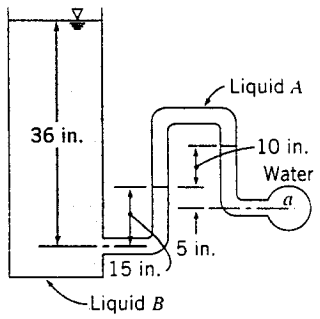
Given: Manometer system as shown

SG Liquid A = 0.75

SG Liquid B = 1.20



Find: Gage pressure at point "a"

Solution:

Basic equation: $\frac{dP}{dz} = -\gamma$ dz

Assumptions: (1) static fluid
(2) gravity is only body force
(3) z axis direction vertically
(4) γ = constant

$dP = -\gamma\, dz$

For γ = constant, then $\Delta P = -\gamma \Delta z$, i.e. $P_j - P_i = -\gamma (z_j - z_i)$

$P_2 - P_1 = -\gamma_B (z_2 - z_1)$

$P_3 - P_2 = -\gamma_B (z_3 - z_2)$

$P_4 - P_3 = -\gamma_A (z_4 - z_3)$

$P_5 - P_4 = -\gamma_{H_2O} (z_5 - z_4)$

Summing these equations recognizing that $P_5 = P_a$ and $P_1 = P_{atm}$ then

$$P_a - P_{atm} = -\gamma_B (z_3 - z_1) - \gamma_A (z_4 - z_3) - \gamma_{H_2O} (z_5 - z_4)$$

$$= 1.20 \times 62.4 \frac{lbf}{ft^3} \times 21 in \times \frac{ft}{12 in} - 0.75 \times 62.4 \frac{lbf}{ft^3} \times \frac{10}{12} ft + 62.4 \frac{lbf}{ft^3} \times \frac{15}{12} ft$$

$$P_{a\,gage} = 170 \frac{lbf}{ft^2} \times \frac{ft^2}{144 in^2}$$

$$P_{a\,gage} = 1.18 \text{ psig}$$

P_a