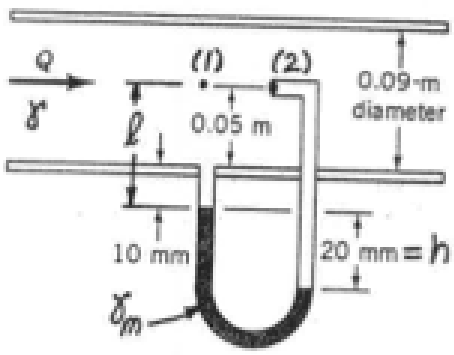
September 27, 2013

NAME

Fluids-ID

Quiz 4. The specific gravity of the manometer fluid shown in the Figure is 1.07. Determine the flow rate *Q* if viscous and compressibility effects are negligible and the flowing fluid is water.



- γ= 9.80 kN/m^3 for water
- Bernoulli equation:

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

Note: Attendance (+2 points), Format (+1 Points)

Solution:

1) Bernoulli equation

Since $z_1 = z_2$ and $V_2 = 0$,

$$\frac{p_1}{\gamma}+\frac{V_1^2}{2g}=\frac{p_2}{\gamma}$$ (+2 points)

2) Manometer

$$p_1+\gamma\cdot l+\gamma_m\cdot h-\gamma(l+h)=p_2$$

$$p_2-p_1=(\gamma_m-\gamma)h$$ (+2 points)

3) Flow rate

$$Q=V_1A_1$$

where,

$$V_1=\sqrt{2g\left(\frac{\gamma_m}{\gamma}-1\right)h}=\sqrt{2\left(9.81\frac{m}{s^2}\right)(1.07-1)(0.02m)}=0.1657\frac{m}{s}$$ (+2 points)

Thus,

$$Q=(0.09\,m)^2\left(\frac{\pi}{4}\right)\left(2.2\frac{m}{s}\right)=1.05*10^{-3}\frac{m^3}{s}$$ (+1 point)