

$$Q = A_1 V_1 = A_2 V_2$$

$$V_1 = 2.27 \text{ m/s}$$

$$V_2 = 9.08 \text{ m/s}$$

Using Bernoulli

~~$$\frac{P_1}{\rho g} + V_1^2 \left(\frac{3}{2g}\right) = \frac{P_2}{\rho g} + V_2^2 \left(\frac{3}{2g}\right) + z$$~~

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z$$

$$\frac{P_1 - P_2}{\rho g} = \frac{V_2^2 - V_1^2}{2g} + 0.15$$

$$\frac{P_1 - P_2}{\rho g} = 4.27 + 0.15 = 4.42$$

$$P_1 - P_2 = 4.42 \times 1000 \times 9.81 = 34701.7 \text{ N/m}^2$$

$$b) h = \pi (13.56 / 0.8) \pi \left(\frac{13.56}{0.8} - 1 \right)$$

$$4.42 = 15.875 \lambda$$

$$\lambda = 0.278 \text{ mm}$$

$$= 278 \text{ mm}$$

$$D \text{ (diameter of throat)} = 170 \text{ mm} = 0.17 \text{ m}$$

$$\text{Diameter of entrance} = 350 \text{ mm} = 0.35 \text{ m}$$

$$\text{Difference in elevation of the throat section and entrance section (z}_1 - z_2) = 300 \text{ mm} = 0.3 \text{ m}$$

$$\text{Range deflection (h)} = 250 \text{ mm} = 0.25 \text{ m}$$

$$\text{Coefficient of discharge (C}_d) = 0.98$$

$$\text{Specific gravity of mercury (S}_m) = 13.6$$

$$\text{Specific gravity of oil (S)} = 0.9$$

$$\text{Area of throat section (a}_2) = \frac{\pi d^2}{4} = \frac{\pi (0.17)^2}{4} = 0.0177 \text{ m}^2$$

$$\text{Area of entrance section (a}_1) = \frac{\pi D^2}{4} = \frac{\pi (0.35)^2}{4} = 0.0937 \text{ m}^2$$

Difference between the pressure head at entrance section and throat section (h_p)

$$= \frac{h}{S_m} = 0.25 \times (13.6 - 1) = 3.42 \text{ m}$$

$$\text{Discharge of oil (Q)} = \frac{C_d \cdot a_2 \cdot C_v \cdot \sqrt{2gh}}{\sqrt{S^2 - 1}}$$

$$= 0.98 \times 0.0177 \times 0.977 \times \sqrt{2 \times 9.81 \times 3.42} = 0.147 \text{ m}^3/\text{s}$$

Pressure difference $P_1 - P_2$

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

$$P_1 - P_2 = \rho g (h - (z_1 - z_2))$$

ρg

$$P_1 - P_2 = (h - (z_1 - z_2)) \times \rho g = (3.42 - 0.3) \times (0.9 \times 9810) = 2842.38 \text{ N/m}^2$$