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

\[ \frac{V_1^2}{2g} = \frac{p_2 - p_1}{\rho g} \]

or

\[ \frac{V_1^2}{2g} = \frac{p_2 - p_1}{\rho g} \]

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

\[ p_1 = \rho g(h_1 + h_2) \]
\[ p_2 = \rho g(h_1 + h_2 + h_3) \]

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

\[ V_1 = \sqrt{2gh_3} = \sqrt{2(9.81 \text{ m/s}^2)(0.12 \text{ m})} = 1.53 \text{ m/s} \]