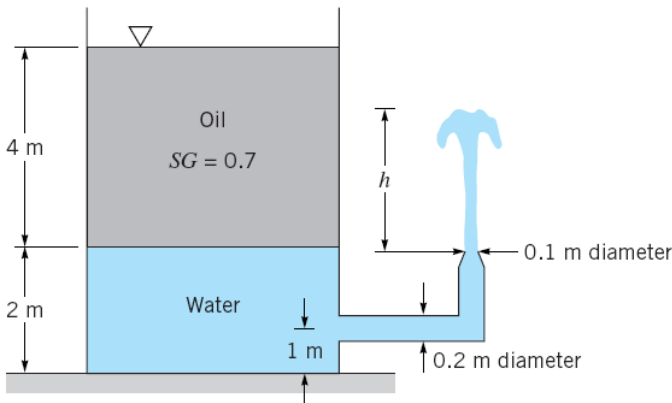**3.29**　　A large open tank contains a layer of oil floating on water as shown in Fig. P3.29. The flow is steady and inviscid. (a) Determine the height, h, to which the water will rise. (b) Determine the water velocity in the pipe. (c) Determine the pressure in the horizontal pipe.


■ **FIGURE P3.29**

3.51　　Air flows through a Venturi channel of rectangular cross section as shown in **Video V3.6** and Fig. P3.51. The constant width of the channel is 0.06 m and the height at the exit is 0.04 m. Compressibility and viscous effects are negligible. (a) Determine the flowrate when water is drawn up 0.10 m in a small tube attached to the static pressure tap at the throat where the channel height is 0.02 m. (b) Determine the channel height, h_2, at section (2) where, for the same flowrate as in part (a), the water is drawn up 0.05 m. (c) Determine the pressure needed at section (1) to produce this flow.
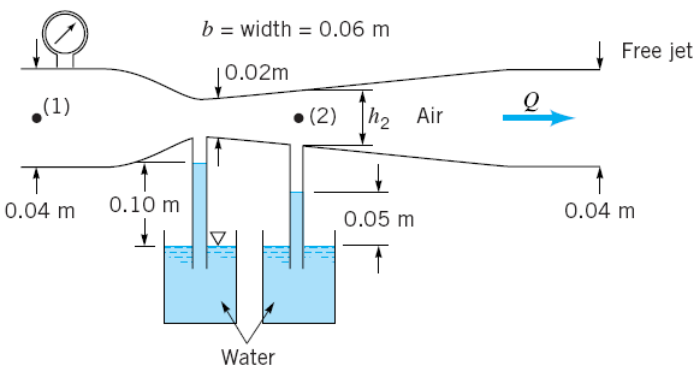
■ **FIGURE P3.51**

4.15　　A three-dimensional velocity field is given by $u = x^2$, $v = -2xy$, and $w = x + y$. Determine the acceleration vector.

4.23　　As a valve is opened, water flows through the diffuser shown in Fig. P4.23 at an increasing flowrate so that the velocity along the centerline is given by $\mathbf{V} = u\hat{\mathbf{i}} = V_0(1 - e^{-ct})(1 - x/\ell)\,\hat{\mathbf{i}}$, where u_0, c, and ℓ are constants. Determine the acceleration as a function of x and t. If $V_0 = 10$ ft/s and $\ell = 5$ ft, what value of c (other than $c = 0$) is needed to make the acceleration zero for any x at $t = 1$ s? Explain how the acceleration can be zero if the flowrate is increasing with time.
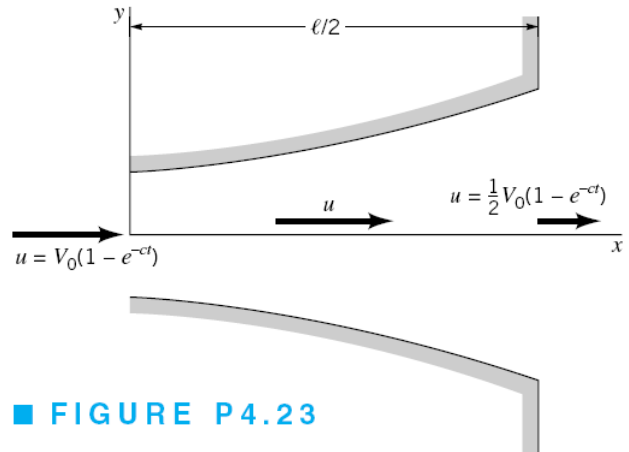
■ **FIGURE P4.23**

■ **FIGURE P4.23**

3.26　　Small-diameter, high-pressure liquid jets can be used to cut various materials as shown in Fig. P3.26. If viscous effects are negligible, estimate the pressure needed to produce a 0.10-mm-diameter water jet with a speed of 700 m/s. Determine the flowrate.
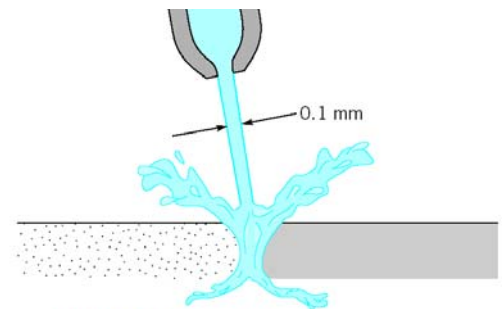
■ **FIGURE P3.26**

4.7　　The velocity field of a flow is given by $u = -V_0 y/(x^2 + y^2)^{1/2}$ and $v = V_0 x/(x^2 + y^2)^{1/2}$, where V_0 is a constant. Where in the flow field is the speed equal to V_0? Determine the equation of the streamlines and discuss the various characteristics of this flow.