
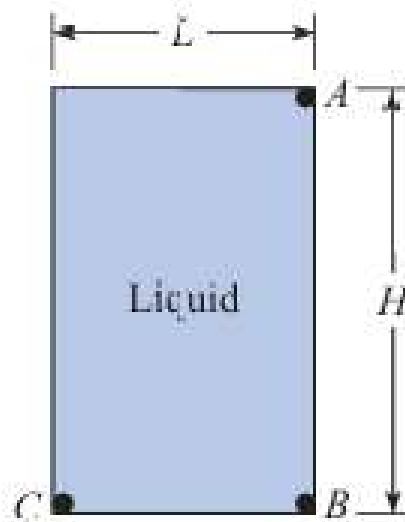

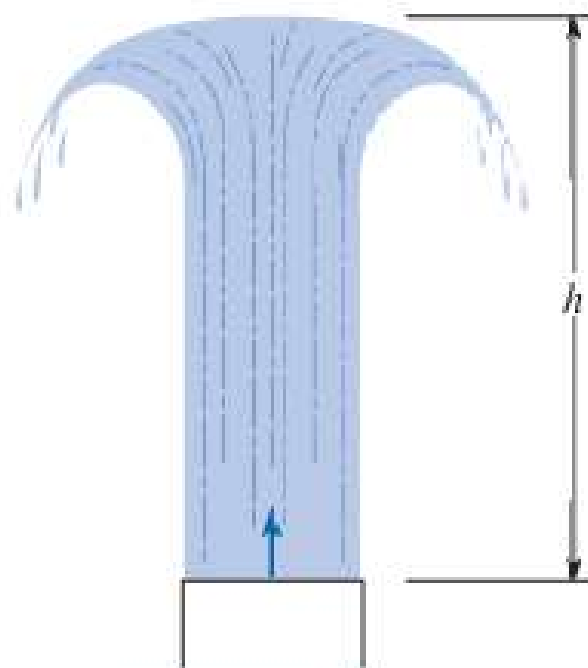


4.46  The closed tank shown, which is full of liquid, is accelerated downward at $\frac{2}{3}g$ and to the right at $1g$. Here $L = 2.5$ m, $H = 3$ m, and the liquid has a specific gravity of 1.3. Determine $p_C - p_A$ and $p_B - p_A$.



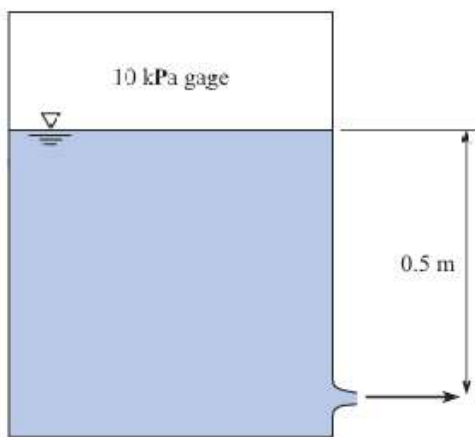
PROBLEMS 4.45, 4.46

4.49  A water jet issues vertically from a nozzle, as shown. The water velocity as it exits the nozzle is 18 m/s. Calculate how high h the jet will rise. (*Hint: Apply the Bernoulli equation along the centerline.*)




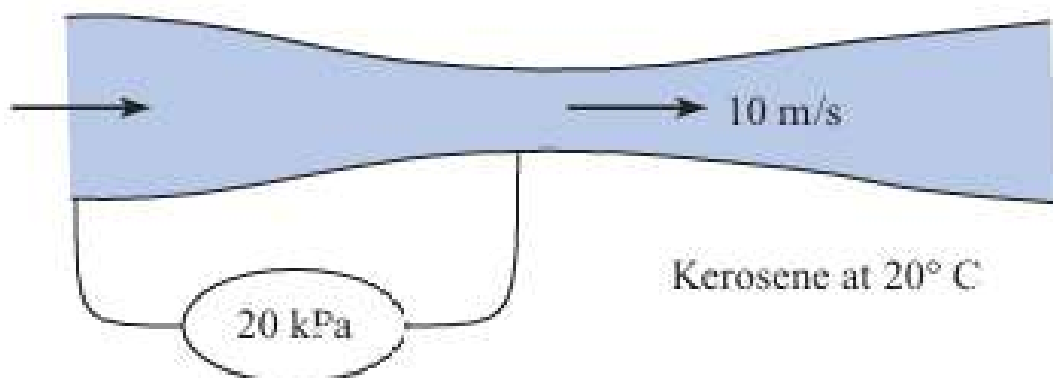
PROBLEM 4.49

4.50 A pressure of 10 kPa, gage, is applied to the surface of water in an enclosed tank. The distance from the water surface to the outlet is 0.5 m. The temperature of the water is 20°C. Find the velocity (m/s) of water at the outlet. The speed of the water surface is much less than the water speed at the outlet.




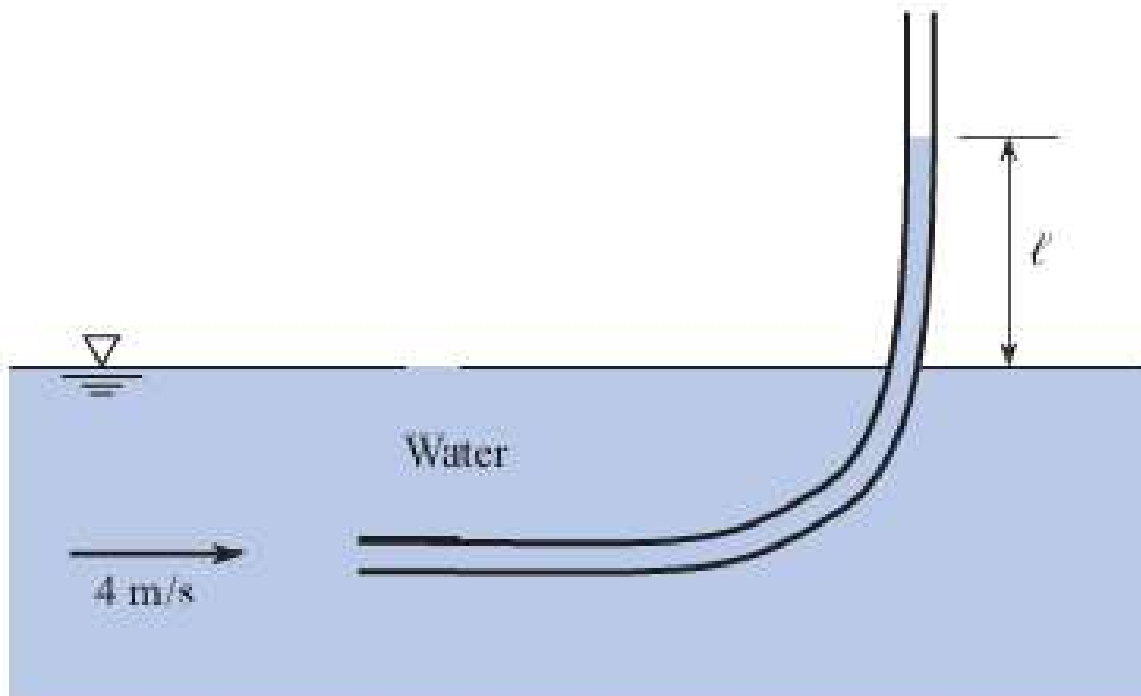
PROBLEM 4.50

4.52  Kerosene at 20°C flows through a contraction section as shown. A pressure gage connected between the upstream pipe and throat section shows a pressure difference of 20 kPa . The gasoline velocity in the throat section is 8 m/s . What is the velocity (m/s) in the upstream pipe?



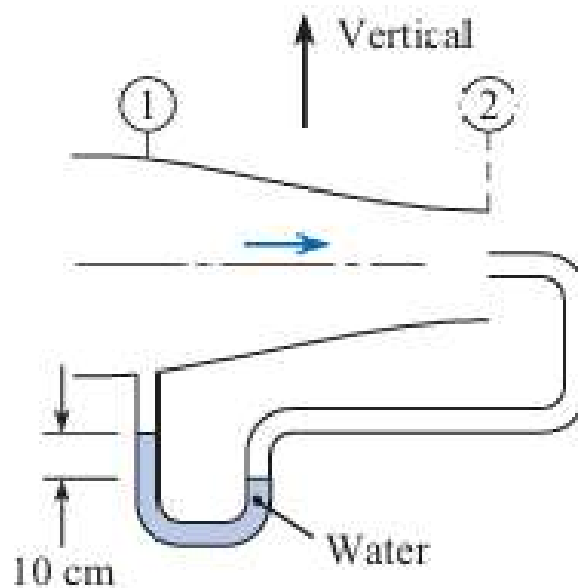
PROBLEM 4.52

4.55  A glass tube is inserted into a flowing stream of water with one opening directed upstream and the other end vertical. If the water velocity is 5 m/s, how high will the water rise in the vertical leg relative to the level of the water surface of the stream?



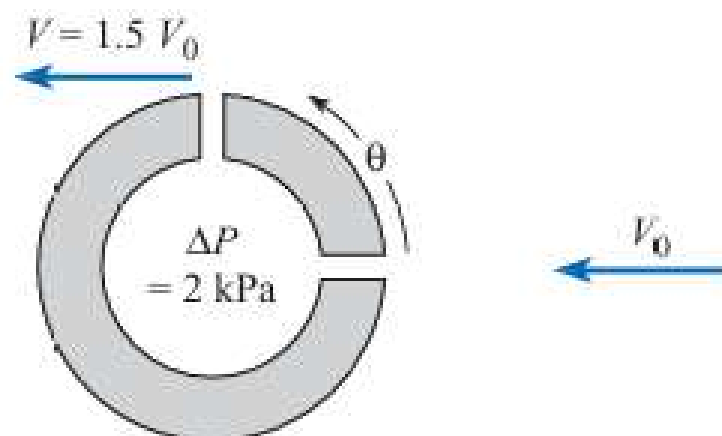
PROBLEM 4.55

4.58 The flow-metering device shown consists of a stagnation probe at station 2 and a static pressure tap at station 1. The velocity at station 2 is 1.5 times that at station 1. Air with a density of 1.2 kg/m^3 flows through the duct. A water manometer is connected between the stagnation probe and the pressure tap, and a deflection of 10 cm is measured. What is the velocity at station 2?



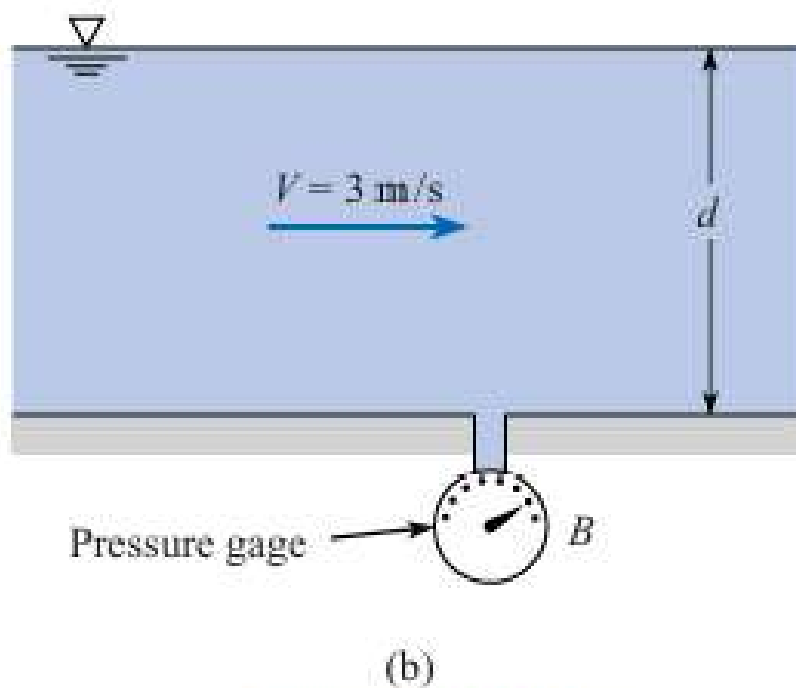
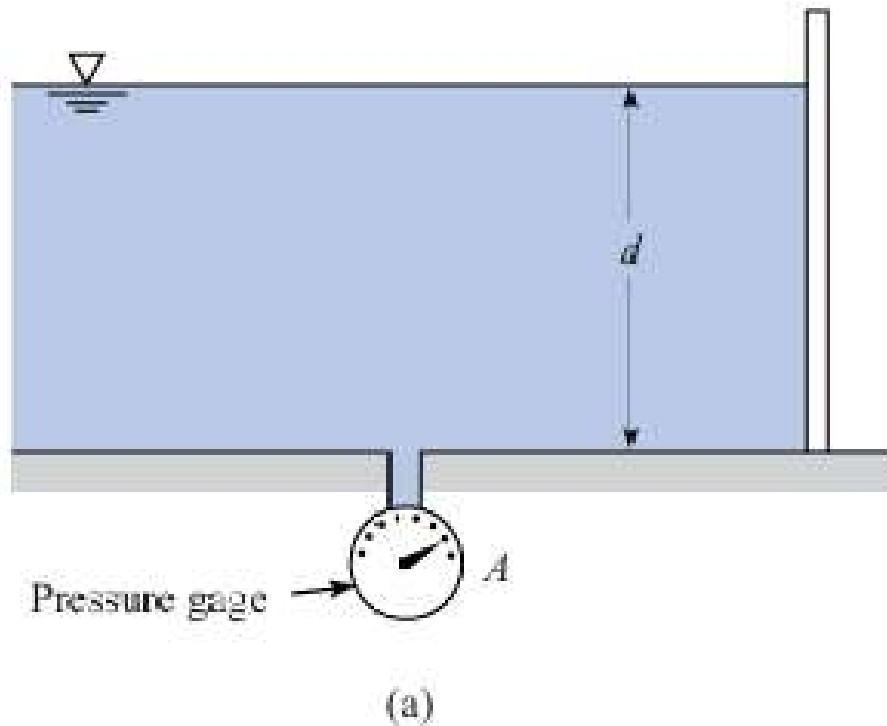
PROBLEM 4.58

4.59 The “spherical” Pitot probe shown is used to measure the flow velocity in water ($\rho = 1000 \text{ kg/m}^3$). Pressure taps are located at the forward stagnation point and at 90° from the forward stagnation point. The speed of fluid next to the surface of the sphere varies as $1.5 V_0 \sin \theta$, where V_0 is the free-stream velocity and θ is measured from the forward stagnation point. The pressure taps are at the same level; that is, they are in the same horizontal plane. The piezometric pressure difference between the two taps is 2 kPa. What is the free-stream velocity V_0 ?




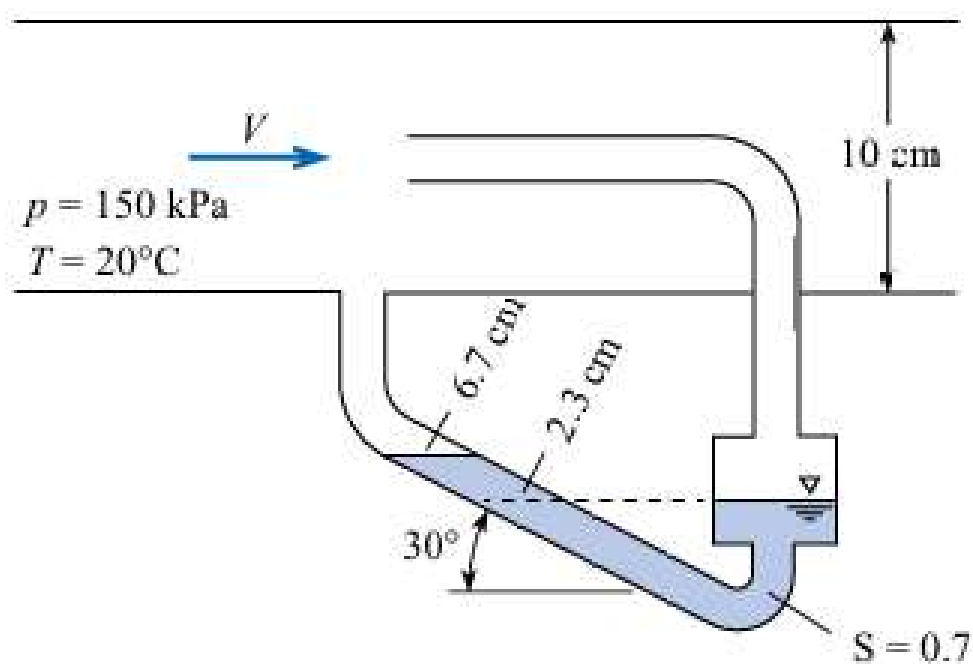
PROBLEM 4.59

4.69 Water in a flume is shown for two conditions. If the depth d is the same for each case, will gage A read greater or less than gage B ? Explain.




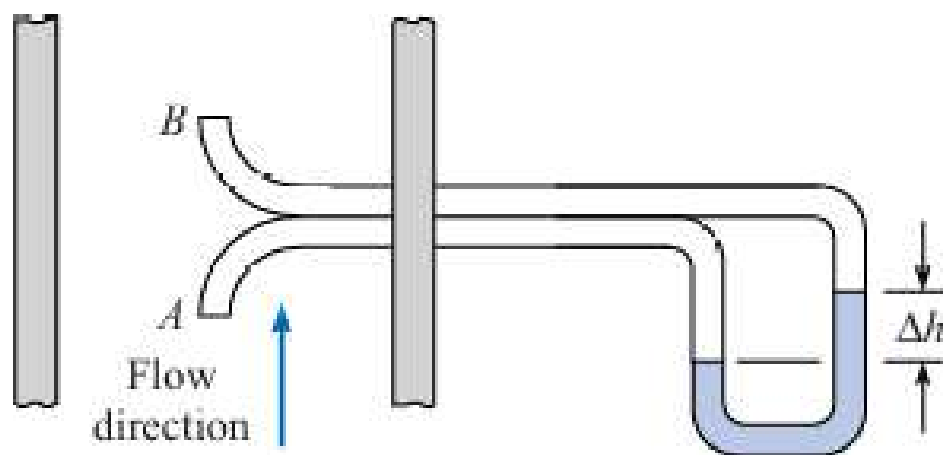
PROBLEM 4.69

4.70  The apparatus shown in the figure is used to measure the velocity of air at the center of a duct having a 10 cm diameter. A tube mounted at the center of the duct has a 2 mm diameter and is attached to one leg of a slant-tube manometer. A pressure tap in the wall of the duct is connected to the other end of the slant-tube manometer. The well of the slant-tube manometer is sufficiently large that the elevation of the fluid in it does not change significantly when fluid moves up the leg of the manometer. The air in the duct is at a temperature of 20°C , and the pressure is 150 kPa. The manometer liquid has a specific gravity of 0.7, and the slope of the leg is 30° . When there is no flow in the duct, the liquid surface in the manometer lies at 2.3 cm on the slanted scale. When there is flow in the duct, the liquid moves up to 6.7 cm on the slanted scale. Find the velocity of the air in the duct. Assuming a uniform velocity profile in the duct, calculate the rate of flow of the air.



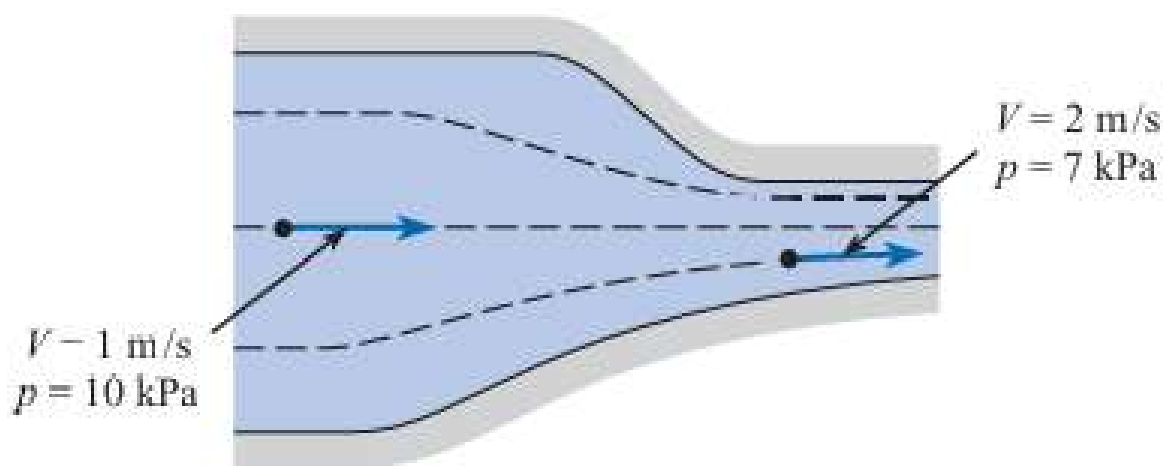
PROBLEM 4.70

4.71  A rugged instrument used frequently for monitoring gas velocity in smokestacks consists of two open tubes oriented to the flow direction as shown and connected to a manometer. The pressure coefficient is 1.0 at A and -0.3 at B . Assume that water, at 20°C , is used in the manometer and that a 5 mm deflection is noted. The pressure and temperature of the stack gases are 101 kPa and 250°C . The gas constant of the stack gases is 200 J/kg K. Determine the velocity of the stack gases.



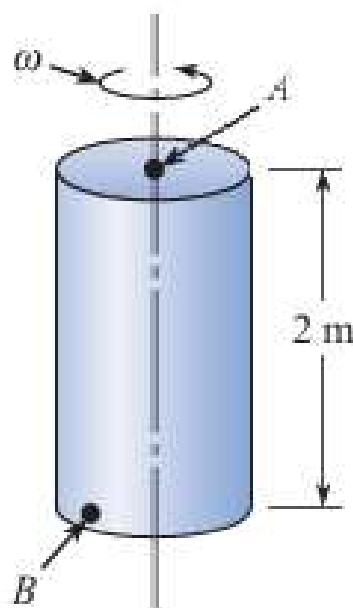
PROBLEM 4.71

4.89 The velocity and pressure are given at two points in the flow field. Assume that the two points lie in a horizontal plane and that the fluid density is uniform in the flow field and is equal to 1000 kg/m^3 . Assume steady flow. Then, given these data, determine which of the following statements is true. (a) The flow in the contraction is nonuniform and irrotational. (b) The flow in the contraction is uniform and irrotational. (c) The flow in the contraction is nonuniform and rotational. (d) The flow in the contraction is uniform and rotational.




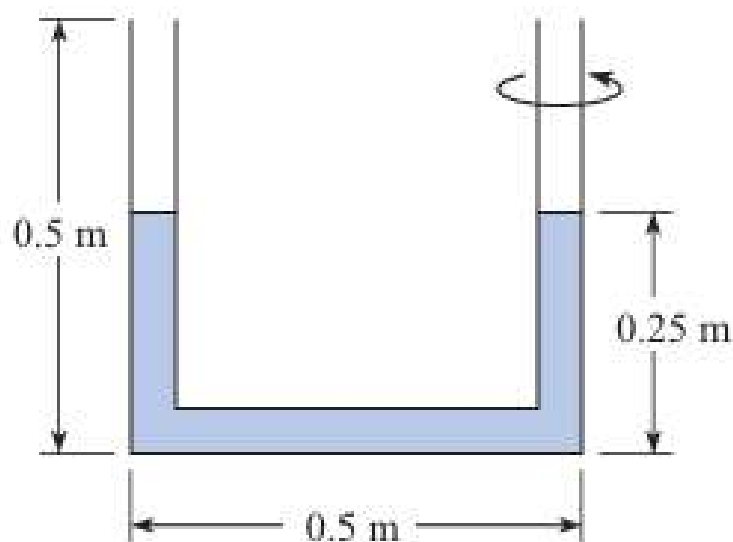
PROBLEM 4.89

4.101 A closed tank of liquid ($S = 1.2$) is rotated about a vertical axis (see the figure), and at the same time the entire tank is accelerated upward at 4 m/s^2 . If the rate of rotation is 10 rad/s , what is the difference in pressure between points A and B ($p_B - p_A$)? Point B is at the bottom of the tank at a radius of 0.5 m from the axis of rotation, and point A is at the top on the axis of rotation.



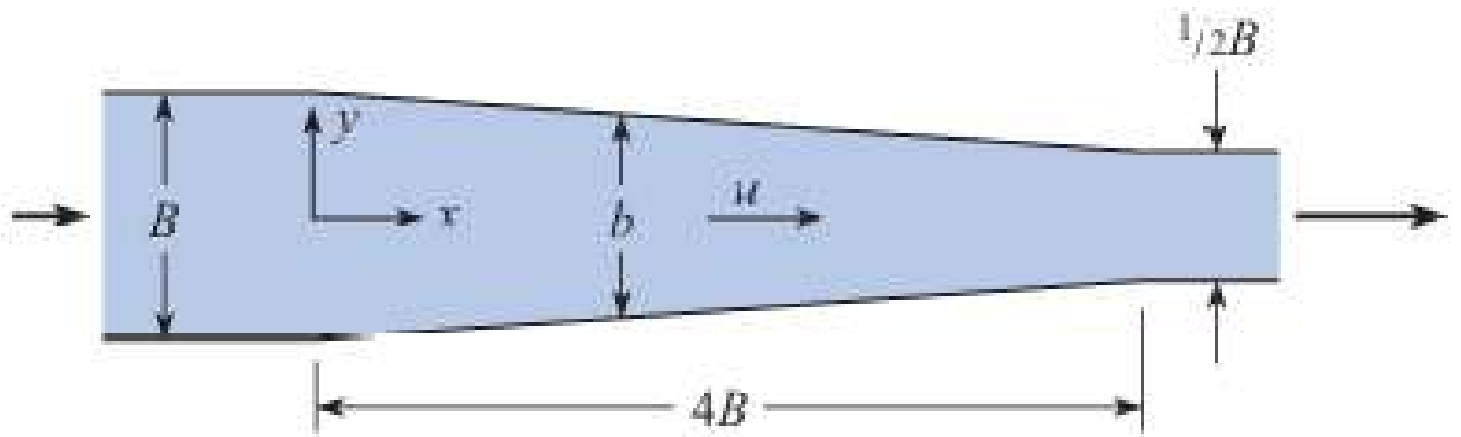
PROBLEM 4.101

4.102  A U-tube is rotated about one leg, as shown. Before being rotated the liquid in the tube fills 0.25 m of each leg. The length of the base of the U-tube is 0.5 m, and each leg is 0.5 m long. What would be the maximum rotation rate (in rad/s) to ensure that no liquid is expelled from the outer leg?




PROBLEM 4.102

4.30 Liquid flows through this two-dimensional slot with a velocity of $V = 2(q_0/b)(t/t_0)$, where q_0 and t_0 are reference values. What will be the local acceleration at $x = 2B$ and $y = 0$ in terms of B , t , t_0 , and q_0 ?

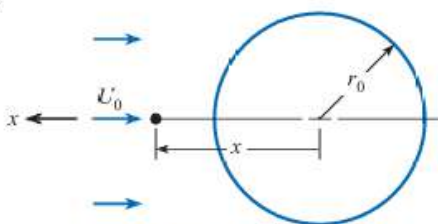


PROBLEMS 4.30, 4.31

occurs.

4.25  The velocity along a pathline is given by $V \text{ (m/s)} = s^2 t^{1/2}$ where s is in meters and t is in seconds. The radius of curvature is 0.4 m. Evaluate the acceleration tangent and normal to the path at $s = 1.5$ m and $t = 0.5$ seconds.

4.26 Tests on a sphere are conducted in a wind tunnel at an air speed of U_0 . The velocity of flow toward the sphere along the longitudinal axis is found to be $u = -U_0 (1 - r_0^3/x^3)$, where r_0 is the radius of the sphere and x the distance from its center. Determine the acceleration of an air particle on the x -axis upstream of the sphere in terms of x , r_0 , and U_0 .



PROBLEM 4.26

low passage the velocity is v