

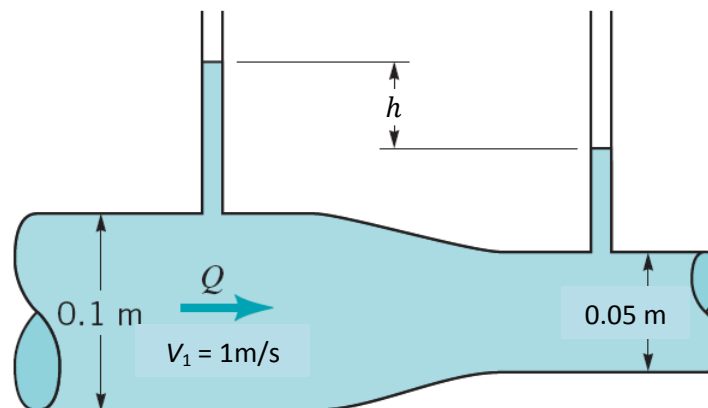
October 3, 2007

NAME _____

Fluids-ID _____

Quiz 3. Two static pressure taps are placed in the pipe contraction shown. The flowing fluid is water, and viscous effects are negligible. Determine the manometer reading, h .

Hint: Flow rate $Q = VA$, Bernoulli equation (along streamline) $\frac{p}{\gamma} + \frac{V^2}{2g} + z = \text{constant}$
 where, V : velocity, A : area, $\gamma = \rho g$: specific weight, ρ : density, $g = 9.81 \text{ m/s}^2$

**Solution:**

1. Continuity (+3 points)

$$Q = V_1 A_1 = V_2 A_2$$

$$V_2 = V_1 \left(\frac{A_1}{A_2} \right) = V_1 \frac{D_1^2}{D_2^2} = 4V_1$$

2. Bernoulli equation (+4 points)

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

Since $z_1 = z_2$,

$$\frac{p_1}{\gamma} - \frac{p_2}{\gamma} = \frac{V_2^2}{2g} - \frac{V_1^2}{2g} = \frac{1}{2g} [(4V_1)^2 - V_1^2] = \frac{15V_1^2}{2g}$$

3. manometer reading (+3 points)

$$p_1 - p_2 = \gamma h$$

$$\therefore h = \frac{p_1 - p_2}{\gamma} = \frac{15V_1^2}{2g} = \frac{15 * (1 \text{ m/s})^2}{2 * 9.81 \text{ m/s}^2} = 0.765 \text{ m}$$

Ans) $h = 0.765 \text{ m}$