⇨ Petrol density / S.G = 0.8

$D_1 = 150mm = 0.15m$.

$D_2 = 75mm = 0.075$

$Z_2 - Z_1 = 150mm = 0.15m$.

$Q_{actual} = 40 L/s = 0.04 m^3/s$

$C_d = 0.96$

$P_1 - P_2 = ?$

$w = \rho g = 800 \times 9.81 = 7848$

$S.D = \frac{\rho_{liquid}}{\rho_{water}}$, $0.8 = \frac{\rho}{1000}$

$\rho = 800$,

$A_1 = \frac{\pi D_1^2}{4} = \pi/4 \times 0.15^2 = 0.01767 m^2$

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

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

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

$0.04 = 0.96 \times 0.00565 \times 4.429 \sqrt{h}.$

$h = \left(\frac{0.04}{0.019}\right)^2 = (2.0608)^2 = 4.247 m$

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

$\frac{P_1 - P_2}{w} = h - (Z_1 - Z_2) = P_1 - P_2 = 4.247 - (-0.15)$

$\frac{P_1}{P_2} = 7848 \times 4.397 = 34507.6 N/m^2$

27. Inlet Diameter - $D_1 = 300mm = 0.3m$

Area of Inlet, $A_1 = \frac{\pi}{4} \times 0.3^2 = 0.07m^2$

Throat Diameter, $D_2 = 150mm = 0.15m$

Area of throat $= A_2 = \frac{\pi}{4} \times 0.15^2 = 0.0177m^2$

$C_d = 0.98$

Differential head $h = \left[\frac{P_1}{w} + z_1\right] - \left[\frac{P_2}{w} + z_2\right] = y\left[\frac{S_{hl}}{S_p} - 1\right]$

recall: S_{hl} = Sg of mecury = 13.6

y = reading of manometer = 250mm = 0.25m.

S_p = S_p = Sg of oil = 0.9.

$h = 0.25\left[\frac{13.6}{0.9} - 1\right] = 3.35m$ of oil

⇒ Discharge of oil =

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

$$Q = \frac{0.98 \times 0.07 \times 0.0177 \times \sqrt{2 \times 9.81 \times 3.53}}{\sqrt{0.07^2 - 0.0177^2}}$$

$Q = 0.1492 m^3/s$

$Q \simeq 0.149$.

0.0183 ≈ 0.018

(i) Pressure difference btwn entrance & throat section: $P_1 - P_2$

recall $h = 3.53m$,

" difference in elevation of throat section & entrance section of the venturimeter is 300mm = 0.3m.

$\therefore z_2 = z_1 = 0.3m \Rightarrow z_1 - z_2 = -0.3m$

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

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

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

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

$(3.83)w = P_1 - P_2$

$P_1 - P_2 = 3.83(9.81 \times 0.9)$.

$P_1 - P_2 = 33.8 KN/m^2$.