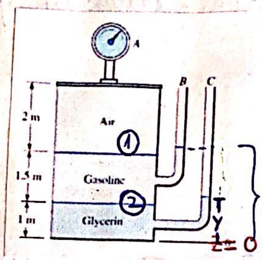
• LISTADO II

- EJERCICIO 1:



Datos:

- $\gamma_{AIRE} = 12 \ N/m^3$
- $\gamma_{Gly} = 12360 \ N/m^3$
- $\gamma_{Gas} = 6670 \ N/m^3$
- $P_A = 1500 \ [Pa]$

* Aplicando hidrostática, se tiene:

$$P_A - P_1 = \gamma_{AIR} \ (2,5 - 4,5)(m)$$
$$P_1 - P_B = \gamma_{Gas} \ (x - 2,5)(m) \quad , \text{ sumando:}$$

$$\Rightarrow \quad P_B = P_A + \gamma_{AIR} \ (4,5 - 2,5)(m) + \gamma_{Gas} \ (2,5 - x)(m)$$

Reemplazando: $\cancel{P_B}^{0} = 1500 \ [N/m^2] + 12 \ [N/m^3] \cdot [2,0 (m)] + 6670 [N/m^3] \cdot [2,5 - x](m)$

$$\boxed{x = 2,73 (m)}$$

* Para determinar "y", se tiene:

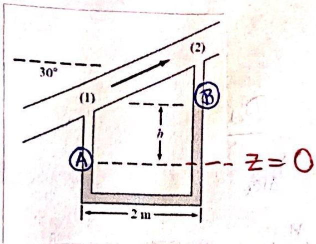
$$P_A - P_1 = \gamma_{Air} \ (2,5 - 4,5)(m)$$
$$P_1 - P_2 = \gamma_{Gas} \ (1 - 2,5)(m)$$
$$P_2 - P_C = \gamma_{Gly} \ (y - 1)(m) \quad , \text{ sumando se obtiene:}$$

$$P_A - P_C = P_A + \gamma_{Air} \ (2,0 (m)) + \gamma_{Gas} \ (1,5 (m)) + \gamma_{Gly} \ (1 - y)(m),$$

Reemplazando: $\cancel{P_C}^{0} = 1500 [N/m^2] + 12 [N/m^3] \cdot 2 (m) + 6670 [N/m^3] \cdot 1,5 (m) + 12360 \left[\frac{N}{m^3}\right] \cdot (1 - y) \ m$

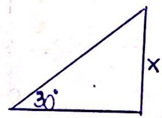
$$\boxed{y = 1,93 \ (m)}$$

- EJERCICIO 2:



Datos:

- $\gamma_{Hg} = 133100\ [N/m^3]$
- $\gamma_{H_2O} = 9790\ [N/m^3]$



$\tan 30 = \frac{x}{2}$

$2 \tan 30 = x$

Por hidrostática, desde el punto ① al punto ②, se tiene:

$$P_1 - P_A = \gamma_{H_2O}\,(0 - h)(m)$$

$$P_A - P_B = \gamma_{Hg}\,(h - 0)(m)$$

$$P_B - P_2 = \gamma_{H_2O}\,((2\tan 30 + h) - h)(m)$$

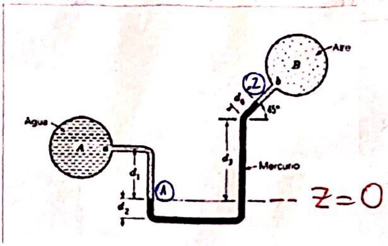
, sumando:

$$P_1 - P_2 = \gamma_{H_2O}\,(-0{,}12)(m) + \gamma_{Hg}\,(0{,}12)(m) + \gamma_{H_2O}\,[2\tan 30](m)$$

$$P_1 - P_2 = -9790\,(0{,}12) + 133100\,(0{,}12) + 9790\,[2\tan 30]$$

$$\boxed{P_1 - P_2 = 26\,101{,}7\ [Pa]}$$

- EJERCICIO 3



- Datos

$d_1 = 0,3 (m)$

$d_2 = 0,15 (m)$

$d_3 = 0,46 (m)$

$d_4 = 0,2 (m)$

$\rho_{Hg} = 13,6 [g/cc]$

Por hidrostática nos queda:

$P_A - P_1 = \gamma_w (0 - d_1)(m)$

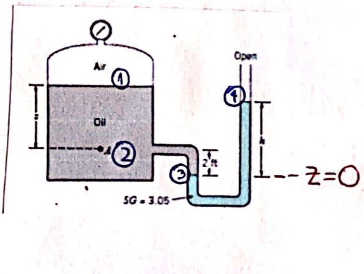
$P_1 - P_2 = \gamma_{Hg} ((d_3 + d_4 \sin 45) - 0)(m)$

$P_2 - P_B = \cancel{\gamma_{Air}}^{\,0} (\quad)$ ... γ_{Air} despreciable.

$P_A - P_B = 9790 (-0,3)(m) + 13,6 \cdot 9800 [0,46 + 0,2 \sin 45°] m$

$\boxed{P_A - P_B = 77\,220,4 [Pa]}$

- EJERCICIO 4



$P_{man} \equiv P_{abs} - P_{atm}$

De enunciado, se tiene:

* $P_1 - P_{atm} = 0,5 [Psi]$ ... (1)
* $P_2 - P_{atm} = 2,0 [Psi]$ ... (2)

Por hidrostática, se tiene:

$P_1 - P_2 = \gamma_{oil} \cdot [2 - [z+2]] (ft)$

$z = \dfrac{P_2 - P_1}{\gamma_{oil}}$ .... (3)

∴ Reemplazando (1) y (2) en (3), queda:

$$Z = \frac{2{,}0\,[psi] + P_{atm} - [0{,}5\,(psi) + P_{atm}]}{54\,[lbf/ft^3]}$$

* $1\,[psi] = 1\left[\frac{lbf}{in^2}\right]$
* $1\,[ft] = 12\,[in]$

$$Z = \frac{(2{,}0 - 0{,}5)\,\frac{lbf}{in^2} \times \left(\frac{12\,in}{1\,ft}\right)^2}{54\,[lbf/ft^3]} = \boxed{4{,}0\,[ft]}$$

b) Se tiene:

$$P_2 - P_3 = \gamma_{oil}\,(0-2)\,[ft]$$

$$P_3 - P_4 = \gamma_{SG}\,(h-0)\,[ft] \quad \text{, sumando:}$$

$$\Rightarrow P_2 - P_4 = \gamma_{oil}\,(-2\,[ft]) + \gamma_{SG}\,(h) \quad \text{, donde } P_4 = P_{atm} = 0$$

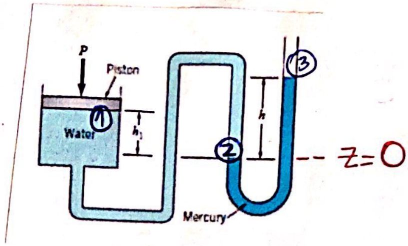
$$h = \frac{P_2 + 2\,\gamma_{oil}}{\gamma_{SG}} \quad \text{, considerando } \gamma_w = 62{,}4\left[\frac{lbf}{ft^3}\right]$$

Reemplazando, queda:

$$h = \frac{2\,\frac{lbf}{in^2} \times \left(\frac{12\,in}{1\,ft}\right)^2 + 2\,[ft] \cdot 54\left[\frac{lbf}{ft^3}\right]}{62{,}4\left[\frac{lbf}{ft^3}\right] \cdot 3{,}05}$$

$$\boxed{h = 2{,}081\,[ft]}$$

EJERCICIO 5



Por hidrostática se tiene: $P_1 - P_2 = \gamma_W (0 - h_1)$

$P_2 - P_3 = \gamma_{Hg} (h - 0)$, sumando:

$\Rightarrow P_1 - P_3 = -h_1 \cdot \gamma_W + h\, \gamma_{Hg}$, reemplazando:

$P_1 - P_3 = -(0{,}06\,(m)) \cdot 9790\,[N/m^3] + 0{,}1\,(m) \cdot 133100\,[N/m^3]$

$\boxed{P_1 - P_3 = 12\,722{,}6\,[Pa]}$

Considerando: $P = \dfrac{F}{A}$; $1\,[Pa] = 1\,[N/m^2]$

Por equilibrio de fuerzas, se tiene:

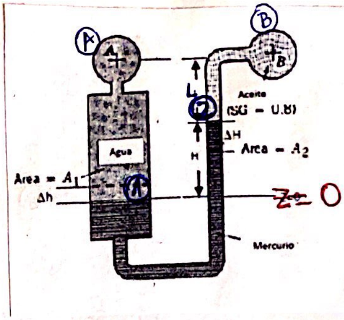
$F_{pistón} = P \cdot A$

$F_{pistón} = (P_1 - P_3) \cdot A_{pistón}$

$F_{pistón} = 12\,722{,}6 \left[\dfrac{N}{m^2}\right] \cdot 0{,}07\ m^2$

$\boxed{F_{pistón} = 890{,}58\,[N]}$

- EJERCICIO 6



- Para la situación original, tenemos:

$$P_A - P_1 = \gamma_w\,(0 - (L+H))$$

$$P_1 - P_2 = \gamma_{Hg}\,(H - 0)$$

$$P_2 - P_B = \gamma_{oil}\,([H+L] - H)$$, sumando, se obtiene:

$$\Rightarrow \quad P_A - P_B = -\gamma_w(L+H) + \gamma_{Hg}(H) + \gamma_{oil}(L) \quad \ldots (1)$$

- Para la situación final se tiene:

$$P_A - P_1 = \gamma_w\,[(0+\Delta h) - (L+H)]$$

$$P_1 - P_2 = \gamma_{Hg}\,[(H-\Delta H) - (0+\Delta h)]$$

$$P_2 - P_B' = \gamma_{oil}\,[(H+L) - (H-\Delta H)]$$, sumando:

$$\Rightarrow \quad P_A - P_B' = \gamma_w(\Delta h - L - H) + \gamma_{Hg}(H - \Delta H - \Delta h) + \gamma_{oil}(L+\Delta H) \quad \ldots (2)$$

- (1) - (2) nos queda:

$$P_B' - P_B = -\gamma_w\,\Delta h + \gamma_{Hg}(\Delta H + \Delta h) - \gamma_{oil}\,\Delta H \quad \ldots (3)$$

Por enunciado, se tiene que:

$$V_{sube} = V_{baja}$$

$$A_1 \cdot \Delta h = A_2 \Delta H$$

$$\frac{A_1}{A_2} = \frac{\Delta H}{\Delta h} \quad \ldots (4)$$

Luego, como $\Delta H = 1[in]$, se despeja de (3):

$$\Delta h = \frac{P_B' - P_B - \gamma_{Hg}\Delta H + \gamma_{oil}\Delta H}{\gamma_{Hg} - \gamma_w} \quad \text{, reemplazando:}$$

$$\Delta h = \frac{0{,}5\left[\frac{lbf}{in^2}\right] \times 144\left[\frac{in^2}{ft^2}\right] - 847\left[\frac{lbf}{ft^3}\right] \times 1\, in \times \frac{1\,[ft]}{12\,[in]} + 62{,}4 \cdot 0{,}8 \times 1\,[in] \times \frac{1\,[ft]}{12\,[in]}}{847\left[\frac{lbf}{ft^3}\right] - 62{,}4\left[lbf/ft^3\right]}$$

$$\Delta h = 0{,}00711\,[ft]$$

, reemplazando en (4), queda:

$$\frac{A_1}{A_2} = \frac{1\,[in] \times \frac{1\,[ft]}{12\,(in)}}{0{,}00711\,ft} = \boxed{11{,}72}$$