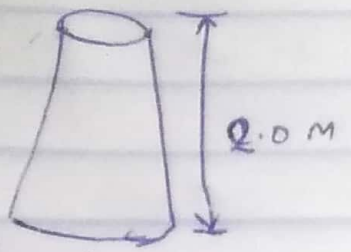
7

(1.)



Length $L = 2.0M$

V_1 = Velocity of flow at (at small end) = 5m/s

V_2 = at lower end) = 2m/s

pressure head at $\left(\frac{P_2}{\omega}\right)$ = ?

H_L = Loss of Head = $\frac{0.25(V_1 - V_2)^2}{2g}$

$= \frac{0.35(5-2)^2}{2 \times 9.81} = 0.16M$

Applying Bernoullis Equation

$P_1/\omega + Z_1 + V_1^2/2g = P_2/\omega + Z_2 + V_2^2/2g + H_2$

$Z_1 = 2.5M$

$Z_2 = 0$

$\Rightarrow 2.5 \times \frac{2 \times 5^2}{2(9.81)} = P_2/\omega = 0 + \frac{2^2}{2(9.81)} + 0.16$

$5.77 \times P_2/\omega + 0.364$

$P_2/\omega = 5.77 - 0.364 = 5.406M$ of liquid

Inlet diameter, $d_1 = 20cm = 0.2m$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi (0.2)^2}{4}$

$= 0.314m^2$

Throat diamet, $dt = 10cm = 0.1M$

$at = \frac{\pi (0.12)^2}{4} = 0.00785M$

P_1 (Pressure of Inlet) = $17.658 N/cm^2$

$= 176580 N/m^2 = 17.658 \times 10^4$

P_1 (Pressure of throat) = 30cm of mercury

$C_d = 0.98$

$\Rightarrow P_1/\omega = \frac{17.658 \times 10^4}{1000 \times 9.81} = 18M$ of water

$\Rightarrow P_t/\omega = -0.3 \times 13.6 = -4.08$ of water

where S.g of mercury = 13.6

S.g of water = 1

Differential head $h = P_1/\omega - P_2/\omega$

$= 18 - (-4.08)$

$= 22.08M$

Discharge for Venturimeter;

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

$= \frac{0.98 \times 0.0314 \times 0.00785 \times \sqrt{2gh}}{\sqrt{0.0314^2 - 0.00785^2}}$

$= \frac{5.0278 \times 10^{-5}}{0.0304}$

$= 0.165 m^3/s$

$\Rightarrow$ Differential Head, $h = x\left[\frac{S_g}{S_{oil}} - 1\right]$

Where Sg of Mercury = 13.6

$$h = 0.80\left[\frac{13.6}{0.9} - 1\right] = 7.065_m \text{ of oil}$$

$\Rightarrow$ Rate of flow $= Q = \frac{C_d A_2 A_1 \sqrt{2gh}}{\sqrt{A_2^2 - A_1^2}}$

$$Q = \frac{0.64 \times 0.01767 \times 0.07068 \times \sqrt{2gh}}{\sqrt{0.07068^2 - 0.01767^2}}$$

$$Q = \frac{9.404 \times 10^{-3}}{0.0684}$$

$$= 0.137 m^3/s$$