

#1.

A jet of air from a nozzle is blown at right angles against a wall in which a pressure tap is located. A manometer connected to the tap shows a head of 0.14 in. of mercury above atmospheric. Determine the approximate speed of the air leaving the nozzle if it is at  $40^{\circ}F$  and 14.7 psia.

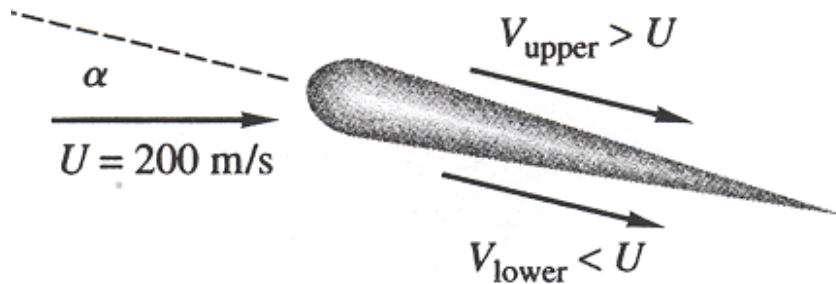
#2.

Consider steady, frictionless, incompressible flow of air over the wing of an airplane. The air approaching the wing is at 10 psia, 40°F, and has a speed of 200 ft/s relative to the wing. At a certain point in the flow, the pressure is – 0.40 psi (gage). Calculate the speed of air relative to the wing at this point.

#3.

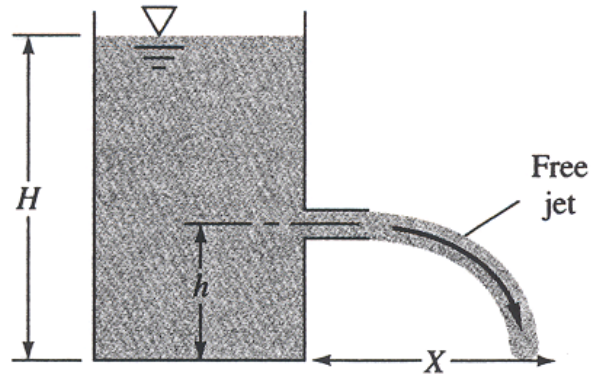
An airfoil at an angle of attack  $\alpha$ , as shown in the Fig., provides lift by Bernoulli effect, because of lower surface slows the flow (high pressure) and the upper surface speeds up the flow (low pressure). If the foil is 1.5 m long and 18 m wide into the paper, and the ambient air is 5000 m standard atmosphere, estimate the total lift if the average velocities on upper and lower surfaces are 215 m/s and 185 m/s, respectively. Neglect gravity.

*Note:* For this case, the angle  $\alpha$  is approximately  $3^\circ$ .



#4.

For the container shown, use Bernoulli's equation to derive a formula for the distance  $X$  where the free jet leaving horizontally will strike the floor, as a function of  $h$  and  $H$ . For what ratio  $h/H$  will  $X$  be maximum? Sketch the three trajectories for  $h/H = 0.4$ , 0.5, and 0.6.

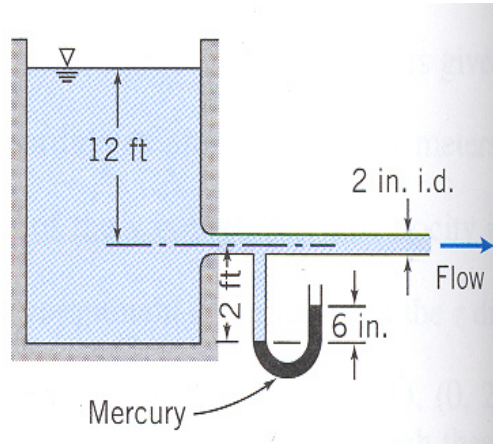


#5.

Water flows in a circular duct. At one section the diameter is 0.3 m, the static pressure is 260 kPa (gage), the velocity is 3 m/s, and the elevation is 10 m above ground level. At a section downstream at ground level, the duct diameter is 0.15 m. Find the gage pressure at the downstream section if frictional effects may be neglected.

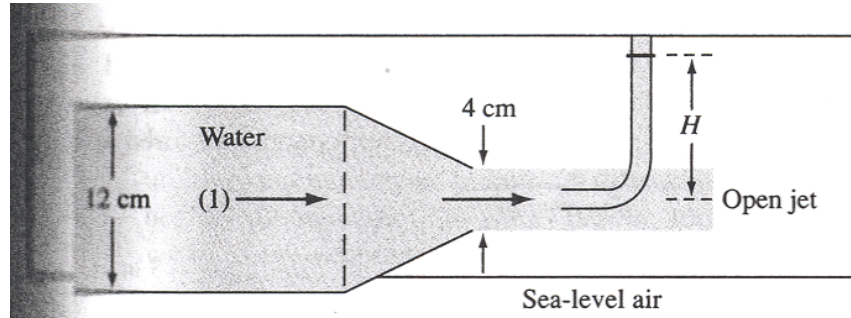
#6.

Water flows from a very large tank through a 2 in. diameter tube. The dark liquid in the manometer is mercury. Estimate the velocity in the pipe and the rate of discharge from the tank.



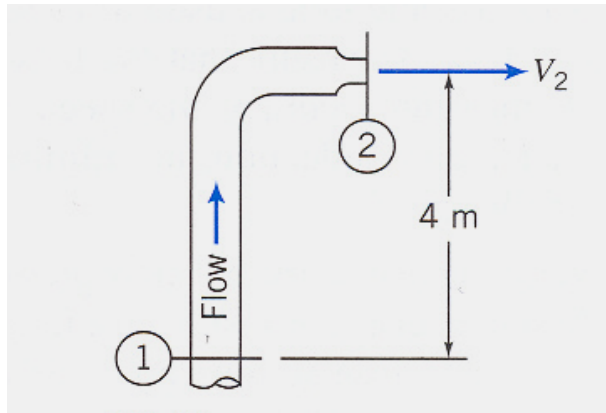
#7.

The open jet of water exits a nozzle into sea-level air and strikes a stagnation tube as shown. If the pressure at the centerline at section 1 is 110 kPa, and losses are neglected, estimate (a) the mass flow in kg/s and (b) the height  $H$  of the fluid in the stagnation tube.



#8.

Water flows steadily up the vertical 0.1 m diameter pipe and out the nozzle, which is 0.05 m in diameter, discharging to atmospheric pressure. The stream velocity at the nozzle exit must be 20 m/s. Calculate the minimum gage pressure required at section ①. If the device were inverted, what would be the required minimum pressure at section ① to maintain the nozzle exit velocity at 20 m/s ?



#9.

Once it has been started by sufficient suction, the *siphon* shown below will run continuously as long as reservoir fluid is available. Using Bernoulli's equation with no losses, show (a) that the exit velocity  $V_2$  depends only on gravity and the distance  $H$  and (b) that the lowest (vacuum) pressure occurs at point 3 and depends on the distance  $L+H$ .

