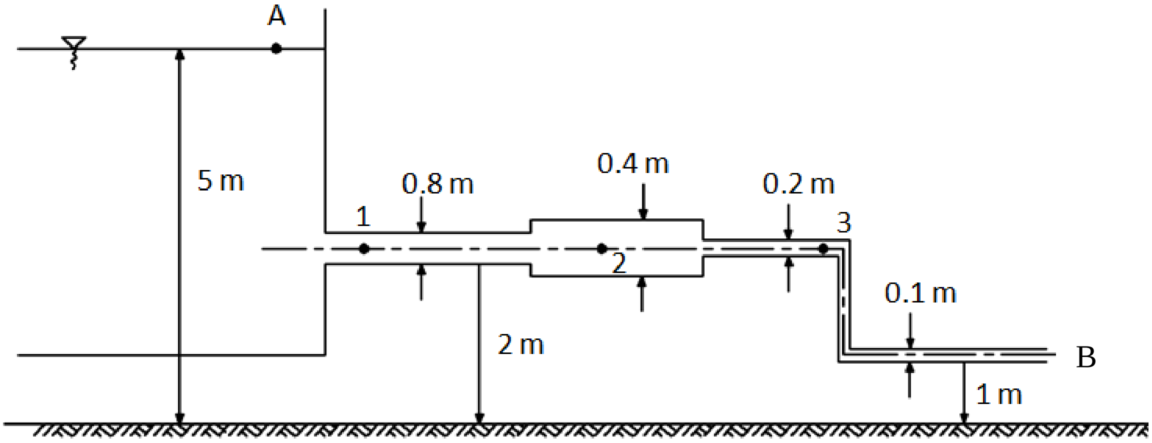
Question 1: For the reservoir pipe system given below:

a- Find the pressures of the fluid at points 1, 2 and 3.

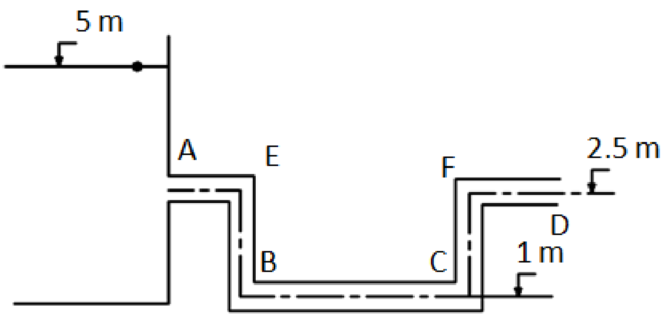
b- Draw the energy and hydraulic grade lines.



Question 2: The flow is opened to the atmosphere at point D which is fed by a very wide reservoir that has a water surface elevation of 5 meters as shown in the figure given below. Elevation of the horizonal axis BC is 1 meter. At sections AB and CD the diameter of the pipe is 0.2 meters. The flow is ideal (inviscid) and absolute atmosphere pressure is 9.81 N/cm^2.

a- Considering the pipe's diameter is 0.15 m at section BC, find the discharges and the velocities of the flow at other sections. Draw the energy and hydraulic grade lines of the system.

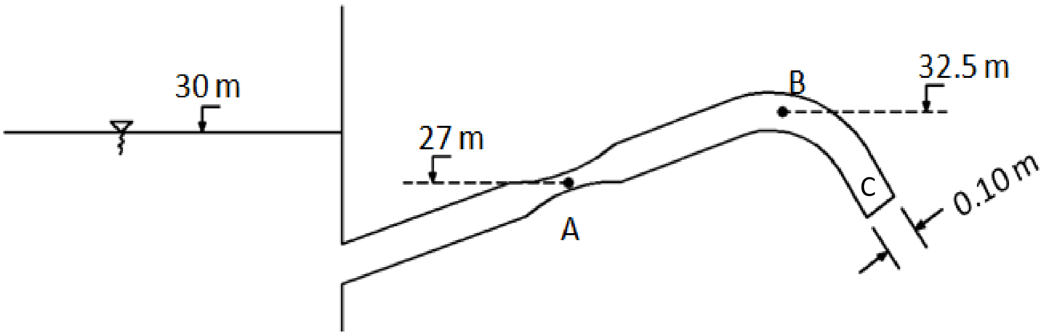
b- Assuming the system discharge is constant and has the value you have found in (a), calculate the maximum pipe diameter that the section BC can take and draw the energy and hydraulic grade lines of this situation. **Note:** Absolute vapor pressure of water is 2.26 kN/m^2.



Answer: a) $v_{CD} = v_{AB} = 7\,m/s$; $v_{BC} = 12.45\,m/s$; $Q = 0.22\,m^3/s$;

b) $D_{\min} = 0.13\,m$

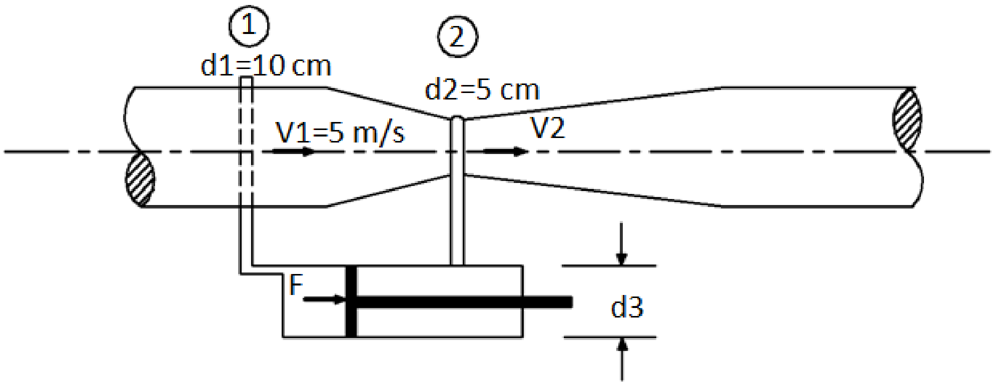
Question 3: Discharge of the system shown in the figure given below is 50 lt/s. In case of an ideal fluid, what should be the dimeter of the pipe at point A in order for the pressures to be the same at



Answer: D_A=0.0723 m

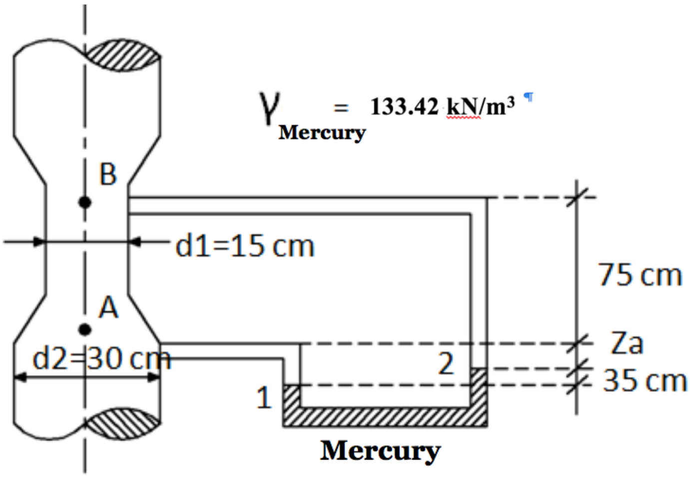
Question 4: A venturimeter is mounted into a horizontal pipe as shown in the figure given below. A piston having a diameter, d3, of 3 cm is installed between sections "1" and "2".

- **a-** Determine the pressure difference between sections "1" and "2", i.e. ΔP=P1-P2.
- **b-** Compute the magnitude of the force, F, caused by the pressure difference and acting on the piston.

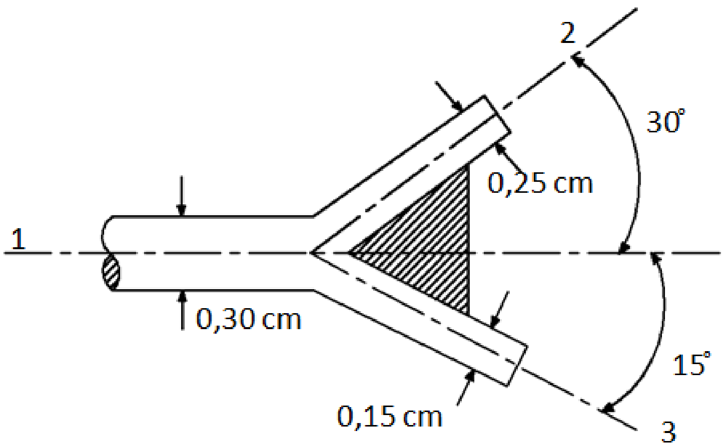


Answer: **a-** $p_1 - p_2 = 195/02\, kN/m^2$ **b-** $F = 0.14\ kN$

Question 5: A venturimeter is placed vertically as shown in the figure given below. Compute the discharge of water passing through the system by neglecting energy losses and by considering the indications of the manometer (m_{ercury}=13.6 t/m³).

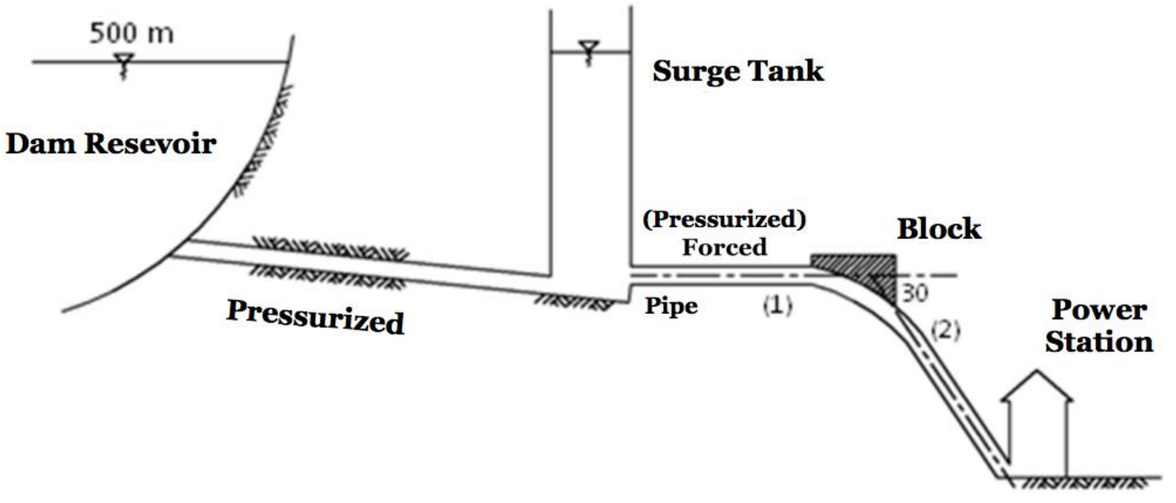


it into two equal-velocity flows as shown in and “3” of the system is 2.5 m/s. Compute the discharges of water in pipes 2 and 3 and compute the magnitude of the force exerted on the section where the flow is split into two parts (End of the pipes “2” and “3” are open to the atmosphere).



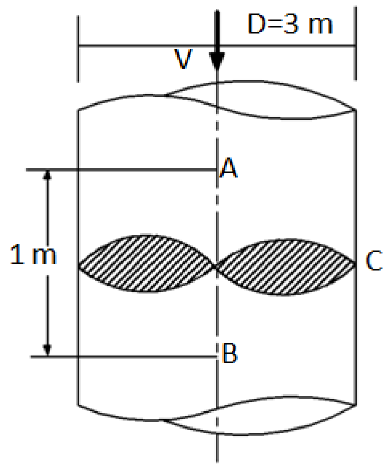
Question 7: Schematic view of a hydroelectric power plant is given in the figure below. Discharge of the system where water is carried from the reservoir to the power station via a gallery, surge tank, and a pressurized pipe is designed to be 10 m³/s. The weight of water between the sections “1” and “2” is determined to be 250 kgf during the run of the system. Compute the minimum block weight

which should be mounted between these two sections (z_1=10m and z_2=8 m; D_1=1.6 m and D_2=1.5 m; p_1=140 kN/m^2).



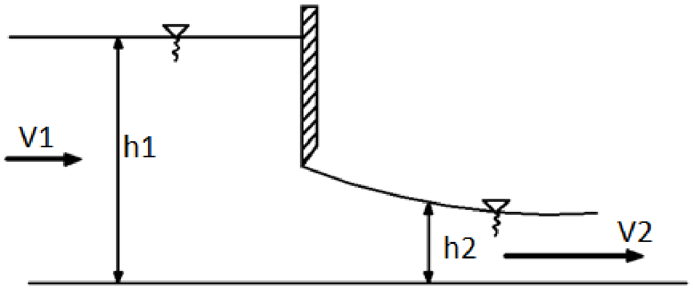
Answer: W=161. 66 kN

Question 8: The velocity of the flow in the pipe shown in the figure given below is measured as 3 m/s at section "A". Compute the power transmitted to the turbine propeller (mounted at section "C") by taking into consideration the relative pressure values at sections "A" and "B" of the pipe as 10 kgf/cm² and -0.1 kgf/cm², respectively. The pipe has a uniform diameter and the fluid is water.



Answer: N=21.22x10^6 N.m/s

Question 9: There is an incompressible and uniform flow between cross sections (1) and (2) of the sluice way shown in the figure given below. Considering the pressure variation is hydrostatic and the streamlines are parallel to each other on the cross-sections find the direction and the magnitude of the force that the flow exerts on the sluice way. (Width of the sluice gate is b.)

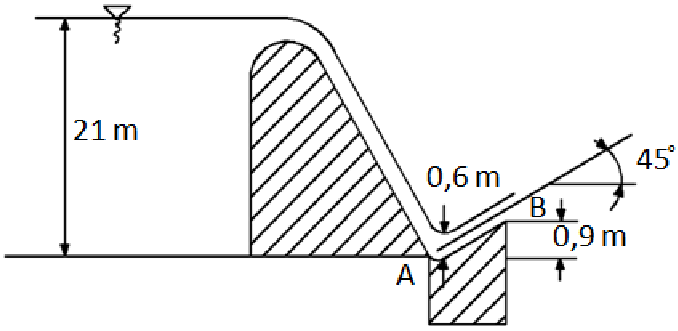


Answer: $R_x = \frac{1}{2}\gamma b\left(h_1^2 - h_2^2\right) - \rho b h_1 v_1^2\left(\frac{h_1}{h_2} - 1\right)$

Question 10: For the system below:

a- Calculate the velocities and the discharges at cross-sections A and B.

b- Find the horizontal and vertical components of the force acting on the shaded obstacle (Water weight between the A-B cross-sections is 2.65 kN).



Answer: $v_a = v_b = 20\, m/s;\ q = 12\ m^3/s/m$ b- $R = 186.78\ kN$

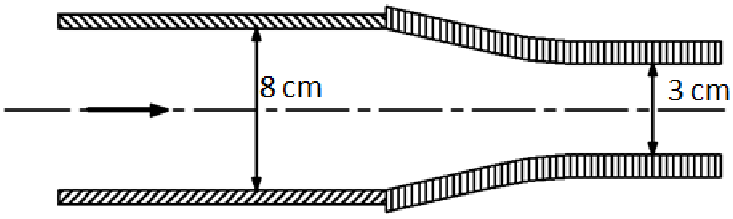
Question 11: The inner diameter of a nozzle, which is attached to an 8 cm diameter garden hose is 3 cm.

a. Compute the energy at the end section of the nozzle, i.e. at the point where the water leaves the system, for a given discharge of 50 l/s.

b. Compute the forces acting on the nozzle for both of the following cases:

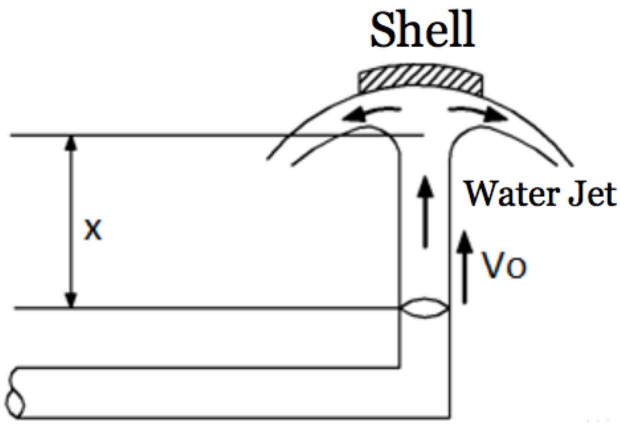
1- The system is running and its discharge is equal to 50 l/s.

2- The system is not running and the water is at rest in the garden hose.



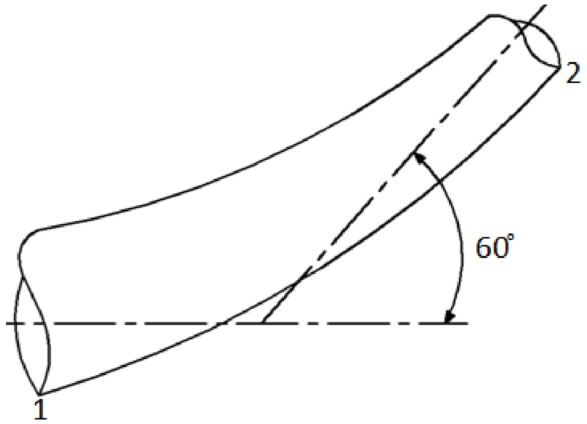
Answer: a-H=255 m b-1. Open: P=9.28 kN, b-2. Closed: P=10.81 kN.

Question 12: A water jet that comes out of a pipe holds the hemispheric Shell which weighs 490.5 N as depicted in the figure given below. Neglecting the air resistance and the water jet's weight, find the jet's elevation in this situation. (Exit velocity Vo=10 m/s, exit cross-sectional area A=0.005 m^2).



Answer: x=3.8 m

Question 13: Find the magnitude and the direction of the resultant force that acts upon the elbow which is located on the horizontal plane. Dimeter of pipe at section (1) is D_1=600 mm, pressure is P_1=166.77 kN/m^2, the diameter at section (2) is D_2= 300 mm and the discharge is Q=1 m^3/s.



Answer: R=44.24 kN