

Question 1 (10points)

All the fluids in the figure below (Figure 1) are at 20°C. If is the atmospheric pressure = 101.33 kPa and at the bottom of the tank the pressure is 242 kPa (absolute pressure), what is the relative density of **fluid X**?

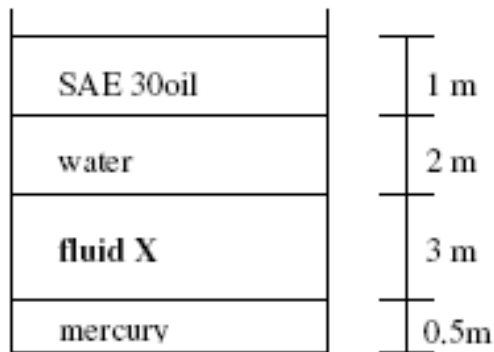


Figure 1

Question 2 (20 points)

The access door, AB, in Figure 2 is 1.2 m in length and 0.8 m in width. By neglecting the effects of the atmospheric pressure, calculate the force acting on the door and the center of pressure (relative density of the fluid $S = 0.82$).

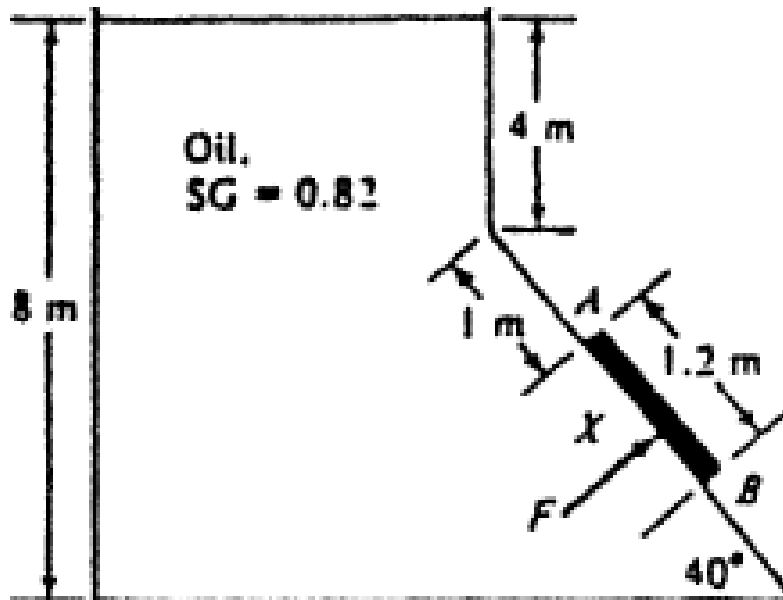


Figure 2

Question 3 (15 points)

The wooden stem of 5 m length in Figure 3 is fixed at the bottom by a cord CD. Determine (a) the force in the cord CD; (b) relative density of the stem - considering it is uniform and out of wood.

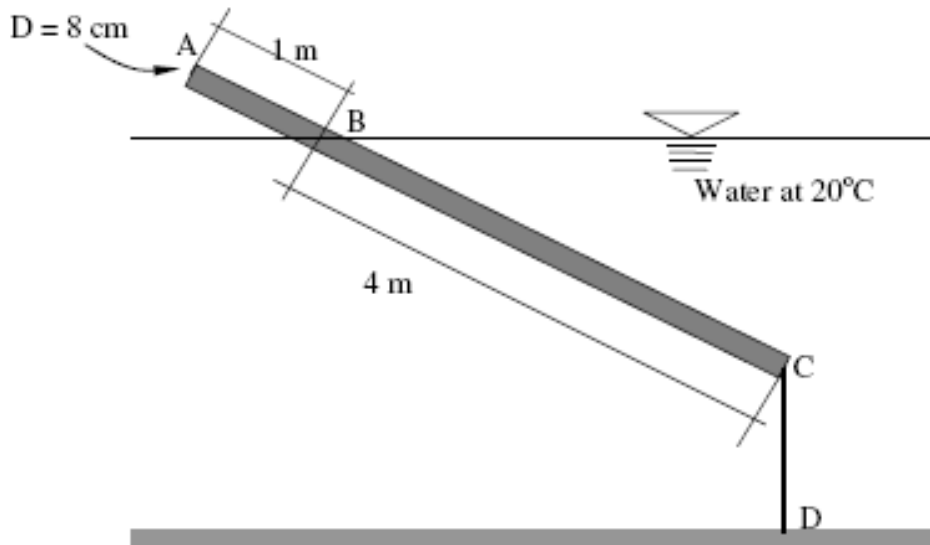


Figure 3

Question 4 (10 points)

Find the pressure at the center of pipe A ($T = 10^\circ\text{C}$).

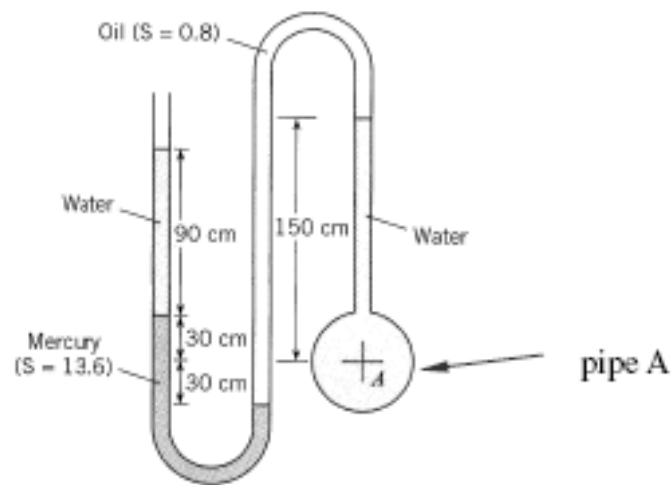


Figure 4

Question 5 (15 points)

A flow of water passes into the free atmosphere by a nozzle (Figure 5) with a flow of $0.30\text{m}^3/\text{s}$. $D_1 = 30\text{cm}$ and $D_2 = 10\text{cm}$. Determine the force necessary to maintain the flange attached to the nozzle stationary. Assume irrotational flow and neglect the gravitational force.

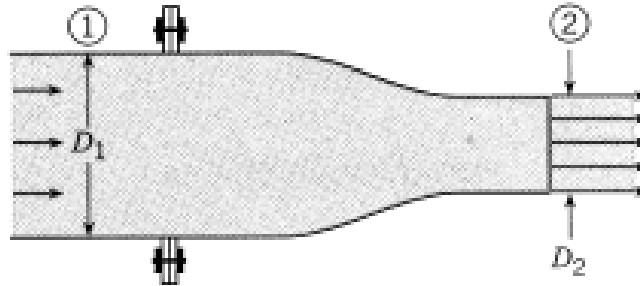


Figure 5

Question 6 (20 points)

Determine the elevation in the free water surface in the tank upstream if the flow in the system is $0.15\text{ m}^3/\text{s}$ (Figure 6). Carefully draw the HGL and EGL lines (Assume $K_e = 0.5$, $K_C = 0.37$ and $K_E = 1.00$).

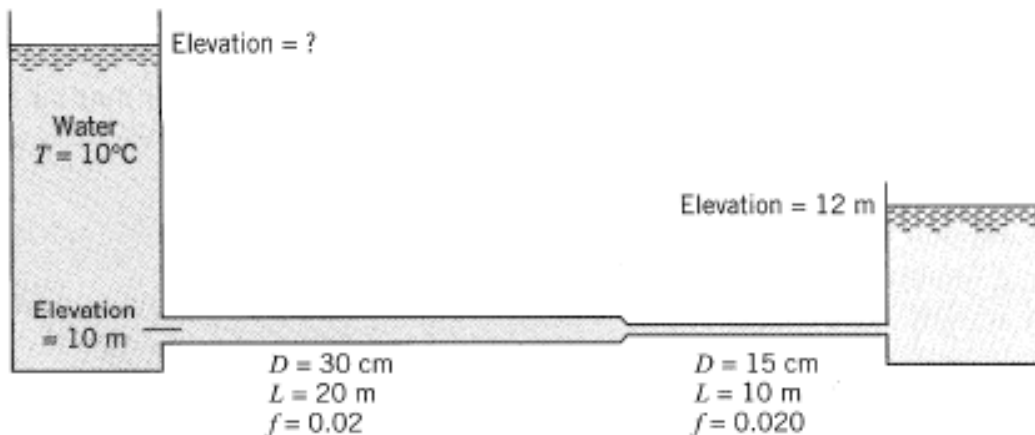


Figure 6

Question 7 (10 points)

For the system shown in Figure 7:

- a) What is the direction of the flow?
- b) What kind of machine is at A?
- c) Is the diameter of both pipes, AB and CA, the same?
- d) Sketch the EGL of the system.
- e) Is there a vacuum at any point or region of the pipes? If so, identify the location.

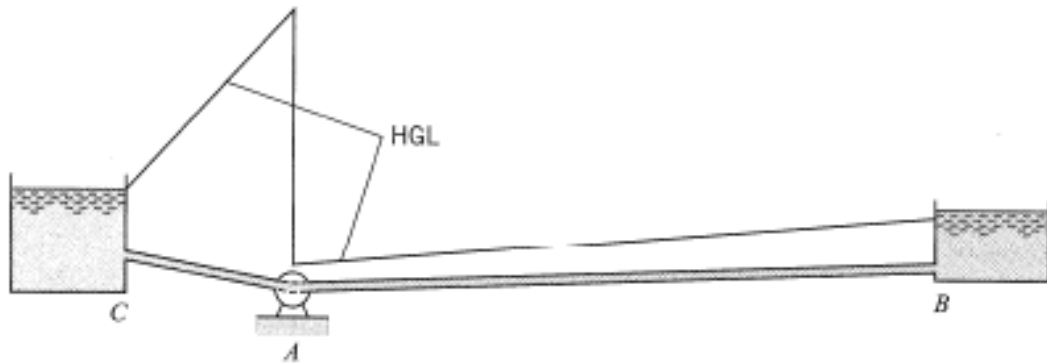


Figure 7