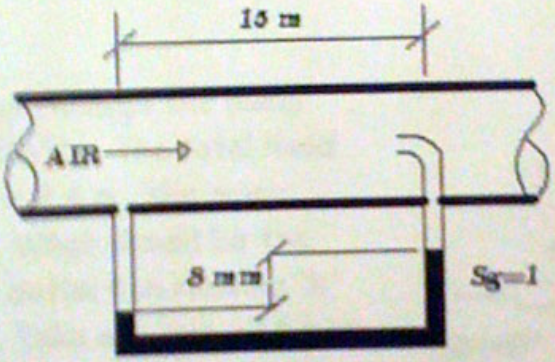
2010 Fluid Part 1 2 hrs

Answer 6 out of 7

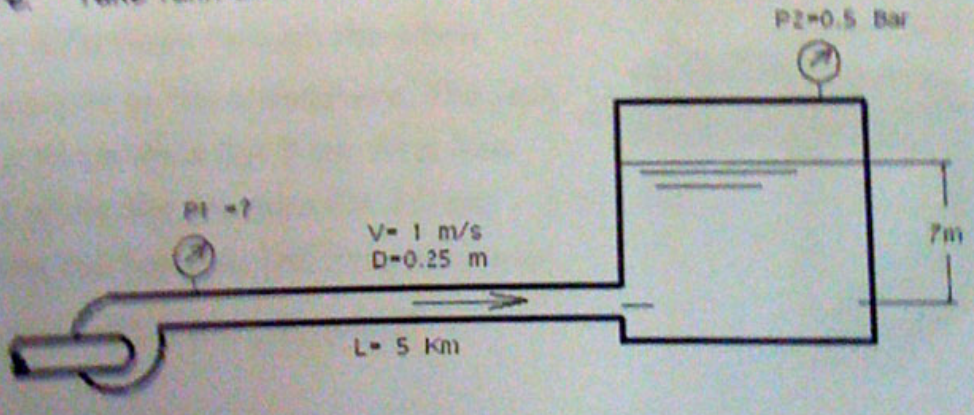
Bonus: [+3 points]

a) Consider the flow of air in a pipe and water in another pipe of the same diameter, at the same mean velocity, same length & same temperature. Which flow is more likely to be turbulent? Why?

b) Suppose you are looking to the following apparatus used to measure the flow velocity of air. The apparatus measure static pressure at the wall and stagnation pressure 15 m downstream .What is wrong with the apparatus and the manometer?

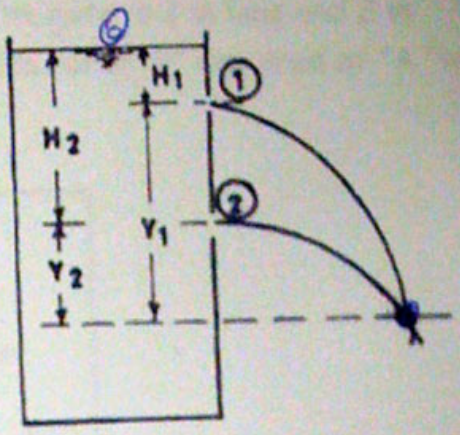


1- Water at 20 C°, flow from the pump to closed reservoir through commercial steel pipe as shown below ($\varepsilon = 4.6.10^{-5}$ m). Determine the pump discharge pressure. Take tank exit minor loss K =1. [5 points]



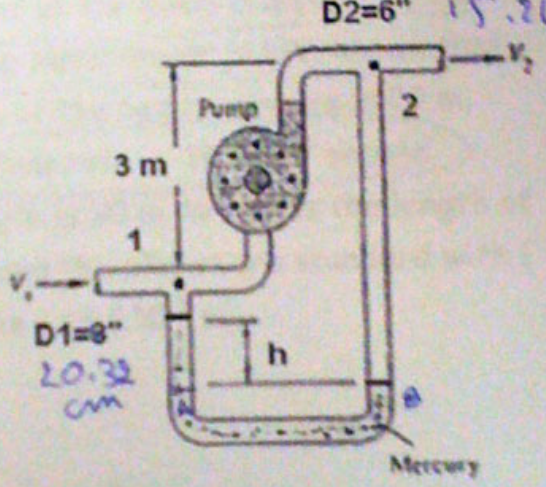
2- For the two identical orifices discharging shown in Figure below , prove that

$H_1Y_1 = H_2Y_2$. [5 points]

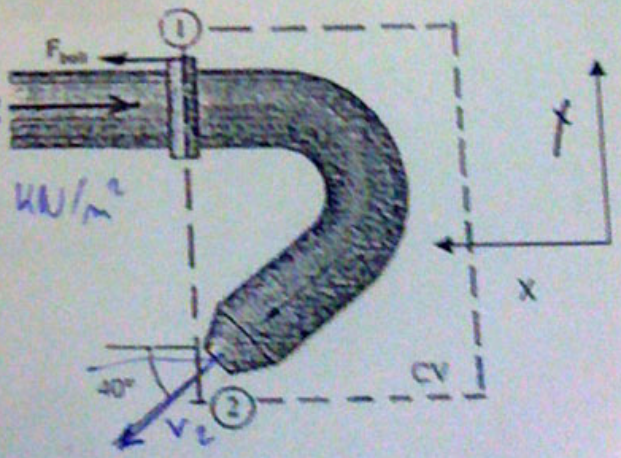


3- Oil is pumped in a 60 cm diameter pipe of length 3000 m. The rate of flow is 0.6 m^3 /sec. Find the head loss and the power required to overcome the viscous resistance of the oil flow (Sg = 0.85, μ = 0.001 Pa. sec, Roughness, e = 0.03 mm). [5 points]

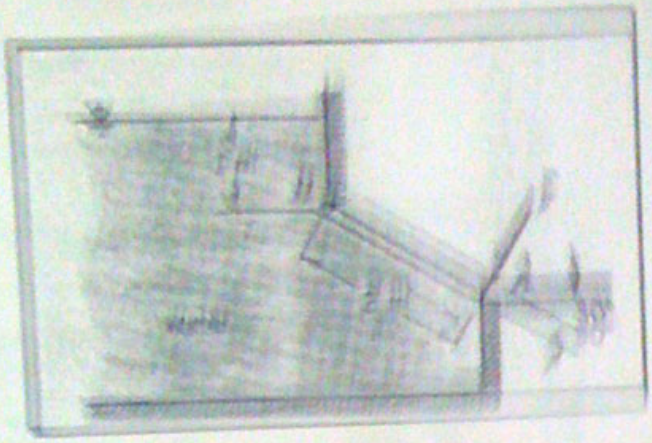
4-Water at 20°C flows through the pump shown below at 0.065 m^3/s . The total head loss between 1 and 2 is 2.4 m , the pump water power is 6 Kw . What should be the mercury -manometer deflection reading "h" be ? ($\upsilon = 1.10^{-6} m^2/s$), Take one inch =2.54 cm [5 points]



5- Water at 50°C flows through the elbow shown below and exit to the atmosphere. The pipe diameter is D_1= 10 cm while D_2= 3 cm. At a flow rate of 0.0153 m^3 /s, the pressure P1= 2.3 bar (gage) . Estimate the force on the flange bolts at section 1. (1 bar =100 KN/m^2) [5 points]



6- The gate shown below is hinged at point "A". The gate is 2 m long and 2 m wide normal to the plane of the diagram. Calculate the force "F" required at "A" to hold the gate closed. [5 points]



7 Obligatory

For the system shown below, calculate a) the head of the pump in meter , b) the delivery & suction pressures of the pump, c) pump water power in kW, known that, the vertical distance between the water surface of the two reservoirs is 20 m, water at ordinary temperature 40° C. The pump flow rate is 10 liters/ second. Discharge diameter is 6 inches and its pipe length is 30 m. Whereas the length of the 3-in pipe is 100 m , both pipes are cast iron and the elbows are standard with (K=1.5) , the gate valve is half open (K=2.1) . (take $\varepsilon = 4.6 \times 10^{-5}$ m)

[10 points]