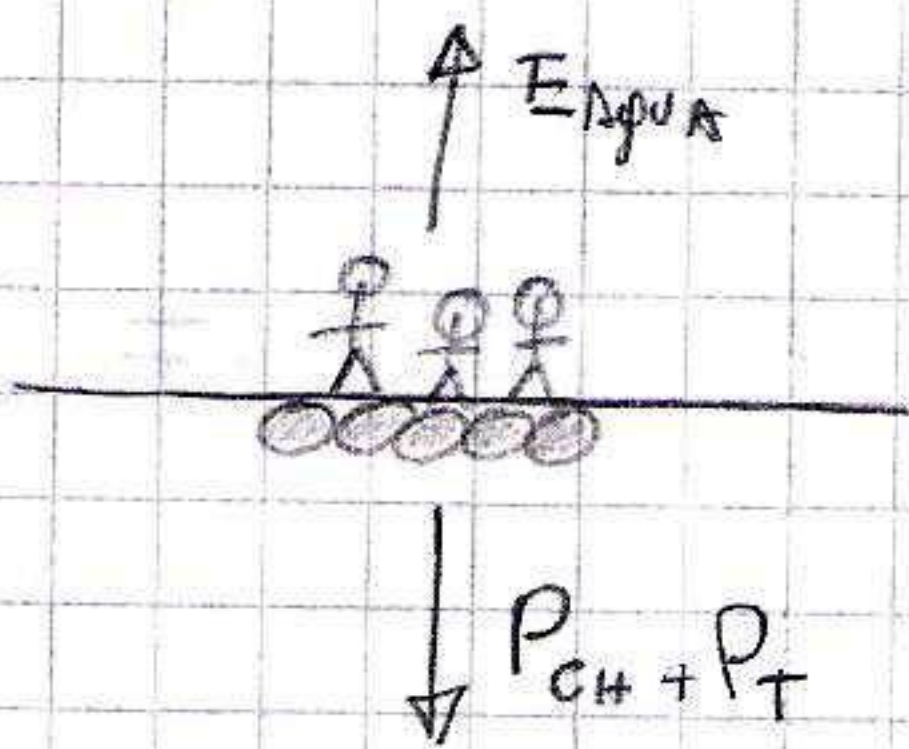
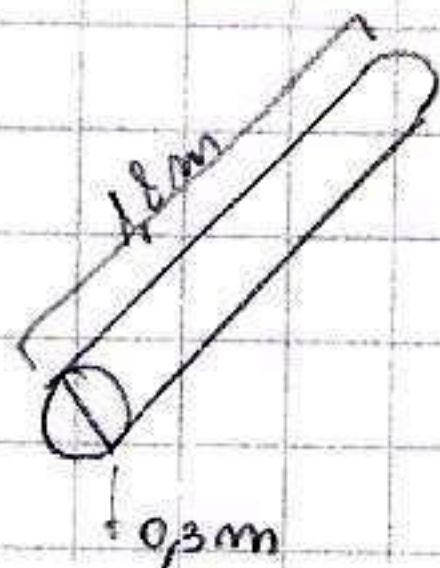
$$V = L_1 \cdot L_2 \cdot h$$

$$12 = \text{Area} \cdot 2$$

$$\boxed{6 \text{ m}^2 = \text{Area}}$$

6) $P_{CH} = 400 \text{ N}$

$\rho_m = 800 \text{ kg/m}^3$



$V_{sum} = V_{tronco}$

$V_{tronco} = \pi \cdot r^2 \cdot h$
 $V_{tronco} = 0,12 \text{ m}^3$

$E_{AGUA} = P_{CH} + P_{tronco}$

$\rho_a \cdot g \cdot V_{sum} = 1200 \text{ N} + \rho_{tronco} \cdot g \cdot V_{tronco}$
 $n_{tr} (10000 \cdot 0,13 \text{ m}^3) = 1200 \text{ N} + (8000 \cdot 0,13 \text{ m}^3) n_{tr}$

$n_{troncos} = 5$

7)



$E_{aceite} = \frac{9}{10} V = V_s$

$E_{agua} = \frac{2}{3} V = V_s$

$\rho_{aceite} \cdot V_s = \rho_{tr} \cdot V_{tr}$ $\rho_{agua} \cdot V_s = \rho_{tr} \cdot V_{tr}$

$\rho_{aceite} \cdot \frac{9}{10} V = \rho_{tr} \cdot V$ $1000 \left(\frac{2}{3} V \right) = \rho_{tr} \cdot V$

b) $\rho_{aceite} = 0,67 \cdot \frac{10}{9}$

a) $\rho_{tr} = 0,67 \text{ g/cm}^3$

$\rho_{aceite} = 0,74 \text{ g/cm}^3$

FECHA

8)



$$\rho_H = 7800 \text{ kg/m}^3$$

$$V_{\text{esfera}} = \frac{4}{3} \pi r^3$$



$$E = P$$

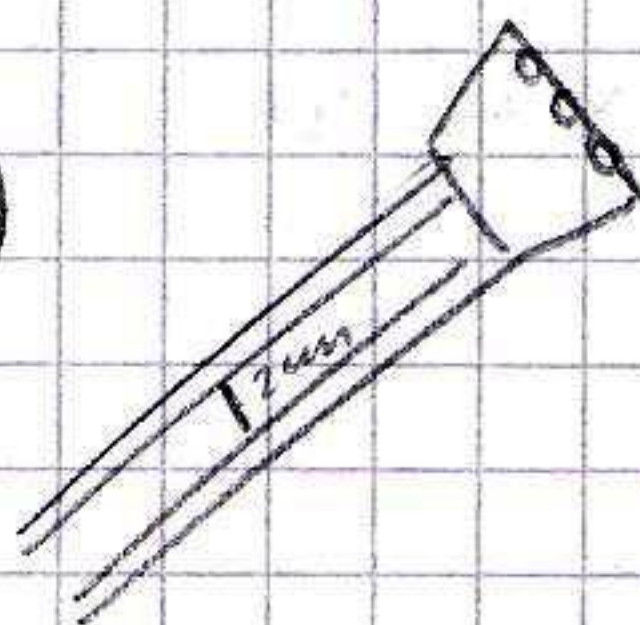
$$(V_E - V_i)$$

$$\rho_A \cdot V_s \cdot g = \rho_H \cdot V_c \cdot g$$

$$1000 \cdot \frac{4}{3} \pi \cdot 0,3^3 = 7800 \cdot \frac{4}{3} \pi (0,3^3 - r_i^3)$$

$$r_i = 0,287 \text{ m}$$

9)



$$v_1 \cdot A_1 = v_2 \cdot A_2$$

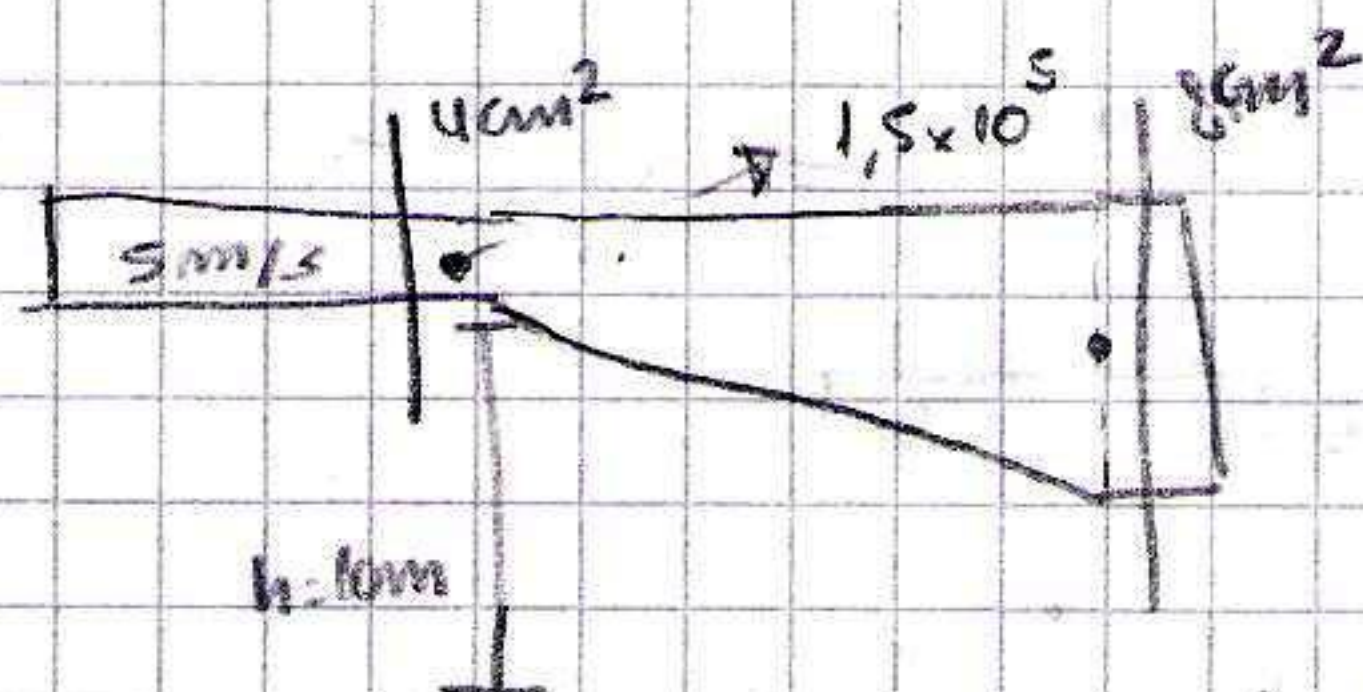
$$Q_1 = Q_2$$

$$1 \text{ m/s} \cdot \pi \cdot (0,01)^2 = v_2 \cdot \pi \cdot (0,0005)^2 \cdot 24$$

$$v_2 = 16,67 \text{ m/s}$$

para agujero de 1 mm.

10)



$$Q_1 = Q_2$$

$$A_1 \cdot v_1 = A_2 \cdot v_2$$

$$0,4 \times 10^{-3} \text{ m}^2 \cdot 5 \text{ m/s} = 0,8 \times 10^{-3} \text{ m}^2 \cdot v_2$$

$$2,5 \text{ m/s} = v_2$$

$$b) p_1 = 1,5 \cdot 10^5 \text{ Pa}$$

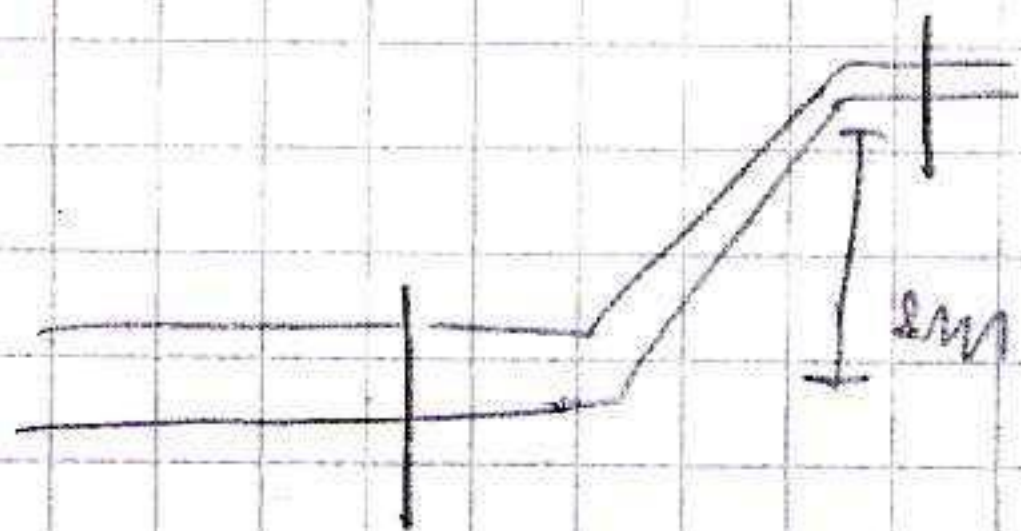
Por Bernoulli =

$$p_1 + \rho g h_1 + \frac{1}{2} \rho v_1^2 = p_2 + \rho g h_2 + \frac{1}{2} \rho v_2^2$$

$$1,5 \times 10^5 \text{ Pa} + 10000 \cdot 10 + \frac{1}{2} \cdot 1000 \cdot 5^2 = p_2 + 10000 \cdot (0) + \frac{1}{2} \cdot 1000 \cdot 2,5^2$$

$$p_2 = 2,59 \times 10^5$$

11) a) $r_1 = 0,025 \text{ m}$
 $p_1 = 2 \times 10^5 \text{ Pa}$
 $r_2 = 0,01 \text{ m}$



$$Q_1 = Q_2$$

$$A_1 \cdot v_1 = A_2 \cdot v_2$$

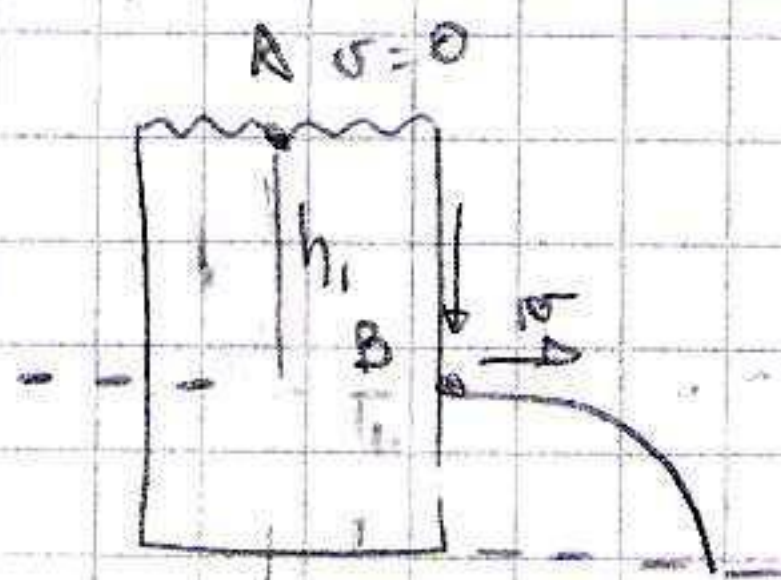
$$\pi \cdot (0,025)^2 \cdot 1 = \pi \cdot (0,01)^2 \cdot v_2$$

$$6,25 \text{ m/s} = v_2$$

b) $p_1 + \rho \cdot g \cdot h_1 + \frac{1}{2} \cdot \rho \cdot v_1^2 = p_2 + \rho \cdot g \cdot h_2 + \frac{1}{2} \cdot \rho \cdot v_2^2$
 $2 \times 10^5 \text{ Pa} + 10000 \cdot 0 + \frac{1}{2} \cdot 1000 \cdot 1^2 = p_2 + 10000 \cdot 8 + \frac{1}{2} \cdot 1000 \cdot (6,25)^2$

$$1 \times 10^5 \text{ Pa} = p_2$$

12)



$$p_1 = p_2 = p_{atm}$$

$$p_1 + \rho \cdot g \cdot h_1 + \frac{1}{2} \rho v_1^2 = p_2 + \rho \cdot g \cdot h_2 + \frac{1}{2} \rho v_2^2$$

$$\rho \cdot g \cdot h_1 = \frac{1}{2} \rho v_2^2$$

$$v_2 = \sqrt{2gh}$$

$$H - h = \frac{1}{2} g t^2$$

$$\sqrt{\frac{2(H-h)}{g}} = t$$

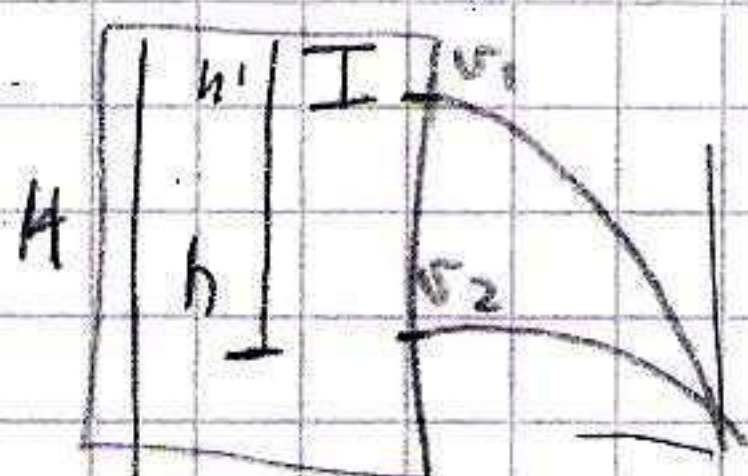
$$x = v \cdot t$$

$$x = \sqrt{2gh} \cdot \sqrt{\frac{2(H-h)}{g}}$$

$$x = 2\sqrt{h(H-h)}$$

FECHA

b)



$$v_2 > v_1$$

• Complementarios.

$$2\sqrt{g h'(H-h)} = 2\sqrt{g h(H-h)}$$

$$h'H - h'^2 = hH - h^2$$

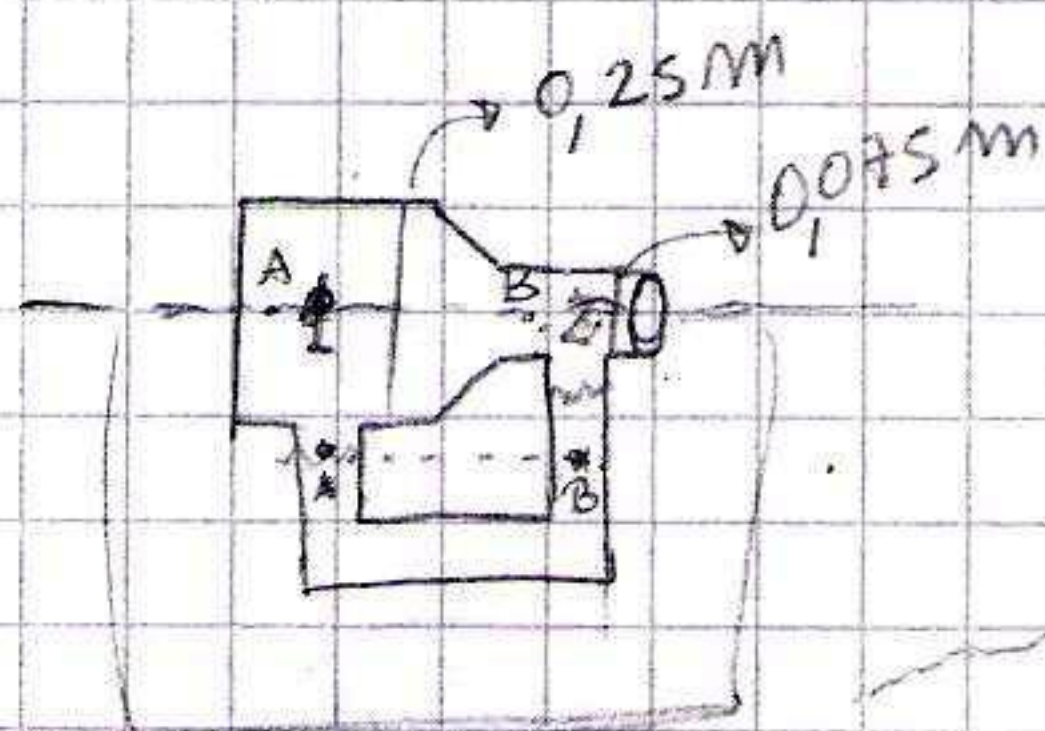
$$h'H - hH + h^2 = h'^2$$

$$H(h'-h) = h'^2 - h^2$$

$$H(h'-h) = (h'-h)(h'+h)$$

$$H - h = h'$$

13)



$$p_1 + \rho g h_1 + \frac{1}{2} \rho v_1^2 = p_2 + \rho g h_2 + \frac{1}{2} \rho v_2^2$$

$$p_1 + \frac{1}{2} \rho v_1^2 = p_2 + \frac{1}{2} \rho v_2^2$$

$$100 \times 10^3 + \frac{1}{2} \rho \left(\frac{v_2 \cdot \pi (0,075)^2}{\pi (0,25)^2} \right)^2 = 70 \times 10^3 + \frac{1}{2} \rho v_2^2$$

$$30000 + 4,05 v_2^2 = 500 v_2^2$$

$$7,78 \text{ m/s} = v_2$$

$$v_1 \cdot A_1 = v_2 \cdot A_2$$

$$v_1 = \frac{v_2 \cdot A_2}{A_1}$$

$$\text{Con: } A_1 = \frac{\pi d^2}{4} = \frac{\pi (0,25)^2}{4}$$

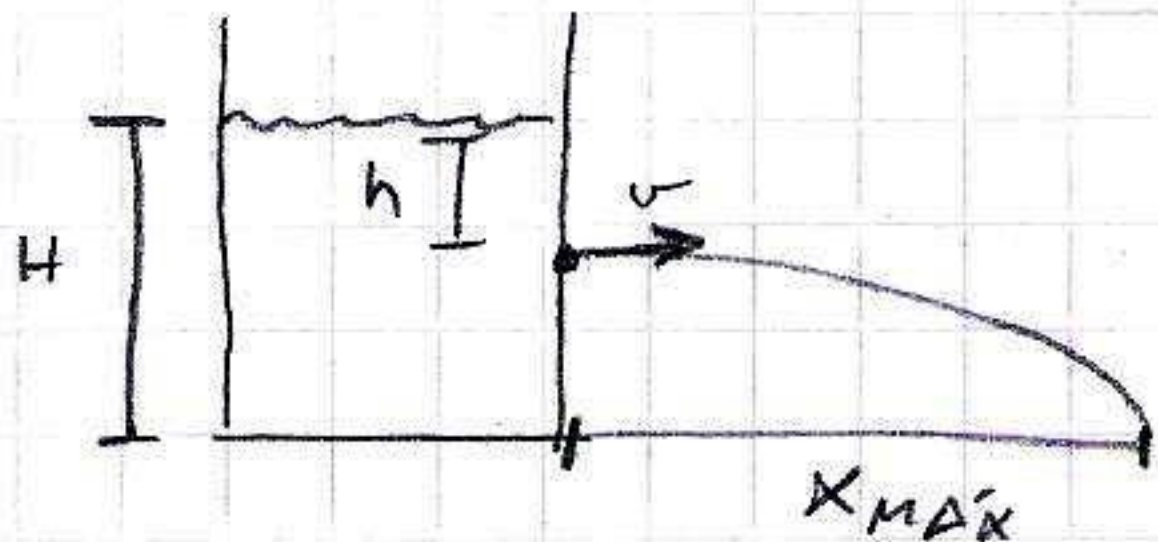
$$A_2 = \frac{\pi d^2}{4} = \frac{\pi (0,075)^2}{4}$$

$$Q = v_2 \cdot A_2$$

$$Q = 0,034 \text{ m}^3/\text{s}$$

14) Distancia hasta que toca el suelo (ej 12):

$$X = 2 \sqrt{h(H-h)} \quad (1)$$



$$X = 2 (Hh - h^2)^{1/2}$$

$$dx = \frac{1}{2} \cdot 2 (hH - h^2) (H - 2h) dh$$

$$0 = (hH - h^2) (H - 2h)$$

①

$$h(H - h) = 0$$

$$\begin{array}{l} H = h \quad X \\ \quad \quad \quad \downarrow \\ h = 0 \quad X \\ \quad \quad \quad \hookrightarrow (v_x = 0) \end{array}$$

②

$$H - 2h = 0$$

$$H = 2h$$

$$\rightarrow \boxed{h = H/2}$$

Reemplazando en (1)

$$X = 2 \sqrt{\frac{H}{2} \left(H - \frac{H}{2} \right)}$$

$$X = 2 \sqrt{\frac{H^2}{4}}$$

$$\boxed{X = H}$$