Diameter of throat $D_2 = 150mm = 0.15m$

Area of inlet $D_1 = \frac{\pi D_2^2}{4} = \frac{\pi * 0.15^2}{4} = 0.01767 m^2$

Specific gravity of heavy liquid (mercury) in tube Manometer $S/G = 13.6$

Specific gravity of Liquid (oil) flowing through pipe $Sp = 0.9$

Reading of differential manometer, $y = 250mm = 0.25m$

The differential "h" is given by;

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

$$= y\left(\left[\frac{S_h}{Sp} - 1\right]\right) = 0.25\left[\frac{13.6}{0.9} - 1\right] = 3.53m \text{ of oil}$$

2) Discharge of oil Q

Using the relation

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

$$Q = \frac{0.98 * 0.07 * 0.07767 * \sqrt{2 * 9.81 * 3.53}}{\sqrt{0.07^2 - 0.07767^2}}$$

$$Q = 0.1489 m^3/s$$

b) Pressure difference between entrance and throat

Section $P_1 - P_2$ we still know h_L:

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

$$= 3.53$$

$$h_L = \left[\frac{P_1}{\omega} - \frac{P_2}{\omega}\right) - \left[Z_1 - Z_2\right]$$

$$= 3.53$$

$$Z_2 - Z_1 = 300mm = 0.3m$$

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

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

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

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

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

$P_1 - P_2 = 3.836$

$P_1 - P_2 = 3.82 * 9.81 * 0.9$

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

Adefisi Mayowa

15/ENG04/004
Elect/Elect Engineering
Fluid mechanic (ENG 204)

1) Given sp of gravity 0.8. $D_1 = 150mm = 0.15m$
$D_2 = 75mm = 0.075m$
$Z_2 - Z_1 = 150mm = 0.15m$ $Q = 40 lit/sec = 0.04m^3/s$
$C_d = 0.96$
Pressure difference $(P_1 - P_2)$

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

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

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

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

$$0.04 = 0.96 \times 0.004565 \times 4.429\sqrt{h}$$

$$h = \left(\frac{0.04}{0.96 \times 0.004565 \times 4.429}\right)^2 = 4.247$$