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Computer Engineering

1 $D_1 = 190mm = 0.19m$

$D_2 = 79mm = 0.079m$

$Z_2 - Z_1 = 150mm = 0.15m$

$Q = 40 litres/sec = 0.04 m^3/sec$

$Cd = 0.96$, relative density $= 0.8$

$$A_1 = \frac{\pi D_1^2}{4} = \frac{3.142 \times 0.15^2}{4}$$

$$= 0.01767 m^2$$

$$A_2 = \frac{\pi D_2^2}{4} = \frac{3.142 \times 0.075^2}{4}$$

$$= 4.4184 \times 10^{-3} m^2$$

$$Q = \frac{Cd A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$0.04 = \frac{0.96 \times 0.01767 \times 4.4184 \times 10^{-3} \times \sqrt{2 \times 9.81 \times h}}{\sqrt{(0.01767)^2 - (4.4184 \times 10^{-3})^2}}$$

$$0.04 = \frac{0.0749 \times \sqrt{19.62h}}{0.0171}$$

$$0.04 = \frac{0.0749 \times 4.429\sqrt{h}}{0.0171}$$

$$0.04 \times 0.0171 = 0.0749 \times 4.429\sqrt{h}$$

$$6.84 \times 10^{-4} = 0.331\sqrt{h}$$

$\sqrt{h} = 2.072 \times 10^{-3}$

$h = (2.072 \times 10^{-3})^2$

$h = 4.29 \times 10^{-6} m$

$h = \left(\frac{P_1}{w} + Z_1\right) - \left(\frac{P_2}{w} + Z_2\right)$

$h = \left(\frac{P_1}{w} - \frac{P_2}{w}\right) + (Z_1 - Z_2)$

$4.29 \times 10^{-6} = \left(\frac{P_1 - P_2}{P_g}\right) - 0.15$

$4.29 \times 10^{-6} + 0.15 = \frac{P_1 - P_2}{P_g}$

$0.15 P_g = P_1 - P_2$

$0.15 \times 0.8 \times 1000 \times 9.81 = P_1 - P_2$

$P_1 - P_2 = 1177.2 \, kN/m^2$

2. $D_1 = 300mm = 0.3m$

$Area = \frac{\pi D_1^2}{4} = \frac{3.142 \times 0.3^2}{4}$

$= 0.07 m^2$

$D_2 = 150mm = 0.15m$

$D_2 = \frac{\pi D_2^2}{4} = \frac{3.142 \times 0.15^2}{4}$

$= 0.017 m^2$

S.G of mecury = 13.6

S.G of oil = 0.9

Differential U-tube mecury manometer = 250mm = 0.25m

$$h = \left(\frac{P_1}{w} + z_1\right) - \left(\frac{P_2}{w} + z_2\right)$$

$$-y\left[\frac{\text{SG of mecury}}{\text{S.G of oil}} - 1\right]$$

$$= 3.53 \text{ m of oil}$$

i Discharge of oil

$$Q = \frac{C_d A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$Q = \frac{0.98 \times 0.07 \times 0.017 \times \sqrt{2 \times 9.81 \times 3.53}}{\sqrt{(0.07)^2 - (0.017)^2}}$$

$$Q = 0.142 \text{ m}^3/\text{s}$$

ii $Z_2 - Z_1 = 300\text{mm} = 0.3\text{m}$

$$\left(\frac{P_1 - P_2}{w}\right) - 0.3 = 3.53$$

$$\frac{P_1 - P_2}{w} = 3.53 + 0.3$$

$$\frac{P_1 - P_2}{w} = 3.53 + 0.3$$

$$\frac{P_1 - P_2}{w} = 3.83$$

$$P_1 - P_2 = 3.83 \times 9.81 \times 0.9$$

$$P_1 - P_2 = 33.8 \text{ kN/m}^2$$