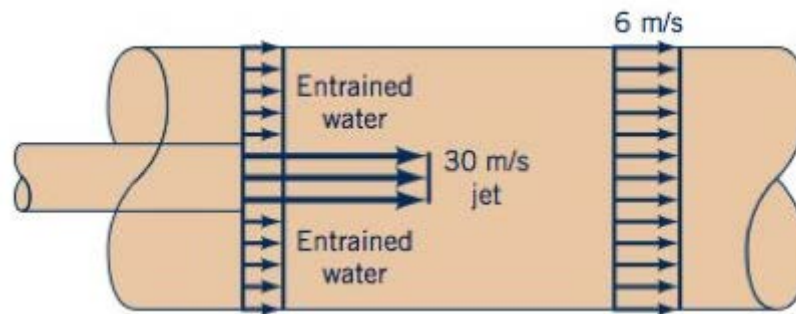


NAME

Fluids-ID

Quiz 6. A water jet pump (See figure) involves a jet cross sectional area of 0.01 m^2 , and a jet velocity of 30 m/s . The jet is surrounded by entrained water. The total cross-sectional area associated with the jet and entrained streams is 0.075 m^2 . These two fluid streams leave the pump thoroughly mixed with an average velocity of 6 m/s through a cross-sectional area of 0.075 m^2 . Determine the pumping rate (i.e. the entrained fluid flowrate) involved in m^3/s .



Note: Attendance (+2 points), format (+1 point)

Solution:

Continuity eq. for fixed CV with 1D flows and discrete CS's,

$$0 = \sum \dot{m}_{out} - \sum \dot{m}_{in} \quad (+4 \text{ points})$$

Where $\dot{m} = \rho Q = \rho VA$, thus

$$0 = (\rho V_3 A_3) - (\rho V_1 A_1 + \rho Q_2) \quad (+2 \text{ points})$$

$$\therefore Q_2 = V_3 A_3 - V_1 A_1 = \left[\left(6 \frac{\text{m}}{\text{s}} \right) (0.075 \text{ m}^2) - \left(30 \frac{\text{m}}{\text{s}} \right) (0.01 \text{ m}^2) \right] = 0.15 \frac{\text{m}^3}{\text{s}} \quad (+1 \text{ point})$$