Properties of fluid

Problems on density/specific gravity

Q1. Find the specific gravity of oil whose specific weight is 7.85 kN/m^3. *(Ans: S = 0.8)*

Q2. Specific gravity of oil is 0.80. What is its specific weight in N/m^3. *(Ans: ω = 7848 N/m^3)*

Q3. One litre of crude oil weight 9.6 N. calculates its specific weight and density. *(Ans: ω = 9600 N/m^3, ρ = 978.6 kg/m^3)*

Q4. The density of liquid is 3000 kg/m^3. Calculate specific gravity and specific weight of liquid. *(Ans: S = 3, ω = 29430 N/m^3)*

Q5. If 7m^3 of liquid weight 63 kN. Determine its specific weight, specific gravity. *(Ans: ω = 9000 N/m^3, S = 0.91)*

Q6. A liquid weights 7.25N per litre. Calculate weight density and specific gravity of oil. *(Ans: ω = 7250 N/m^3, S = 0.74)*

Q7. A 400ml of certain liquid weighs 9N. Calculate weight density and specific gravity of liquid. *(Ans: ω = 22500* N/m^3*, S = 2.29)*

Q8. Calculate the specific weight, density and specific gravity of one litre liquid which weight 7 N. *(Ans: ω = 7000 N/m^3, ρ = 713.5 kN/m^3, S = 0.71)*

Problems on Viscosity

Q9. Determine the specific gravity of a fluid having viscosity 0.005 N-s/m^2 and kinematic viscosity 0.035 x 10^{-4} m^2/s. *(Ans: S = 1.42)*

Q10. A liquid has dynamic viscosity 0f 0.01 poise and specific mass is 1594 kg/m^3. Calculate kinematic viscosity. *(Ans: υ = 6.27 x 10 $^{-11}$ stokes)*

Q11. Find the kinematic viscosity of an oil having density 980 kg/m^3, having shear stress 0.25 N/m^2 and velocity gradient 0.3 /S *(Ans: υ = 8.50 x 10 $^{-4}$ m^2/s)*

Q12. At a certain point in castor oil, the shear stress is 0.216 N/m^2 and the velocity gradient 0.216 s-1. If the mass density of castor oil is 959.42 kg/m^3, find kinematic viscosity. *(Ans: υ = 1.04 x 10 $^{-3}$ m^2/s)*

Q13. The velocity distribution over a plate is given by V = (2/3) Y – Y^2 where v is the velocity in m/s. determine shear at y = 0 and y = 0.15 m. Take μ = 8.63 poise. *(Ans: τ_0 = 0.57 N/m^2 , $\tau_{0.15}$ = 0.31 N/m^2)*

Q14. Two plates are separated by a film of oil of 0.025 mm. The top plate moves with velocity of 50 cm/sec, while the bottom plate is kept fixed. Find the fluid viscosity of oil if force required to move the plate is 1.96 N/m2. *(Ans: μ = 0.098 x 10^{-3} N-s/m^2)*

Problems on Surface Tension

Q15. Find the surface tension in liquid drop of 40 mm diameter when the inside pressure is 3 N/m^2 above the atmospheric pressure. *(Ans: σ = 0.03 N/m)*

Q16. Calculate the diameter of the water droplet, if the pressure inside the droplet is 400 N/m^2 above the atmospheric pressure. Take surface tension of water in contact with air as 0.073 N/m. *(Ans: d = 0.73 mm)*

Q17. In a soap bubble, internal pressure 30 N/m^2 in excess of outside pressure and surface tension of 0.15 N/m. calculate the bubble diameter. *(Ans: d = 40mm)*

Q18. Calculate the diameter of water drop if inside pressure of water drop is 50 N/m^2, in excess of external pressure and surface tension of water is 0.0736 N/m. *(Ans: d = 5.9 mm)*

Q19. Determine the surface tension of the liquid in contact with air and tube if a capillary tube of diameter 2 mm is dipped in a liquid of specific gravity 0.8. The liquid rises in the tube by 15 mm making angle of contact of 25^0 with the tube. Determine the surface tension of the liquid in contact with air and tube. *(Ans: σ = 0.069 N/m)*

Problems on Capillary

Q20. Calculate the capillary rise, if the capillary tube of glass, 1.5 diameter is dipped vertically in **mercury**. If the angle of contact is 128^0 and surface tension of the mercury is 0.53 N/m. *(Ans: h = - 6.52 mm)*

Q21. The capillary rise in the glass tube is 0.2 mm of water. Determine the minimum size of glass tube if given that surface tension = 0.0725 N/m. *(d = 14.8 cm)*

Fluid Pressures and Pressure Measurement

Problems on measuring pressure

Q1. Convert the pressure of 20 N/cm^2 to the height of water column. *(Ans: h = 20.38 m of water)*

Q2. Convert 30 cm of oil column in N/cm^2. Take specific gravity of oil as 1.2 *(Ans: 0.353 N/cm^2)*

Q3. Convert 3.5 bar pressure into equivalent mercury column. *(Ans: h = 2.62 m of mercury)*

Q4. Convert 15 cm mercury column equivalent to water column. *(Ans: h = 2.04 m of water)*

Q5. Barometric reading at a place is 75 cm of Hg. Express the pressure intensity of 10 N/cm^2 in

a) m of water *(Ans: 10.19m)*
b) mm of mercury *(Ans: 744mm)*
c) kN/m^2 Abs *(Ans: 200.06 kN/m^2)*

Q6. For the water column of height 6m, calculate

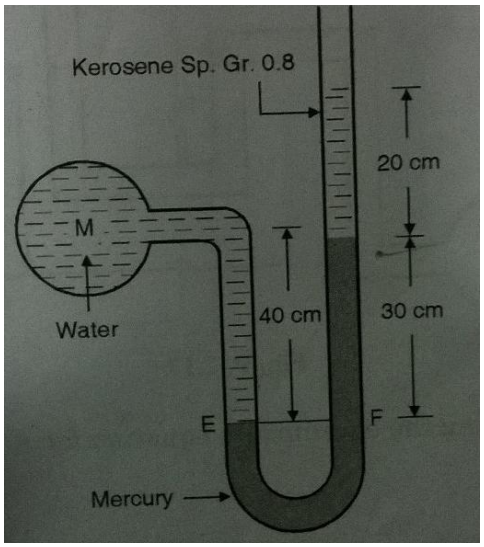
a) intensity of pressure in KPa *(Ans: 58.86 KPa)*
b) mm of mercury *(Ans: 441mm of Hg)*
c) m of water *(Ans: 6m of water)*
d) N/m^2 absolute *(Ans: 158.86 x 10^3 N/m^2)*

Q7. Convert 25 bar into MPa *(Ans: 2.5 MPa)*

Q8. Convert vacuum gauge reading 20 cm of Hg into absolute pressure in N/cm^2. *(Ans: P = 7.47 N/cm^2)*

Problems on manometers

Q9. Find the pressure in the pipe in terms of pressure head of water. *(Ans: h = 3.84 m)*

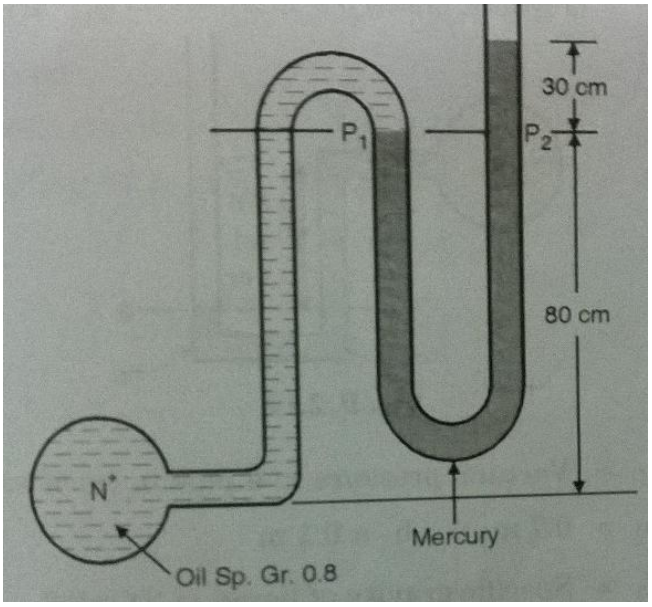


Q10. A tube containing mercury has its right limb open to atmosphere. The left limb is connected to a pipe containing water under pressure. If the mercury level in the right side is higher by 50 mm. find the pressure in pipe. The center of pipe is 30 mm above the right limb mercury level. *(Ans: P = 5.886 kN/m^2)*

Q11. A simple U-tube manometer shows mercury level 90 mm above center of pipe in the open limb and 60 mm below the center of pipe in the left limb connected to pipe. The pipe is horizontal and carries an oil of Sp. Gr 0.8. Calculate the absolute in the pipe. *(Ans: P = 120.87 kN/m^2)*

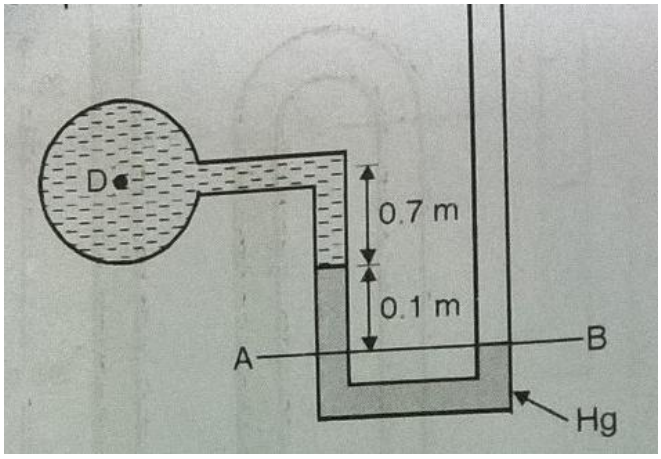
Q12. A tube you manometer is used to measure the pressure of oil having specific gravity 0.85 flowing in a pipe line. Its left end is connected to pipe and right limb is open to atmosphere. The center of pipe is 100 mm below the level of mercury in right limb. If difference in mercury level, in two limbs is 160mm. find absolute pressure in kPa. *(Ans: P = 119.08 kN/m^2)*

Q13. Find the absolute velocity in the pipe at point N. *(Ans: P_{abs} = 147.65 kN/m^2)*

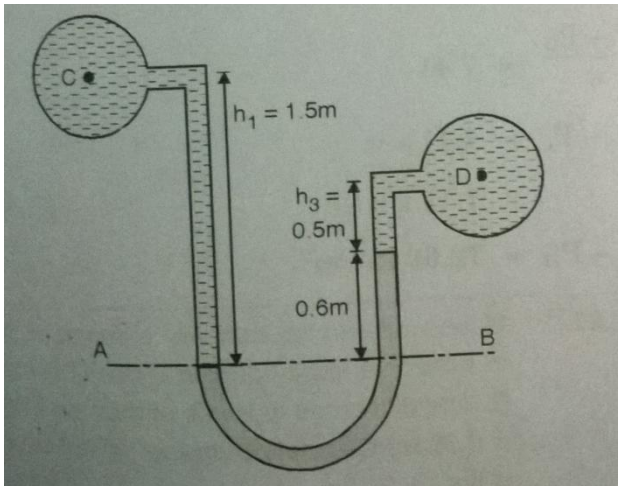


Q14. A simple U-tube manometer containing Hg is connected to a pipe in which a fluid of specific gravity 0.8 and ***having vacuum pressure*** is flowing the other end of the manometer which is open to the atmosphere. Find the vacuum pressure in pipe, if the difference in Hg level in the two limbs is 40 cm and the height of fluid in the left from the center of pipe is 15 cm below. . *(Ans: $P = -54543.6\ N/m^2$)*

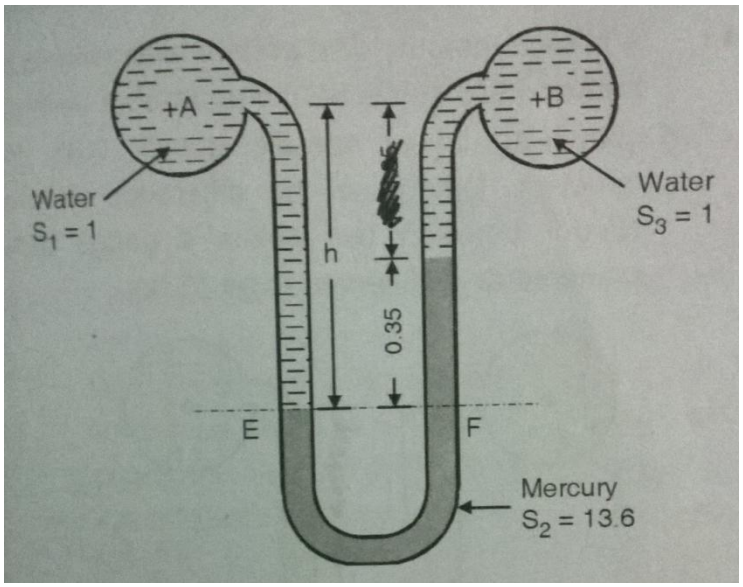
Q15. Find the vacuum pressure in the pipe containing a liquid of specific gravity 0.9 as shown the figure. *(Ans: $P_{vacuum} = -19.52\ kN/m^2$)*



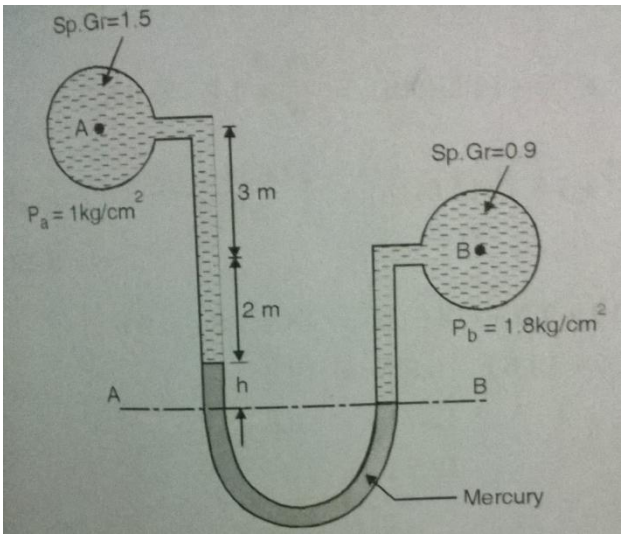
Q16. U-tube differential manometer containing Hg is used to measure the difference in pressure for two pipes C and D as shown in the figure. Pipe C contains carbon tetrachloride of specific gravity 0.8. Pipe D contains oil of specific gravity 0.9. Find the difference of pressure in two pipes. *(Ans: $P_C - P_D = 72.69\ kN/m^2$)*



Q17. U-tube differential mercury manometer is connected to horizontal pipe carrying water at two points A and B. the difference in mercury level in the two limbs is 0.35 m. calculate the pressure difference at A and B in KPa. *(Ans: $P_A - P_B = 43.26\ kN/m^2$)*



Q18. A differential manometer is connected at two points A and B of two different pipes as shown in figure. The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity of 0.9. The pressure at A and B are 1 Kg/cm2 and 1.8 Kg/cm2 respectively. Find the difference in mercury level. . *(Ans: h = 0.18 m)*



Q19. An inverted U tube was used to determine the difference of pressures in two pipes carrying water as shown in the figure. Find the difference of pressure in the two pipes in terms of head of water and kN/m^2, if the manometric fluid is oil having specific gravity 0.8. *(Ans: $P_A - P_B = 2.156\ kN/m^2$)*