David David lawrence
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Mechanical Engineering

2) Sp gravity = 0.8, D_1 = 150mm = 0.15m D_1 = 75m 0075 m
$Z_2 - Z_1$ = 150m = 0.15m Q_{act} = 40 litres/sec = 0.04 m^3/s C_d = 0.96

$A_1 = \frac{\pi}{4} D^2 = \frac{\pi}{4} \times 0.15^2 = 0.01767 m^2$

$A_2 = \frac{\pi}{4} D_2^2 = \frac{\pi}{4} \times (0.075)^2 = 0.00442 m^2$

$Q_{act} = C_d \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$

$0.04 = 0.96 \times \frac{0.01767 \times 0.00442}{\sqrt{0.01767^2 - 0.00442}} \times \sqrt{2 \times 9.81} \times \sqrt{h}$

$\therefore h = \left(\frac{0.04}{0.96 \times 0.001565 \times 4.429} \right) = 4.247 m$

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

$4.247 = \left(\frac{P_1}{w} - \frac{P_2}{w} \right) + (z_1 - z_2)$

$= \left(\frac{P_1 - P_2}{Pg} \right) - 0.15$

$P_1 - P_2 = Pg (4.247 + 0.15)$

$= (0.8 \times 1000 \times 9.81)(4.247) + 0.15 \, N/m^2$

$= 34.51 kN/m^2$

1) ~~Incorrect~~

1)

$D_1 = 300mm = 0.3m$

$A_1 = \frac{\pi}{4} \times 0.3^2 = 007 m^2$

$D_2 = 150mm = 0.15m$

$A_2 = \frac{\pi}{4} \times 0.15^2 = 001767 m^2$

$S_N = 13.6$

$SP = 0.9$

$y = 250mm = 0.25m$

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

$$= y\left[\frac{S_w}{SP} - 1\right] = 0.25\left[\frac{13.6}{0.9} - 1\right]$$

$$Q = C_d \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh} = 0.98 \times \frac{0.07 \times 0.01767}{\sqrt{0.07^2 - 0.01767^2}} \times \sqrt{2 \times 9.81 \times 3.53}$$

$$= \frac{0.001212}{0.0677} \times 8.32 = 0.1489 \, m^3/s$$