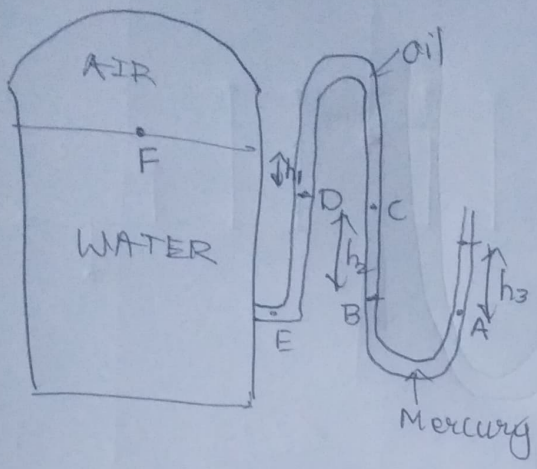
MIN-106 ~Tut 1

Q.1.



$P_D = P_F + \rho_w g h_1$

$P_B = P_D + \rho_o g h_2$

$P_B = P_{atm} + \rho_m g h_3$

$\Rightarrow P_{atm} + \rho_m g h_3 = P_F + \rho_w g h_1 + \rho_o g h_2$

$\Rightarrow P_F - P_{atm} = \rho_m g h_3 - \rho_w g h_1 - \rho_o g h_2$

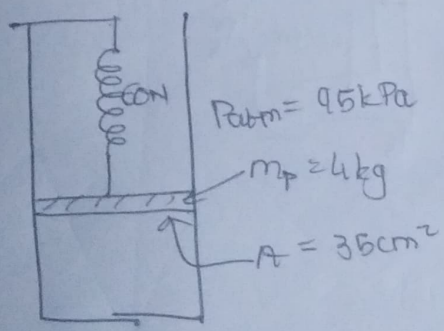
$= 9.8[13,600 \times 0.46 - 1000 \times 0.2 - 850 \times 0.3]$

$= 9.8 \times 5801$

$= 56,849.8 \text{ Pa}$

$= 56.9 \text{ kPa}$.

Q.2.

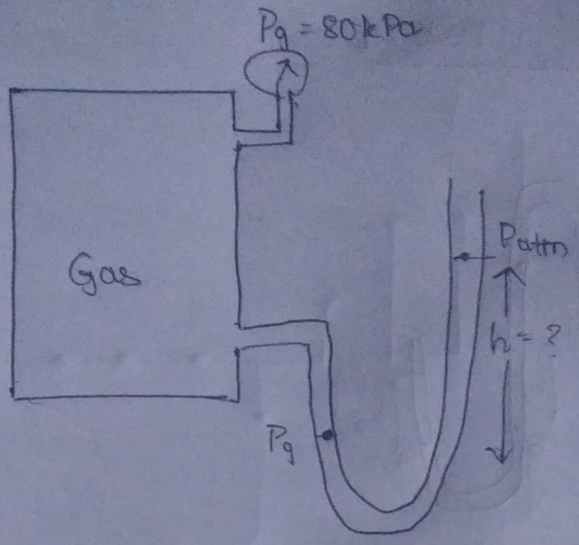


$P_{cont} = P_{atm} + \frac{60 + 4 \times 9.8}{35 \times 10^{-4}}$

$= 95 kPa + \frac{99.2}{35} \times 10 \text{ kPa}$

$= 123.34 kPa$

Q. 3.



(a) Mercury:

~~$P_g = P_{atm} = 80\,kPa$~~ ~~$P_g = P_{atm}$~~ +

$$P_g = \rho_m g h$$

$$80 \times 1000 = 13{,}600 \times 9.8 \times h$$

$$\Rightarrow h = \frac{800}{136 \times 9.8} = 0.6\,m.$$

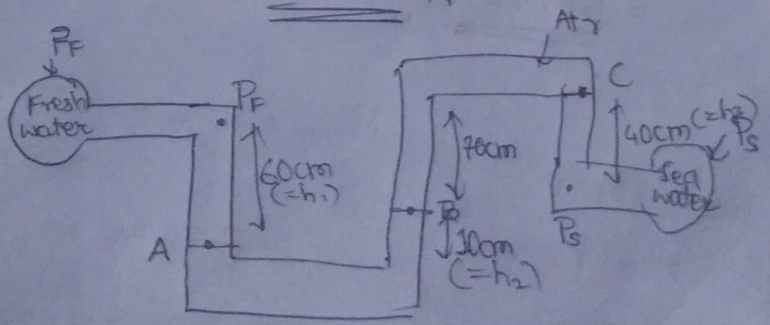
(b) Water:

$$P_g = \rho_w g h$$

$$\Rightarrow 80{,}000 = 1000 \times 9.8 \times h$$

$$\Rightarrow h = 8.16\,m.$$

Q. 4.



$$P_A = P_F + \rho_w g h_1$$

$$P_B = P_A + \rho_m g h_2$$

$$P_C = P_s - \rho_{sea} g h_3$$

$$P_B = P_C \Rightarrow P_F + \rho_w g h_1 + \rho_m g h_2 = P_s - \rho_{sea} g h_3$$

$$\Rightarrow P_s - P_F = g[\rho_w h_1 + \rho_m h_2 + \rho_{sea} h_3]$$

$$= 9.8 \times [1000 \times 0.6 + 13{,}600 \times 0.1 + 1095 \times 0.4]$$

$$= 9.8 \times 2374 = 23265.2\,Pa$$

$\Rightarrow P_F - P_3 = g[\rho_m h_2 - \rho_w h_1 - \rho_{sea} h_3]$

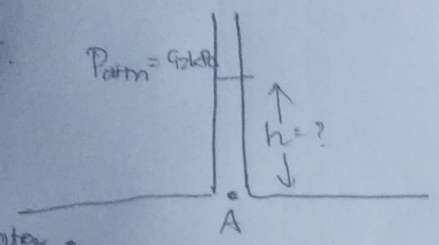
$= 9.8 \times [1360 - 600 - 1035 \times 0.4]$

$= 9.8 \times 346$

$= 3390.8\ Pa = \underline{3.39\ kPa}$

Here, the air column doesn't affect calculation because its density is negligible.

Q5.



$P_A = 115\ kPa$ ... given

$\Rightarrow P_A - P_{atm} = \rho_w g h$

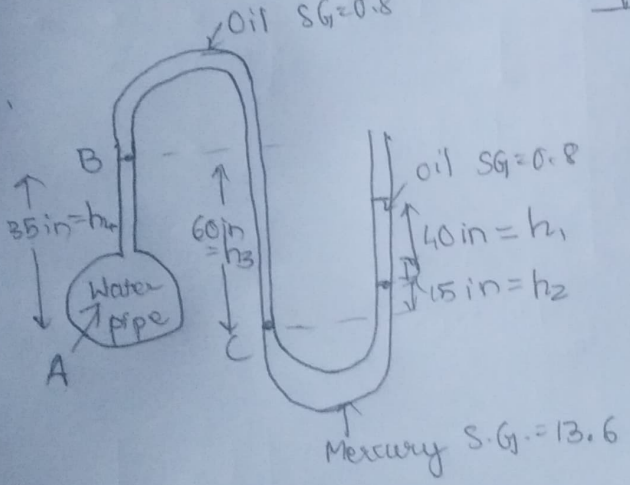
$\Rightarrow (115 - 92) \times 10^3 = 10^3 \times 9.8 \times h$

$\Rightarrow 23 = 9.8 \times h$

$\Rightarrow \boxed{h = 2.3469\ m}$

$\Rightarrow \boxed{h = 2,346.9\ mm}$

Q.6.



$P_D = P_{atm} + \rho_o g h_1$ $\quad P_C = P_D + \rho_m g h_2$

$P_B = P_C - \rho_o g h_3$ $\quad P_A = P_B + \rho_w g h_4$

$\Rightarrow P_A = P_{atm} + \rho_o g h_1 + \rho_m g h_2 - \rho_o g h_3 + \rho_w g h_4$

$= 92kPa + \frac{9.8}{39.37}\left(800 \times (-\frac{20}{39.37}) + 13600 \times \frac{15}{39.37} + 1000 \times \frac{35}{39.37}\right)\ Pa$

$= 92kPa + \frac{9.8 \times 223}{39.37}\ Pa = 92kPa + 55.5\ kPa$

$= \underline{147.5\ kPa}$