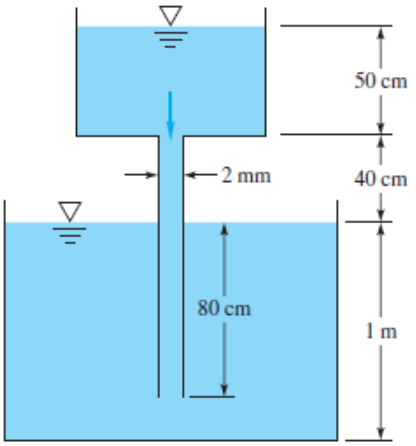
24 November 2023

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

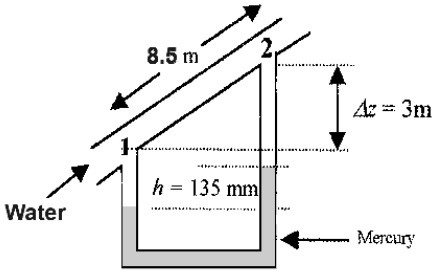
Assignment Problems Set #10

Problem 1 (3 points) For the configuration shown in the figure below, the fluid is ethyl alcohol at 20°C, ($\rho = 789$ kg/m^3 and $\mu = 0.0012$ kg/m·s) and the tanks are very wide. If the flow is steady and laminar, find the flow rate that occurs, in m^3/h. *Neglect minor losses.*



Problem 2: Water at 20°C ($\gamma_w = 9790$ N/m^3) flows upward at 4 m/s in a 7-cm-diameter pipe. The pipe length between points 1 and 2 is 8.5 m and point 2 is 3m higher as shown in the Figure below. A mercury manometer, connected between 1 and 2, has a reading h = 135 mm, with p_1 higher. Determine

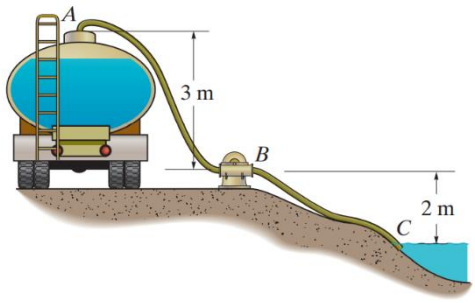
a) the pressure change ($p_1 - p_2$) (**1 point**)
b) the head loss, in meters (**1 point**)
c) the friction factor of the flow and the Reynolds number (**2 points**)



Problem 3: Water (ρ = 1000 kg/m^3, $\nu = 1\times10^{-6}$ m^2/s) from a river is pumped into the truck. The pump creates a flow of 300 liter/min through a 40-mm-diameter hose as shown in the figure to the right. If the total length of the hose is 8 m and the tank is open to the atmosphere, determine:

a) the Reynolds number for the flow in the pipe (**1 Marks**)
b) the friction factor *f* for a smooth hose (**2 Marks**)
c) the power that must be supplied by the pump (**2 Marks**)

Neglect any minor losses.



Problem 4: The tank-pipe system shown in the figure below is to deliver at 11 m^3/h of water at 20°C (ρ = 998 kg/m^3 and μ = 0.001 kg/m·s) to the reservoir. Determine:

a) the average velocity of the water in the pipe (**1 point**)
b) the major head loss in meters (**2 points**)
c) the roughness height, ε allowable for the pipe (**3 points**)

Neglect the minor losses.