Parcial 4

(1) $5cm = 0.05m$

$d = 2cm = 0.02m$

$W = 7.5N$

a $d = \frac{m}{V}$, $V_{cubo} = L^3 = (0.05m)^3 = 0.000125m^3$

$V_{agujero} = \pi r^2 \cdot h = \pi (0.01)^2 m \cdot 0.05m = 0.0000157m^3$

$V_{Total} = 0.000125m^3 - 0.0000157m^3 = 1.093 \times 10^{-4} m^3$

$m = \frac{W}{g} = \frac{7.5N}{9.8m/s^2} = 0.76Kg$

Así $d = \frac{0.76Kg}{1.093 \times 10^{-4} m^3} = \boxed{6953.34 \, Kg/m^3}$ → Densidad del metal

b. $d = \frac{m}{V} = \frac{\frac{W}{g}}{V} = \frac{W}{gV}$ → $W = d \cdot g \cdot V = 6953.34 Kg/m^3 \cdot 9.8 m/s^2 \cdot 1.25 \times 10^{-4} m^3$

$\boxed{= 8.51 N}$ → Peso antes del agujero

2 $m_{plomo} = m_{aluminio}$, sabemos que $\rho_{plomo} = 11.3 \times 10^3\ Kg/m^3$

$\rho_{aluminio} = 2.7 \times 10^3\ Kg/m^3$

$m = \rho V$, como las masas son iguales:

$$\rho_{plomo} V = \rho_{aluminio} V \rightarrow 11.3 \times 10^3\ Kg/m^3 (\cancel{4/3 \pi}\, r_{plomo}^3) = 2.7 \times 10^3\ Kg/m^3 (\cancel{4/3 \pi}\, r_{aluminio}^3)$$

$$\frac{r_{aluminio}^3}{r_{plomo}^3} = \frac{11.3 \times 10^3\ Kg/m^3}{2.7 \times 10^3\ Kg/m^3} = 4.18 \rightarrow \frac{r_{aluminio}}{r_{plomo}} = \boxed{1.61}$$

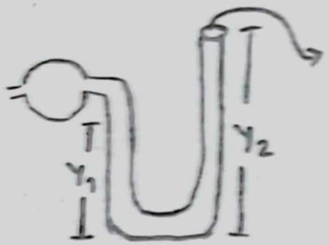
$\rightarrow$ Es decir la razón entre el radio de la esfera de aluminio y de plomo es 1.61.

3) $Y_1 = 3\text{ cm} = 0.03\text{ m}$

$Y_2 = 7\text{ cm} = 0.07\text{ m}$

$P_{ATM} = 980$ milibares $= 0.98 \times 10^5\ Pa$

$\rho = 13.55 \times 10^3\ Kg/m^3$



$P_0 = P_{ATM}$

$Y_2 - Y_1 = 0.04\,m$

a. $P = P_0 + \rho g h$

$= 0.98 \times 10^5\ Pa + (13.55 \times 10^3\ Kg/m^3)(9.8\ m/s^2 \cdot 0.07\,m)$

$= \boxed{1.07 \times 10^5\ Pa}$ → Presión absoluta en la base del tubo U

b. $P = 0.98 \times 10^5\ Pa + (13.55 \times 10^3\ Kg/m^3)(9.8\ m/s^2 \cdot 0.04\,m)$

$= \boxed{1.03 \times 10^5\ Pa}$ → Presión absoluta tubo abierto 4cm debajo de la superficie libre

c. $P = 0.98 \times 10^5\ Pa + (13.55 \times 10^3\ Kg/m^3 \cdot 9.8\ m/s^2\ (0.07\,m - 0.03\,m))$

$= \boxed{1.03 \times 10^5\ Pa}$ → Presión absoluta del gas

d. $P_0 = 13.55 \times 10^5\ Kg/m^3 \cdot 9.8\ m/s^2 \cdot 0.04\,m = \boxed{5.31 \times 10^5\ Pa}$ → Presión manométrica

4) $A_1 = 0.07\,m^2$

$V_1 = 3.5\,m/s$

$A_1 V_1 = A_2 V_2$

a. $A_2 = 0.105\,m^2$

$\rightarrow V_2 = V_1 \left(\frac{A_1}{A_2}\right) = 3.5\,m/s \left(\frac{0.07\,m^2}{0.105\,m^2}\right) = \boxed{2.33\,m/s}$

b. $V_2 = 3.5\,m/s \left(\frac{0.07\,m^2}{0.047\,m^2}\right) = \boxed{5.21\,m/s}$

$A_2 = 0.047\,m^2$

c. 1 hora

$= 3600\,s$

$V = V_1 A_1 \cdot t = 3.5\,m/s \cdot 0.07\,m^2 \cdot 3600\,s = \boxed{882\,m^3}$

5 $P_2 = P_1 + \frac{1}{2}\rho(v_1^2 - v_2^2) + \rho g(y_1 - y_2)$ Note que $v_1 A_1 = v_2 A_2 \rightarrow v_2 = \frac{1}{4} v_1$

$v_2^2 = \frac{1}{16} v_1$

$v = 3 m/s$

$P = 5 \times 10^4 Pa$

$\rho = 1 \times 10^3 Kg/m^3$

$h = 11 m$

Así $P_2 = P_1 + \frac{1}{2}\rho\left(v_1^2 - \frac{1}{16} v_1^2\right) + \rho g(y_1 - y_2)$

$= P_1 + \rho\left[\left(\frac{15}{32} v_1^2 + g(y_1 - y_2)\right)\right]$

$= 5 \times 10^4 Pa + 1 \times 10^3 Kg/m^3 \left(\frac{15}{32}(3 m/s)^2 + 9.8 m/s^2 (11 m)\right)$

$\boxed{= 1.62 \times 10^5 Pa}$ → Presión manométrica 11 m más abajo

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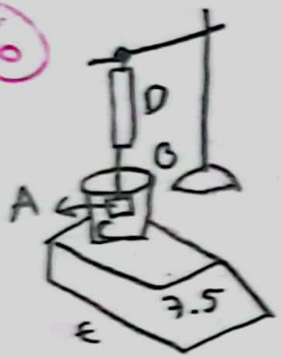

$m_B = 1\,Kg$

$m_C = 1.8\,Kg$

$m_D = 3.5\,Kg$

$m_E = 7.5\,Kg$

$V_A = 3.8 \times 10^{-3}\,m^3$

a. $F_D + F_E - (W_A + W_B + W_C) = 0$

$W_A = F_D + F_E - W_B - W_C$

$\hookrightarrow m_A = m_D + m_E - m_B - m_C$

$= 3.5\,Kg + 7.5\,Kg - 1\,Kg - 1.8\,Kg$

$= 8.2\,Kg$

$B = \rho V_A \cdot g$

Así, $B + F_D - W_A = 0 \rightarrow \rho V_A \cdot g + m_D \cdot g - m_A \cdot g = 0$

$\rho V_A + m_D = m_A$

Luego $\rho = \dfrac{m_A - m_D}{V_A} = \dfrac{8.2\,Kg - 3.5\,Kg}{3.8 \times 10^{-3}\,m^3} = \boxed{1.23 \times 10^3\,Kg/m^3}$ $\rightarrow$ Densidad del líquido

b. Si el bloque A se saca, la balanza [D lee la masa de 8.2 Kg] y la balanza [E lee la masa total de B y C = 2.8 Kg]

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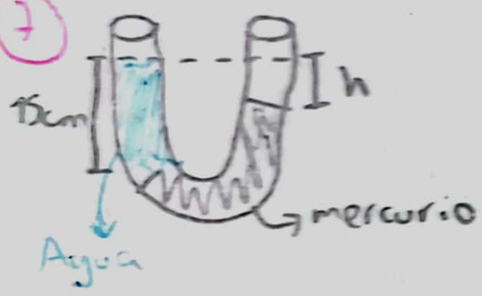

a. $P_0 = P_a$, así $P - P_a = \rho_A g h \Rightarrow 1\times10^3\ Kg/m^3 \cdot 9.8\ m/s^2 \cdot 0.15\ m$

$\downarrow$

$P = P_0 + \rho g h$

$\boxed{= 1470\ Pa}$ → Presión manométrica en la interfaz agua-mercurio

b. $P_1 = P_a + \rho_A g \underbrace{h}_{0.15m}$, $P_2 = P_a + \rho_M g \underbrace{h}_{(0.15m - h)}$

$P_1 = P_2 \Rightarrow \rho_A g(0.15m) = \rho_M g(0.15m - h)$, $(0.15m - h) = \dfrac{1\times10^3\ Kg/m^3\ (0.15m)}{13.55\times10^3\ Kg/m^3} = \boxed{0.011\ m}$

La distancia h entre la superficie del mercurio y del agua es 0.011 m