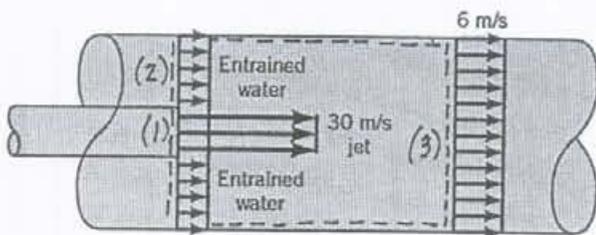


5.17

5.17 A water jet pump (see Fig. P5.17) 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 liters/s.



■ FIGURE P5.17

For steady incompressible flow through the control volume

$$Q_1 + Q_2 = Q_3$$

or

$$\bar{V}_1 A_1 + Q_2 = \bar{V}_3 A_3$$

Thus

$$Q_2 = \bar{V}_3 A_3 - \bar{V}_1 A_1 = \left[\left(6 \frac{\text{m}}{\text{s}} \right) (0.075 \text{ m}^2) - \left(30 \frac{\text{m}}{\text{s}} \right) (0.01 \text{ m}^2) \right] \left(1000 \frac{\text{liters}}{\text{m}^3} \right)$$

$$Q_2 = \underline{\underline{150 \frac{\text{liters}}{\text{s}}}}$$