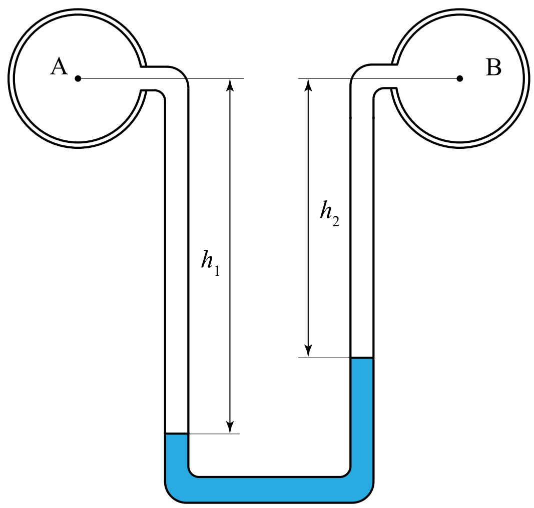
Homework #2

MEMS 0071 - Introduction to Fluid Mechanics

Assigned: September 7^{th}, 2019
Due: September 13^{th}, 2019

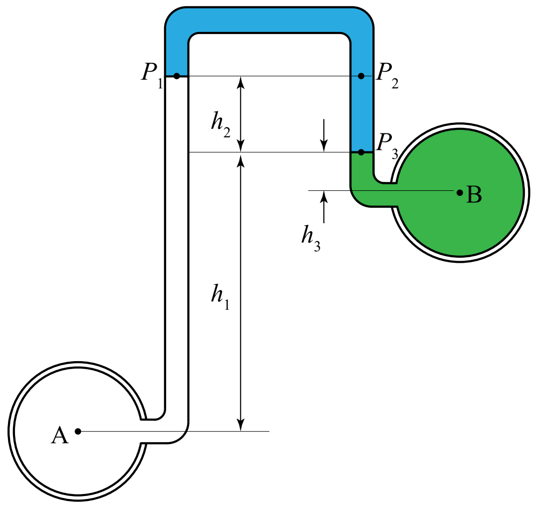
Problem #1

Consider the following differential manometer. The fluid represented by the white is air, that by blue is water. Given h_1=96 [mm], h_2=74 [mm], determine the pressure difference ΔP=P_{A}-P_{B} in [kPa].



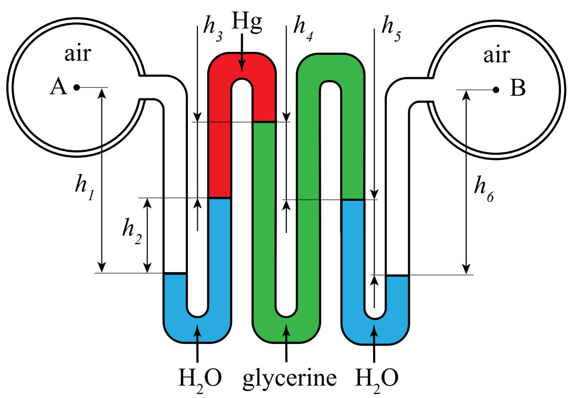
Problem #2

Consider the following differential manometer. The fluid represented by the white is air, that by blue is water and that by green is oil, with a specific gravity SG=0.83. Given h_1=130 [mm], h_2=36 [mm] and h_3=18 [mm], determine the pressure difference ΔP=P_A-P_B in [kPa].



Problem #3

Given the manometer below, find the pressure difference ΔP=P_A-P_B. The heights are h_1=h_6=86 [mm], h_2=h_3=h_4=h_5=35 [mm]. The fluid properties are ρ_{H_2O}=998 [kg/m^3], SG_{Hg}=13.6, ρ_{air}=1.225 [kg/m^3], $\gamma_{glycerine}$=11,067 [N/m^3] and ρ_{oil}=900 [kg/m^3].

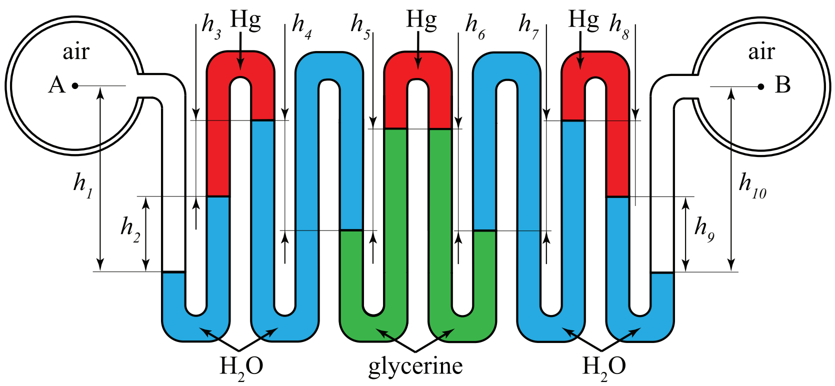


Problem #4

Given the manometer below, find the pressure difference ΔP=P_A-P_B. The density of the fluids used within the manometer, as well as the heights of each fluid level, are given below:

- ρ_{H_2O}=1,000 [kg/m^3]
- SG_{Hg}=13.6
- ρ_{air}=1.225 [kg/m^3]
- γ_{glyc}=11,067 [N/m^3]

- h_1=h_{10}=86 [mm]
- h_2=h_9=35 [mm]
- h_3=h_8=35 [mm]
- h_4=h_7=51 [mm]
- h_5=h_6=47 [mm]



Problem #5

Given the expression for the resultant force acting on y' of a a submerged plate as:

$$y'F_R = P_o y_c A + \rho g \sin(\theta)(I_{\hat{x}\hat{x}} + y_c^2 A)$$

prove that y' is equal to the following:

$$y' = y_c + \frac{\rho g \sin(\theta) I_{\hat{x}\hat{x}}}{F_R}$$

Problem #6

Given the expression for the resultant force acting on y' of a a submerged plate as:

$$y'F_R = P_o y_c A + \rho g \sin(\theta)(I_{\hat{x}\hat{x}} + y_c^2 A)$$

prove that y', when ambient pressure is neglected, is equal to the following:

$$y' = y_c + \frac{I_{\hat{x}\hat{x}}}{A y_c}$$