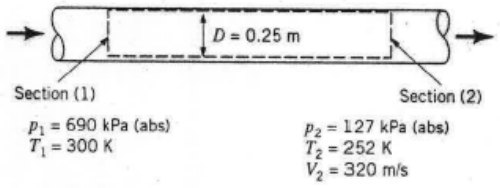
Homework 4 – Due March 6
Problems 5.6, 5.14, 5.36,5.40 and 5.50

1)

5.6

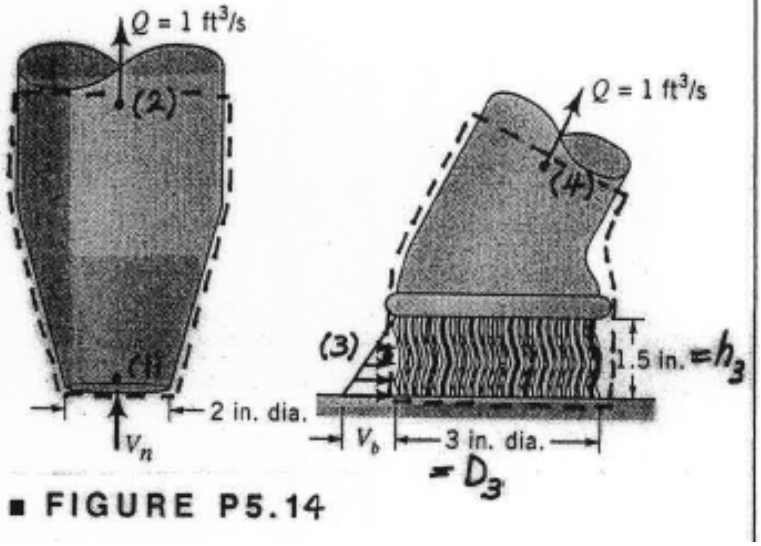
5.6 Air flows steadily between two cross sections in a long, straight section of 0.25-m inside diameter pipe. The static temperature and pressure at each section are indicated in Fig. P5.6. If the average air velocity at section (2) is 320 m/s, determine the average air velocity at section (1).



■ FIGURE P5.6

2)

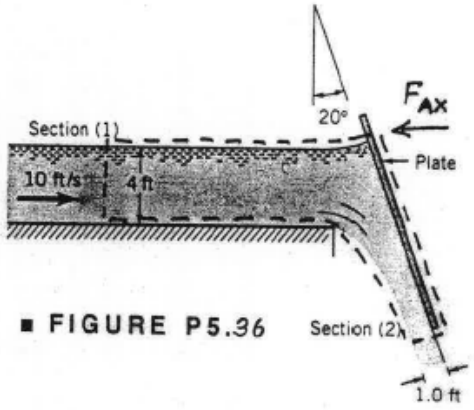
5.14 Various types of attachments can be used with the shop vac shown in **Video V 5.2**. Two such attachments are shown in Fig. P5.14—a nozzle and a brush. The flowrate is 1 ft^3/s. **(a)** Determine the average velocity through the nozzle entrance, V_n. **(b)** Assume the air enters the brush attachment in a radial direction all around the brush with a velocity profile that varies linearly from 0 to V_b along the length of the bristles as shown in the figure. Determine the value of V_b.



■ FIGURE P5.14

3)

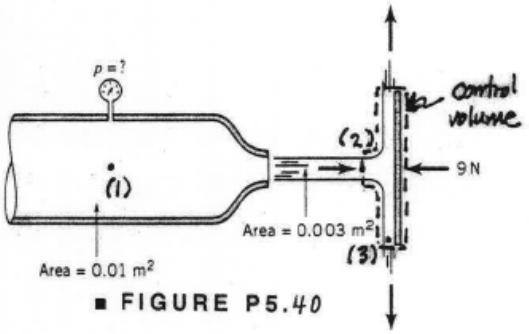
5.36 Water flows from a two-dimensional open channel and is diverted by an inclined plate as illustrated in Fig. P5.36. When the velocity at section (1) is 10 ft/s, what horizontal force (per unit width) is required to hold the plate in position? At section (1) the pressure distribution is hydrostatic, and the fluid acts as a free jet at section (2). Neglect friction.



■ FIGURE P5.36

4)

5.40 Air flows into the atmosphere from a nozzle and strikes a vertical plate as shown in Fig. P5.40. A horizontal force of 9 N is required to hold the plate in place. Determine the reading on the pressure gage. Assume the flow to be incompressible and frictionless.



■ FIGURE P5.40

5)

5.50 A variable mesh screen produces a linear and axisymmetric velocity profile as indicated in Fig. P5.50 in the air flow through a 2-ft-diameter circular cross-sectional duct. The static pressures upstream and downstream of the screen are 0.2 and 0.15 psi and are uniformly distributed over the flow cross-sectional-area. Neglecting the force exerted by the duct wall on the flowing air, calculate the screen drag force.