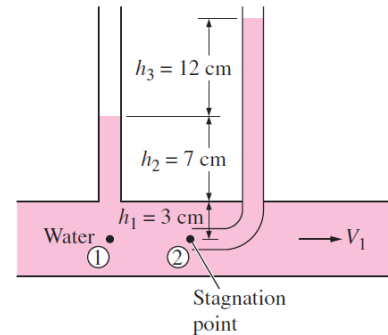NAME

Fluids-ID

Quiz 3. A piezometer and a Pitot tube are tapped into a horizontal water pipe to measure static and stagnation pressures. For the indicated water column heights in the figure, determine the velocity at the center of the pipe.

- Bernoulli Eq.:

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

Solution:

Noting that point 2 is a stagnation point and thus $V_2 = 0$ and $z_1 = z_2$, the application of the Bernoulli equation between points 1 and 2 gives

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

or

$$\frac{V_1^2}{2g} = \frac{p_2 - p_1}{\rho g}$$ (+5 points)

The gage pressures at points 1and 2 can be expressed as

$$p_1 = \rho g(h_1 + h_2)$$
$$p_2 = \rho g(h_1 + h_2 + h_3)$$ (+3 points)

Substituting the p_1 and p_2 expressions into the Bernoulli equation and solving for V_1 gives

$$V_1 = \sqrt{2gh_3} = \sqrt{2(9.81\,m/s^2)(0.12\,m)} = 1.53\ m/s$$ (+2 points)