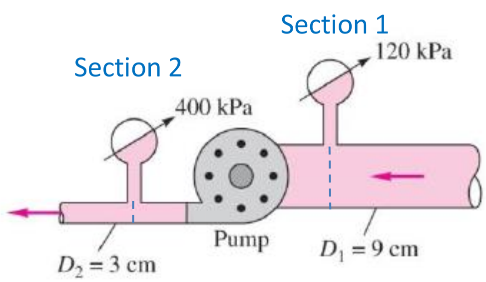
11 November 2022

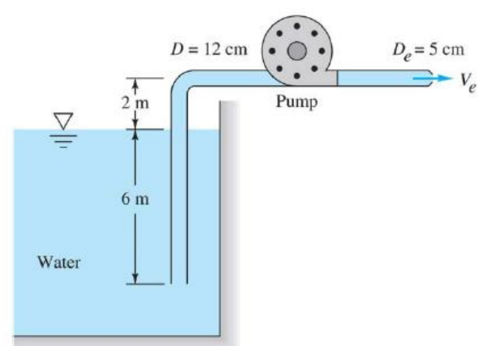
Mechanical, Automotive and Materials Engineering
Fluid Mechanics I
MECH-3233-F23

Assignment Problems Set #8

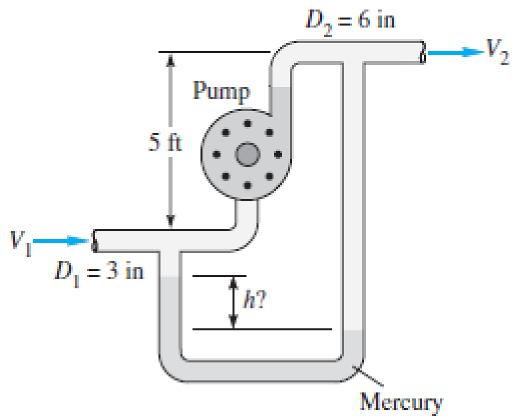
Problem 1(5 points): The horizontal pump in the Figure below discharges water at 57 m^3/h. The losses between 1 and 2 are given by $h_L = K\frac{V_1^2}{2g}$, where K = 7.5 is a dimensionless loss coefficient. Take the kinetic energy correction factor α = 1.06 for both sections 1 and 2 and find the power delivered to the water by the pump (water density is 1000 kg/m^3).



Problem 2 (5 points): When the pump in the Figure below draws 220 m^3/hr of water at 20°C (ρ = 998 kg/m^3) from the reservoir, the total friction head loss is 5 m. The flow discharges through a nozzle to the atmosphere. Estimate the pump power in kW delivered to the water.
Note: Take turbulent pipe flow kinetic correction factor α = 1.11.



Problem 3 (6 points) Kerosene at 20°C (ρ = 804 kg/m^3) flows through the pump at 2.3 ft^3/s as shown in the figure below. Head losses between 1 and 2 are 8 ft, and the pump delivers 8 hp to the flow. What should the mercury (γ_{Hg} = 846 lbf/ft^3) manometer reading h ft be?



Problem 4 (4 points): The wave overtopping device consists of a floating reservoir that is continuously filled by waves, so that the water level in the reservoir is always higher than that of the surrounding ocean. As the water drains out at A, the energy is drawn by the low-head hydro turbine, which then generates electricity. Determine the power that can be produced by this system if the water level in the reservoir is always 1.5 m above that in the ocean. The waves add 0.3 m^3/s to the reservoir, and the diameter of the tunnel containing the turbine is 600 mm. The head loss through the turbine is 0.2 m. Take $\rho_w = 1050\ kg/m^3$.