

Notes by-

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Three Reservoir Problem

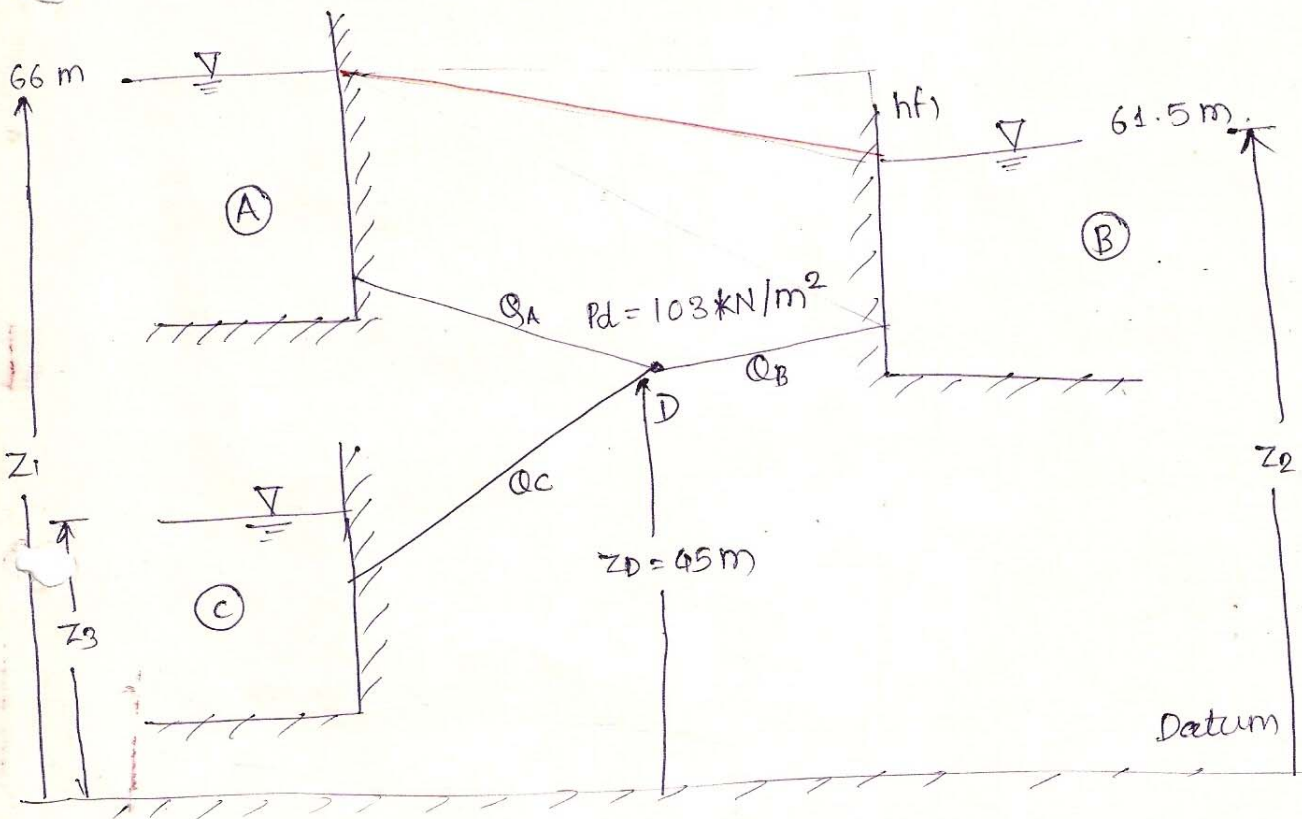
(3)

The water levels in the two reservoirs A & B are respectively 66 m & 61.5 m above datum. A pipe joins each to a common point 'D', where the pressure is 103 kN/m² gauge & ht. is 45 m above datum. Another pipe connects D to the another tank 'C'. What will be the ht. of WL in 'C' assuming the same value of friction factor for all the pipes.

Given:-
Pipe

Pipe	Length	Diameter
A-D	2400 m	0.30 m
B-D	2700 m	0.45 m
C-D	3000 m	0.60 m

Solution:-



$$z_1 = \frac{P_d}{\gamma} + z_d + h_{f1} \Rightarrow 66 = \frac{103}{9.81} + 45 + h_{f1} \Rightarrow \boxed{h_{f1} = 10.5 \text{ m}}$$

$$z_2 = \frac{P_d}{\gamma} + z_d + h_{f2} \Rightarrow 61.5 = \frac{103}{9.81} + 45 + h_{f2} \Rightarrow \boxed{h_{f2} = 6 \text{ m}}$$

$$z_3 = \frac{P_d}{\gamma} + z_d - h_f \Rightarrow z_3 + h_f = \frac{103}{9.81} = 10.5$$

$$A_A \sqrt{A} = A_B \sqrt{B} + A_C \sqrt{C} \text{ as } Q_A = Q_B + Q_C$$

But $\frac{f L_1 V_1^2}{2gD_1} = h_{f1} = 10.5$ & $\frac{f L_2 V_2^2}{2gD_2} = 6 \text{ m}$ & $z_3 + \frac{f L_3 V_3^2}{2gD_3} = 10.5$

$$\therefore V_1 = 0.16 \sqrt{f}$$

$$V_2 = 0.14 \sqrt{f}$$

$$V_3 = \sqrt{(z_3 + 55.49) \times 0.62f}$$

Let $A_A \cdot V_A = \frac{1}{4} AB \cdot V_B + A_C \cdot V_C$

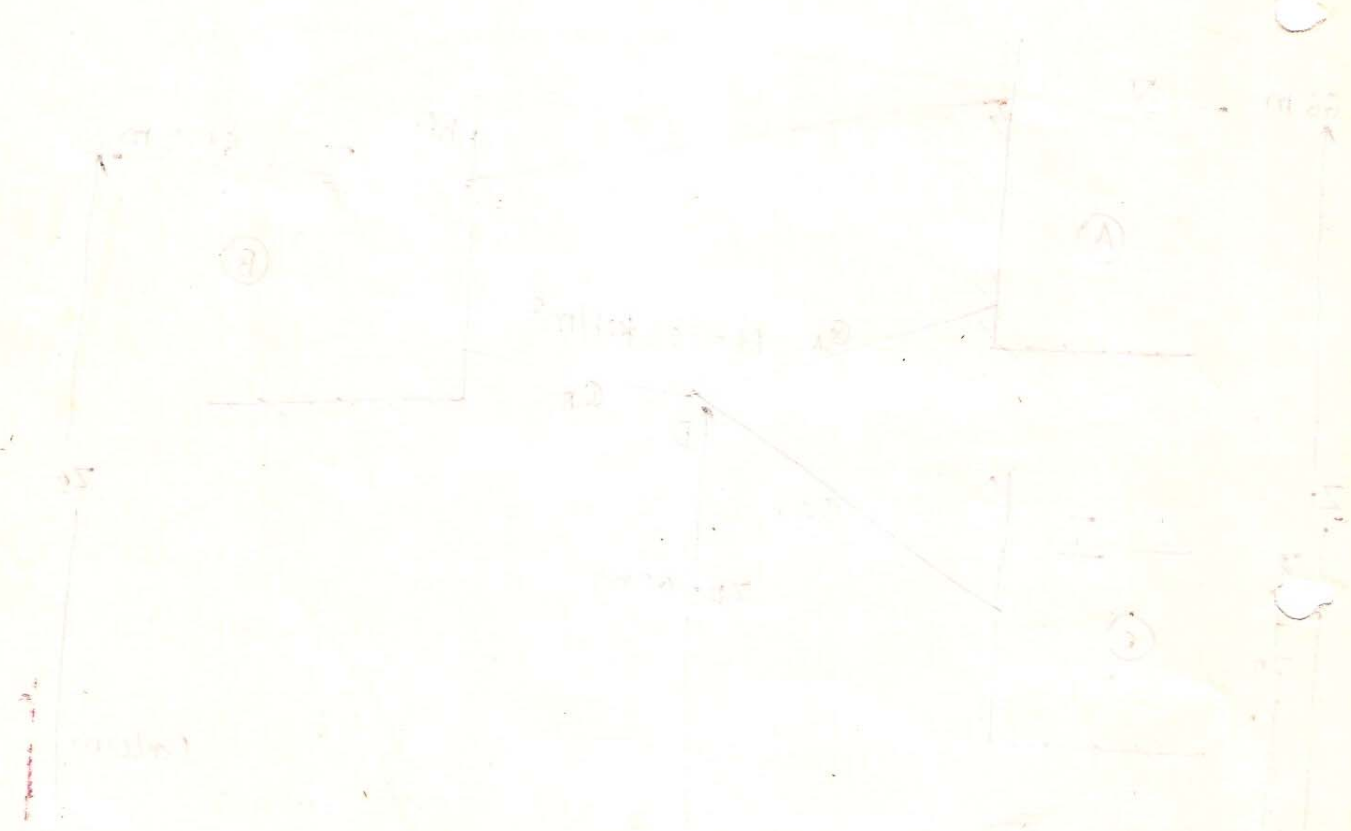
$$= \frac{\pi}{4} (0.3)^2 \times 0.16 \sqrt{f} = \frac{\pi}{4} (0.45)^2 \times 0.14 \sqrt{f} + \frac{\pi}{4} (0.6)^2 \times \sqrt{(55.49 - Z_3) \times 0.62 f}$$

$$\therefore 0.0144 = 0.02835 + 0.36 \sqrt{34.4 - 0.62 Z_3}$$

$$\therefore -0.01395 = 0.36 \sqrt{34.4 - 0.62 Z_3}$$

$$\therefore 1.946 \times 10^{-4} = 0.1296 (34.4 - 0.62 Z_3)$$

$$\boxed{Z_3 = 51.90} \text{ --- Ans.}$$



[Faint handwritten notes and calculations, including the word 'Ans.' and some illegible text.]