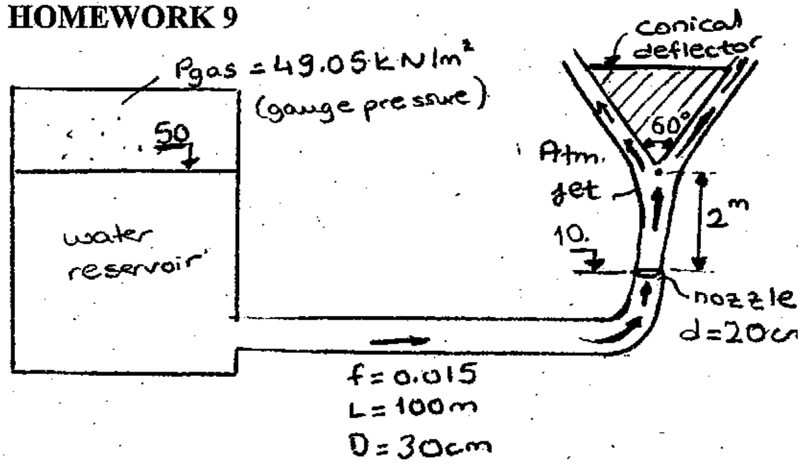
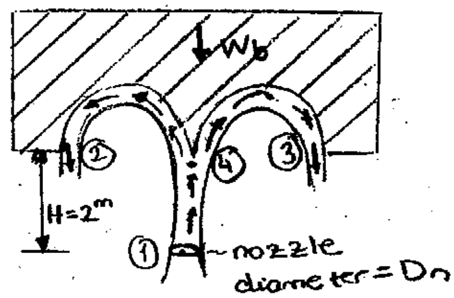
CE 371 HOMEWORK 9



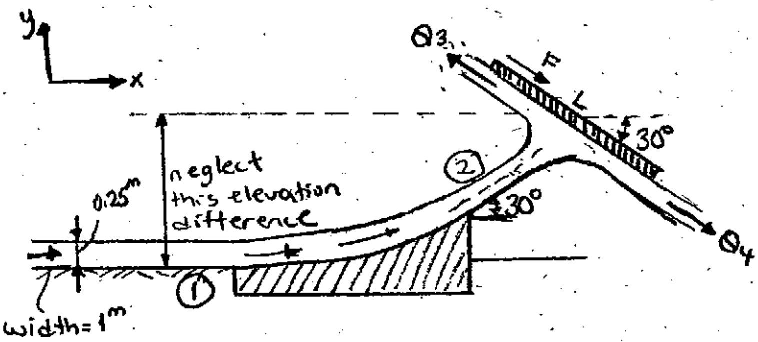
Q1) A vertical circular cross-section jet of water strikes a completely free conical deflector. What is the weight of the conical·deflector so that it preserves its position as shown in the figure. Neglect the height of the conical object and weights of jets. ($W = 1780.53\ N$)



Q2) The block weighs 3kN and is hold up by the water jet issuing from the nozzle of diameter Dn. If the block preserves its position as shown in the figure and H=2m, determine the velocity of water leaving the nozzle and its diameter Dn. Diameter of water jet at Section 4 is 10cm. $\rho_w = 1000\ kg/m^3$

$V_n = 15.17\ m/s$

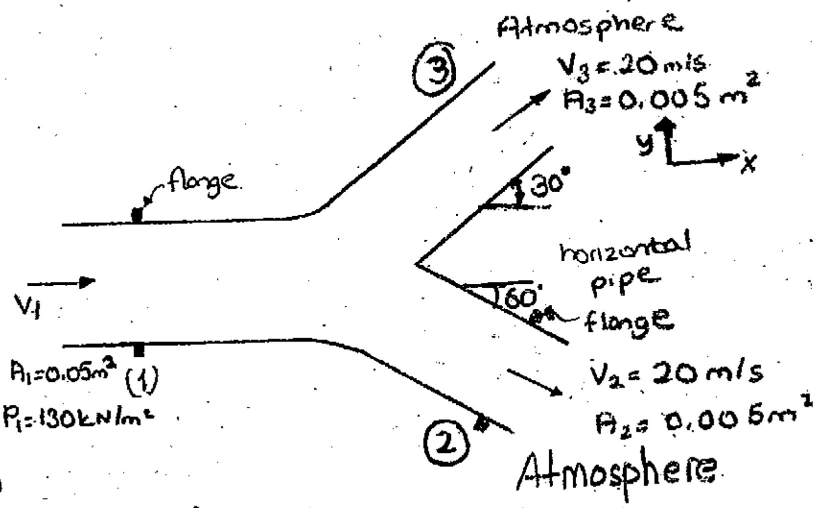
$D_n = 0.0952\ m$



Q3) According to the figure (a) Find the reaction forces at the plate due to water jet (b) If the plate preserves its position as shown in the figure, determine the weight of the plate W and the force F acting on the plate. $Q = 2m^3/s$, $Q_4 = 3Q_3$. Neglect headloss, the elevation difference between Section (1) and Section (2) and weights of water jets. $\rho_w = 1000\ kg/m^3$

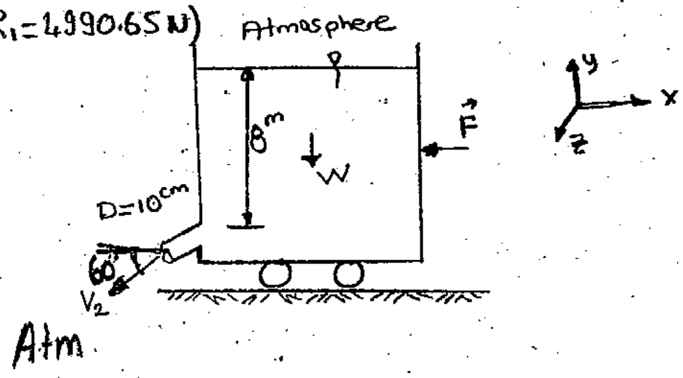
$R_x = 2143.59\ N$; $R_y = 8000\ N$

$F = 8000\ N$, $W = 16000\ N$



Q4) Water flows steadily through the double nozzle assembly shown in a horizontal plane. The cross-sectional area of the supply line is 0.05 m2 and the outlet cross-sectional area of each of the two nozzle is 0.005m2. The pressure of the water entering at Section (1) is 130 kN/m2. The water speed at each nozzle outlet is 20 m/s. Calculate the net forces caused by the nozzle assembly on the flange of the pipe at Section (1) and (2). $P_w = 1000\ kg/m^3$

(In this question there is unknown energy loss) ($R_2 = 845.3\ N$; $R_1 = 4990.65\ N$)



Q5) The weight of the tank containg water is 6kN. Determine the horizontal force F necessary to hold up the tank. Also find the vertical force acting at the wheels of the tank. $W = W_{tank} + W_{water} = 6\ kN$

$\gamma_w = 9810\ N/m^3$

$\rho_w = 1000\ kg/m^2$

$F = 616.54\ N$

$F_y = 4932.12\ N$

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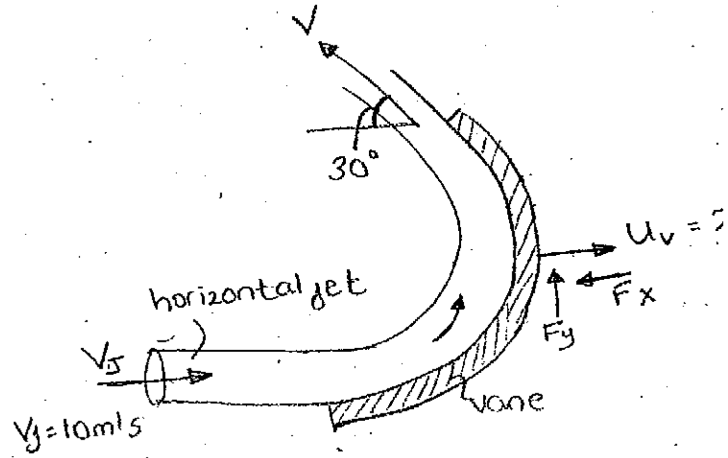
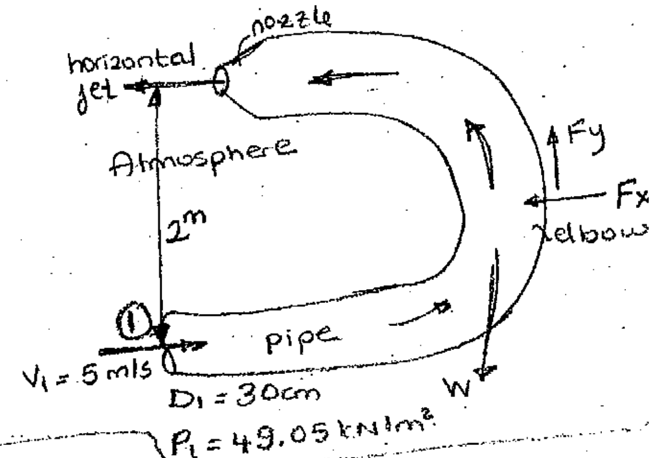
Q1) As shown in the figure, a jet of water 2.5 cm in diameter strikes a vane with a velocity of V_j = 10m/s. The vane has a horizontal velocity of U_v. If the force exerted by the water jet on the vane is 5N, What is the velocity U_v of the vane ? Neglect the weights of jets, air-entrainment into the jets and energy losses in the system. ρ_w = 1000 kg/m^3.

(U_v= 7.7 m/s)

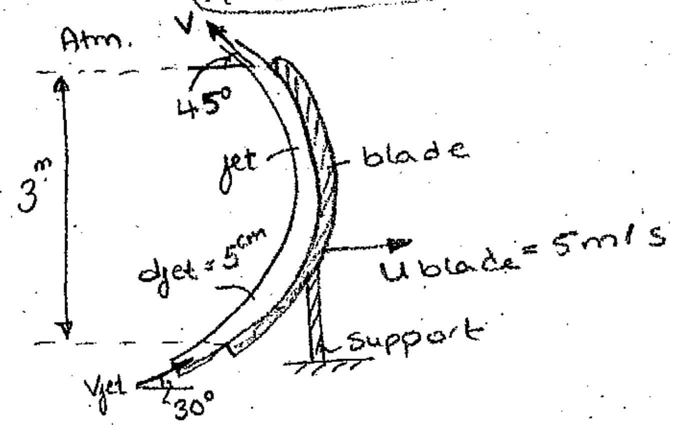


Q2) The elbow-nozzle assembly shown in the figure is in the vertical plane. Find the force exerted by the water flow on the elbow-nozzle assembly. The interior volume of the elbow-nozzle assembly is 0.12 m^3. Note: ρ_w = 1000 kg/m^3 and γ_w = 9810 N/m^3. Neglect energy losses. (8504.9 N)



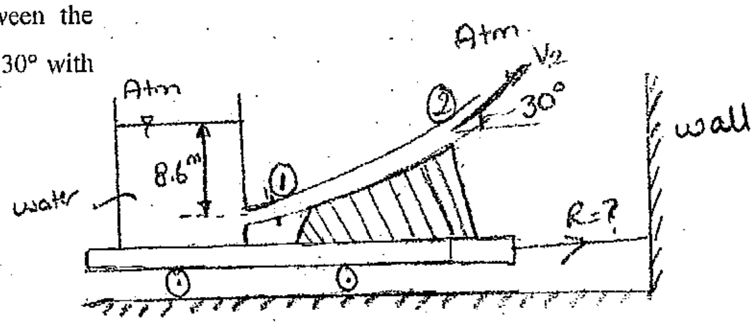
Canceled **Q3)** Blade is in the vertical plane. Find the force acting on the support because of the water jet. Neglect the weight of the fluid, blade dimensions and headloss.

V_{jet} = 50m/s
d_{jet} = diameter of water jet = 5 cm

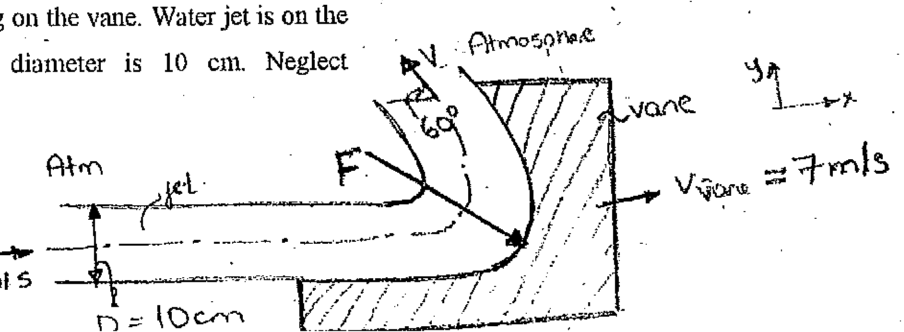


Q4) According to the figure, find the tension force R of the cable. Neglect the elevation difference between the section (1) and section (2). Cross sectional area of the water jet is 10 cm2. Neglect headloss and the friction between the wheels and ground. Velocity at section (2) makes 30° with the horizontal. (146.1 N)

$z_1 \cong z_2$ (neglect difference.)
A_{jet} = 10 cm^2



Q5) Find the force F acting on the vane. Water jet is on the horizontal plane and its diameter is 10 cm. Neglect headloss. (870.63N)



CE 371 HOMEWORK 8

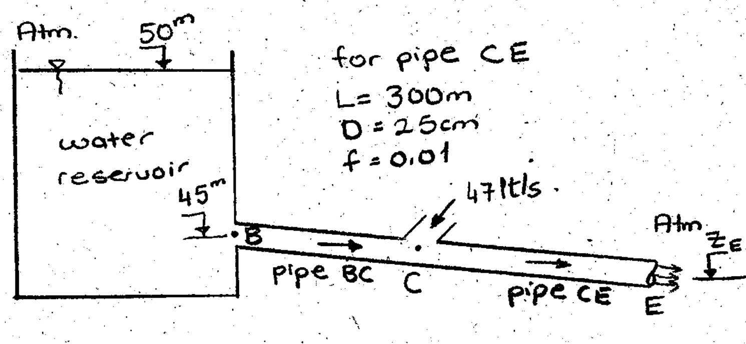
$$\boxed{h_L = f \cdot \frac{L}{D} \cdot \frac{V^2}{2g}}$$

Q1) According to the figure (a) find the geometric elevation of point E (z_E=?) (b) Draw energy and hydraulic grade lines on the system. $(z_E = 28.86\,m)$

$\gamma_w = 9810\ N/m^3$

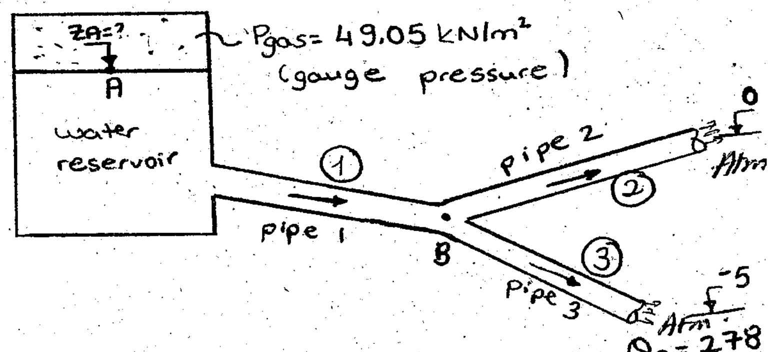
$h_{f_{BC}} = 10m$

for pipe BC
$L = 500\,m$
$D = 25cm$
$f = 0.01$



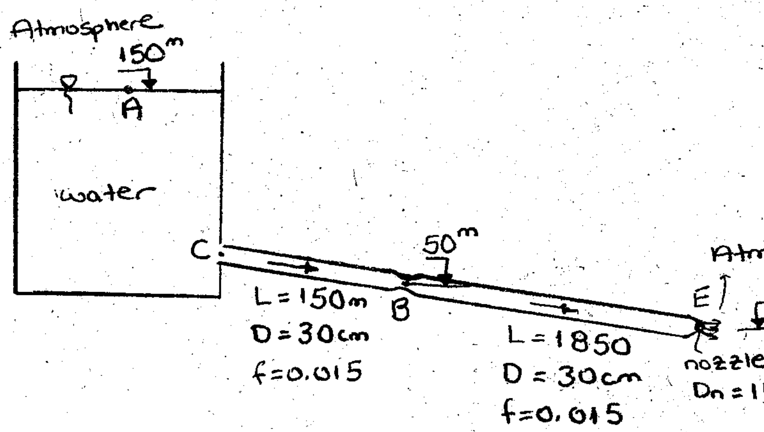
Q2) Consider the pipe system given in the figure. (a) Find the geometric elevation of water surface in the reservoir (z_A=?) (b) Draw energy and hydraulic grade lines on the system. $(Z_A = 159.45m)$

pipe 1	pipe 2	pipe 3
$L_1 = 500m$	$L_2 = 100m$	$L_3 = 50m$
$D_1 = 25\,cm$	$D_2 = 25\,cm$	$D_3 = 20cm$
$f_1 = 0.015$	$f_2 = 0.02$	$f_3 = 0.01$



Q3) From a reservoir, the water is discharged into the atmosphere through a pipe system shownin the figure. Find the pressure at point B and draw energy and piozemetric lines. The diameter of the pipe at point B is 15 cm. Elevations at points A and B are 150m and 50m, respectively. $(P_B = 802.75\ kN/m^2)$

$\gamma_w = 9810\ N/m^3$



Q4) According to the pipe system shown in the figure (a) find the discharge of the pipe (b) Draw piezometric and energy lines (c) Find the pressure at point C.

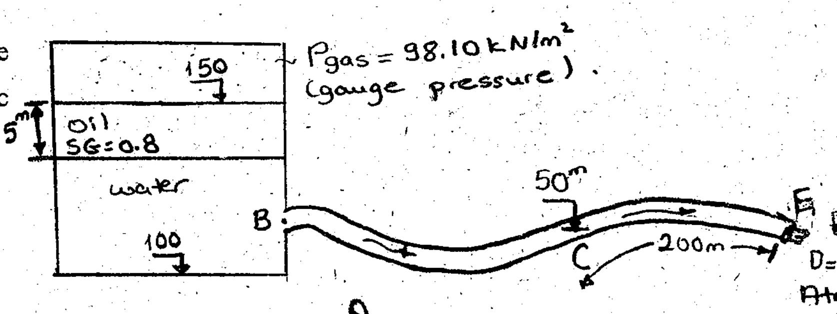
$(Q = 0.310\ m^3/s\ ;\ P_C = 311.47\ kN/m^2)$

$\gamma_{water} = 9810\ N/m^3$, $f = 0.013$

SG of oil = 0.8 , $L_{BE} = 2000m$

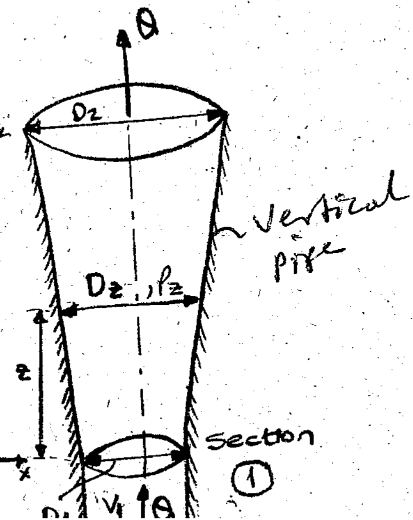
Diameter of the pipe = 30cm

Diameter of the nozzle at E = 10cm



Q5) Considering the vertical pipe shown in the figure (a) Derive an expression between the diameter at Section 1 and the diameter at any section (which is "z" distance from Section 1) in terms of parameters at Section 1. (b) If D_1= 20cm, ρ_w=1000kg/m³, γ_w=9810 N/m³, Q=0.157 m³/s, then find the diameter of the pipe at z=1m from Section 1 and determine the velocity of that section.

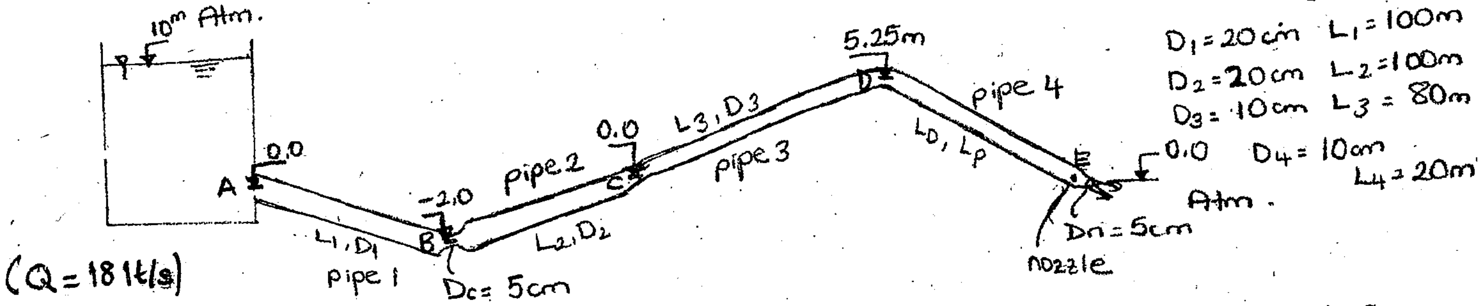
If the pressure along the pipe is same
$P_1 = P_z$



$$\frac{D_1}{D_z} = \frac{(V_1^2 - 2gz)^{1/4}}{V_1^{1/2}} \quad ; \quad D_{z=1m} = 0.294m$$

CE 371 HOMEWORK 8.2

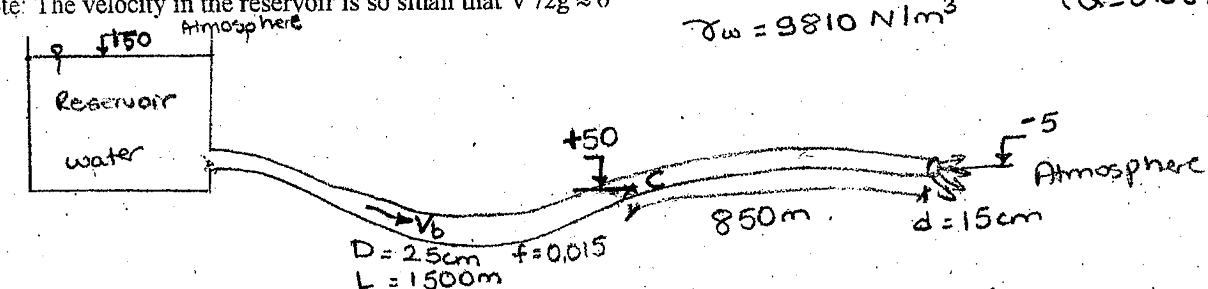
Q1) From a reservoir, the water is discharged into the atmosphere through a pipe system shown in the figure below.(a) Find the discharge Q (b) Draw the energy grade (total head) and hydraulic grade (piezometric head) line, in detail, by calculating and showing all components of head at every location. (c) The expression for the head loss through pipes is given by $h_L = 0.02 \frac{L}{D}\frac{V^2}{2g}$



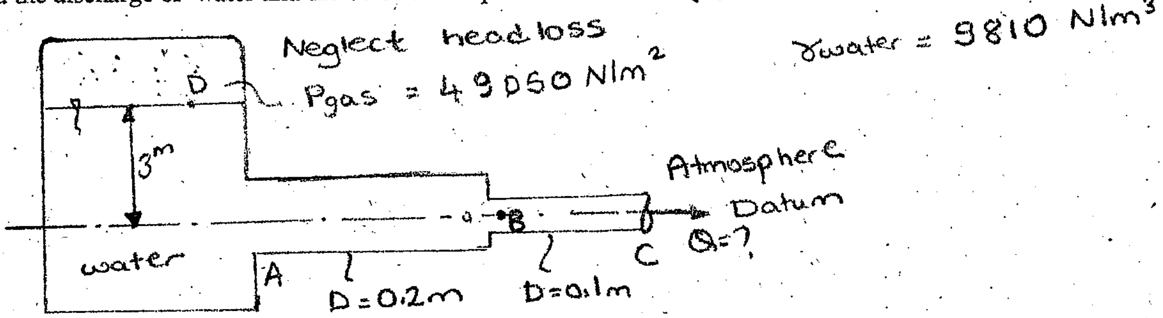
(Q = 18 lt/s)

Q2) According to the figure below, (a) Find the discahrge (b) Draw piezometric and energy lines (c) Find the pressure at point C

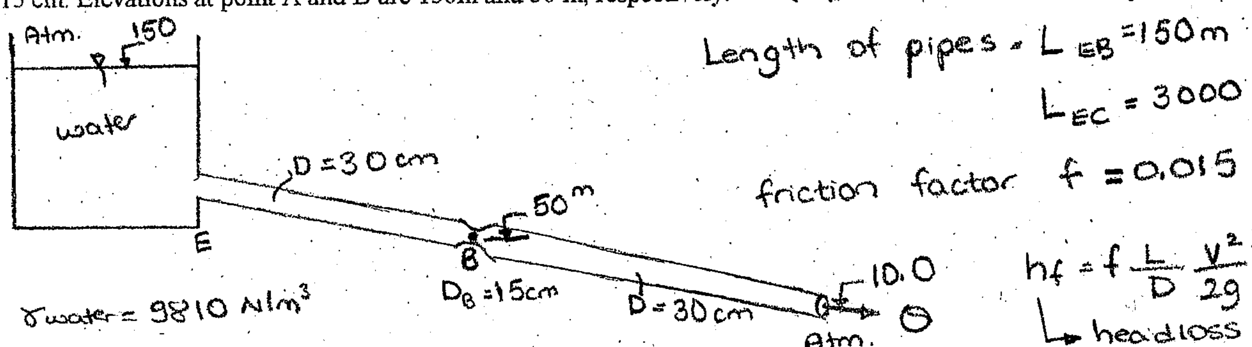
Note: The velocity in the reservoir is so small that $V^2/2g \approx 0$ (Q = 0.0898 m^3/s)



Q3) Find the discharge of water and the velocities at points B and C. (Q = 98.4 lt/s)



Q4) According to the figure, find the pressure at point B and draw energy and piozemetric lines: The diameter of the pipe at point B is 15 cm. Elevations at point A and B are 150m and 50 m, respectively. (P_B = 767.24 kN/m²)



Q5) According to the figure below, (a) Find the pressure at point B
(b) Draw piezometric and energy lines