

Review problems for Exam 2

Bernoulli equation

5-55 Air at 110 kPa and 50°C flows upward through a 6-cm-diameter inclined duct at a rate of 45 L/s. The duct diameter is then reduced to 4 cm through a reducer. The pressure change across the reducer is measured by a water manometer. The elevation difference between the two points on the pipe where the two arms of the manometer are attached is 0.20 m. Determine the differential height between the fluid levels of the two arms of the manometer.

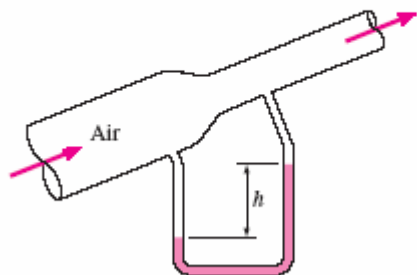


FIGURE P5-55

Energy Equation

5-69 Underground water is to be pumped by a 70 percent efficient 3-kW submerged pump to a pool whose free surface is 30 m above the underground water level. The diameter of the pipe is 7 cm on the intake side and 5 cm on the discharge side. Determine (a) the maximum flow rate of water and (b) the pressure difference across the pump. Assume the elevation difference between the pump inlet and the outlet and the effect of the kinetic energy correction factors to be negligible.

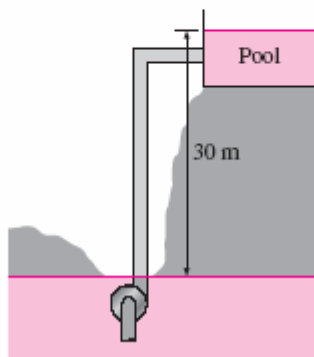


FIGURE P5-69

Momentum equation

6-25 A reducing elbow is used to deflect water flow at a rate of 30 kg/s in a horizontal pipe upward by an angle $\theta = 45^\circ$ from the flow direction while accelerating it. The elbow discharges water into the atmosphere. The cross-sectional area of the elbow is 150 cm^2 at the inlet and 25 cm^2 at the exit. The elevation difference between the centers of the exit and the inlet is 40 cm . The mass of the elbow and the water in it is 50 kg . Determine the anchoring force needed to hold the elbow in place. Take the momentum-flux correction factor to be 1.03 .

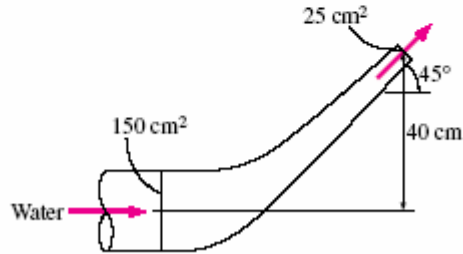


FIGURE P6-25

Dimensional Analysis

The wave resistance of a model of a ship at $1/25$ scale is $2[\text{lbf}]$ at a model speed of $5[\text{ft/s}]$. What are the corresponding velocity and wave resistance of the prototype?

Pipe Flow

8-46 Glycerin at 40°C with $\rho = 1252 \text{ kg/m}^3$ and $\mu = 0.27 \text{ kg/m} \cdot \text{s}$ is flowing through a 5-cm -diameter horizontal smooth pipe with an average velocity of 3.5 m/s . Determine the pressure drop per 10 m of the pipe.