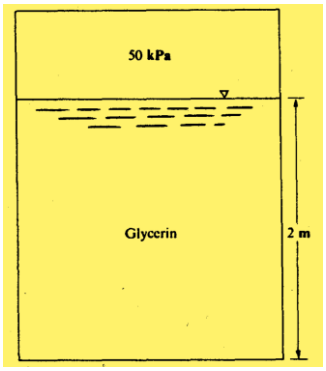
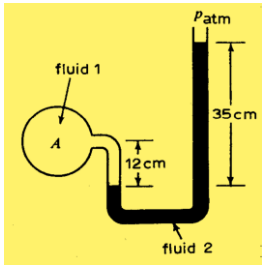
PRACTICE PROBLEM SET 1
(The problems have been borrowed from different sources)

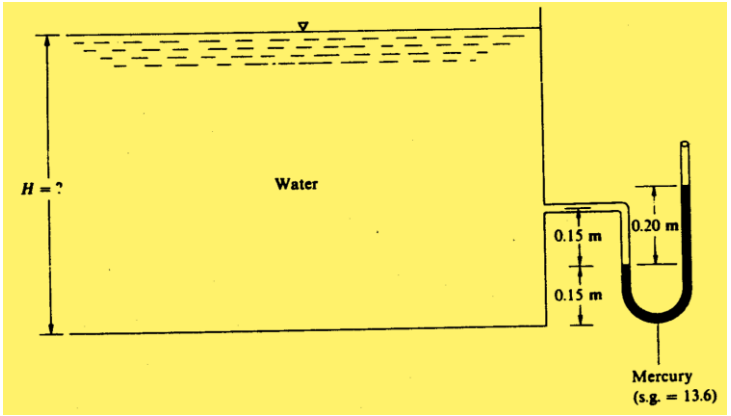
1. For the vessel containing glycerin under pressure as shown below, find the pressure at the bottom of the tank. (Mass density of glycerin is 1258 kg/m^3)



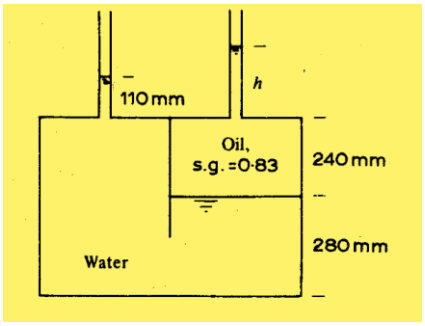
2. Fluid 2 is carbon tetrachloride and fluid 1 is benzene. If P_{atm} = 101.5 kPa, determine the absolute pressure at point A. (specific weight of carbon tetrachloride is 15.57 kN/m^3 and specific weight of benzene is 8.62 kN/m^3)



3. A manometer is attached to a water tank, as shown below. Find the height of the free water surface above the bottom of the tank.



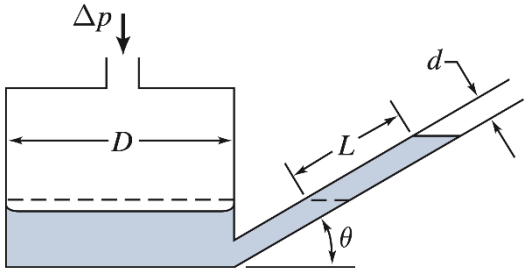
4. Calculate the level *h* of the oil in the right-hand tube. Both tubes are open to the atmosphere.



5. a) Deduce an expression for the deflection *L* for an inclined tube manometer as shown in figure below.

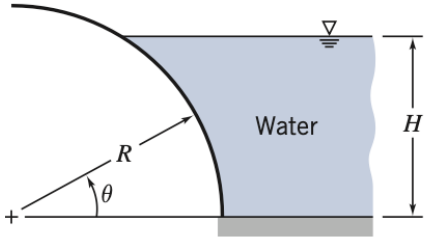
b) For D=85 mm and d=8 mm. Determine the angle, θ, required to provide a 6:1 increase in L, compared with the total deflection in a regular U-tube manometer. Evaluate the sensitivity of this inclined-tube manometer.

c) Compute the angle, θ, that will give a 15 cm deflection along the inclined tube for an applied pressure of 25 mm of water (gage), if Carbon Tetrachloride is used as the manometer (SG=1.6). Also, determine the sensitivity.

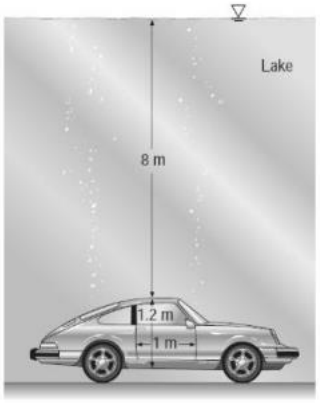


6. A canoe is represented by a right semi-circular cylinder, with R=1 m and L=6 m. The canoe floats in water that is 15 m deep. Set up a general algebraic expression for the total mass (canoe and contents) that can be floated, as a function of depth. Evaluate for the given conditions. Plot the results over the range of water depth $0 \leq d \leq R$.

7. A curved surface is formed as a quarter of a circular cylinder with R=1 m as shown in figure below. The surface is w=5 m wide. Water stands to the right of the curved surface to depth H=0.7 m. Calculate the vertical hydrostatic force on the curved surface. Evaluate the line of action of this force. Find the magnitude and line of action of the horizontal force on the surface.



8. A heavy car plunges into a lake during an accident and lands at the bottom of the lake on its wheels. The door is 1.2 m high and 1 m wide, and the top edge of the door is 8 m below the free surface of the water. Determine the hydrostatic force on the door and the location of the pressure centre, and discuss if the driver can open the door.



9. A circular plate of diameter 3 meters is immersed in water in such a way that its greatest and least depth below the free surface are 4 meters and 1.5 metres respectively. Determine the total pressure on one face of the plate and p of the centre of pressure.

10. If in the above problem the circular plate is having a concentric circular hole of diameter 1.5 meters, then calculate the total pressure and position of centre of pressure on one face of the plate.