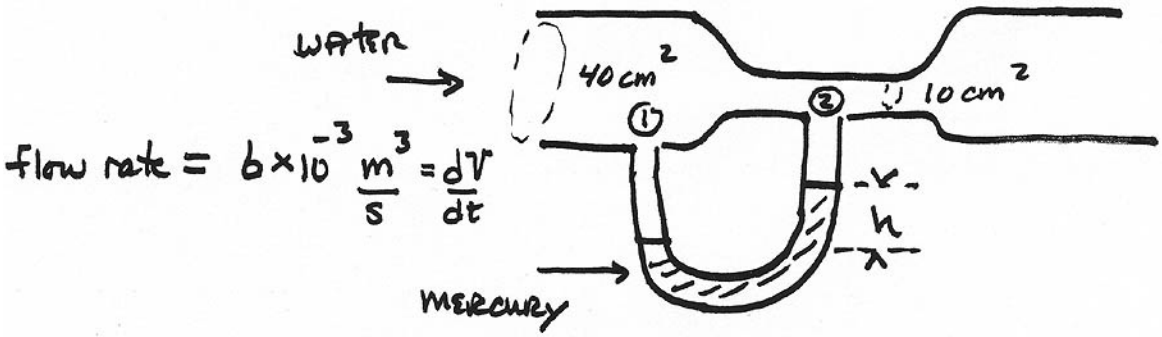
DAY 2 - Problem 3



A) What ARE the water speeds AT points ① and ②?
B) What is the pressure difference?
C) What is the height difference in mercury?

A) Continuity Equation says $\rho A v = \rho \frac{dV}{dt} = \text{constant} = \frac{dm}{dt}$

① $v_1 = \frac{dV/dt}{A} = \frac{6\times10^{-3}\ m^3/s}{40\times10^{-4}\ m^2} = 1.5\ m/s$

② $v_2 = \frac{6\times10^{-3}\ m^3/s}{10\times10^{-4} m^2} = 6.0\ m/s$

B) Bernoulli's Equation $\Delta p = -\frac{1}{2}\rho \Delta v^2 - \rho g \Delta y = -\frac{1}{2}\rho \Delta v^2$

$\Rightarrow \Delta p = \frac{1}{2}\rho(v_1^2 - v_2^2) = \frac{1}{2}\left(10^3 \frac{kg}{m^3}\right)\left[(1.5^2 - 6^2)\frac{m^2}{s^2}\right] = -1.69\times10^4\ Pa$

C) $\Delta P = \rho_{Hg} g h \Rightarrow h = \frac{\Delta P}{\rho_{Hg} g} = \frac{1.69\times10^4\ Pa}{\left(13.6\times10^3 \frac{kg}{m^3}\right)(9.8\ m/s^2)} = .127\ m$