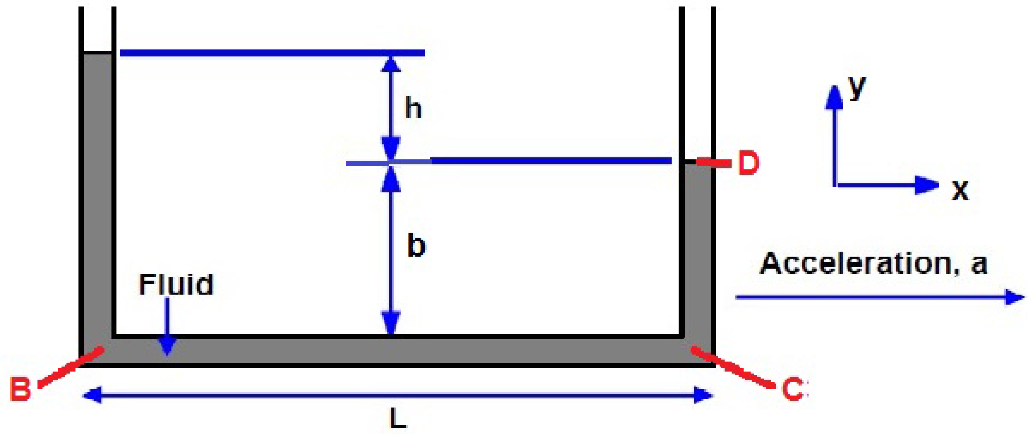
Solution to Problem 102B:



Defining axes y vertically and x to the right, the acceleration a acts in a manner precisely analogous to the acceleration due to gravity, g, so that

$$\frac{\partial p}{\partial x} = -\rho a \quad ; \quad \frac{\partial p}{\partial y} = -\rho g \tag{1}$$

where ρ is the density of the fluid. Another way to obtain the same results is to consider the use of Euler's equations with the velocities set to zero so that

$$\rho \frac{\partial u}{\partial t} = \rho a = -\frac{\partial p}{\partial x} \quad ; \quad 0 = -\frac{\partial p}{\partial y} - \rho g \tag{2}$$

If the fluid is static relative to the U-tube then $\partial u/\partial t = a$, $\partial v/\partial t = 0$ and we recover the first equation.

Then if atmospheric pressure is denoted by p_a:

$$p_B = p_a + \rho g h + \rho g b \tag{3}$$

$$p_C = p_B - \rho a L = p_a + \rho g h + \rho g b - \rho a L \tag{4}$$

$$p_D = p_C - \rho g b = p_a + \rho g h - \rho a L = p_a \tag{5}$$

Therefore

$$a = gh/L \tag{6}$$