Sheet No. 1

Dr. Thamer J.M

Q1/ Find the height of the free surface if 0.8 ft^3 of water is poured into a conical tank as shown in Fig. 1 20 in height with a base radius of 10 in. How much additional water is required to fill the tank ?

Ans. 6.04"

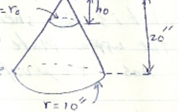


Fig. 1

Q2/ A heavy tank contains oil (A) and water (B) subject to variable air pressure; the dimensions shown in Fig. 2 corresponds to 1 atm. If air is slowly added from a pump to bring pressure p up to 1 MPa gage, what will be the total downward movement of the free surface of oil & air ? Take $K_{av.} = 2050$ MPa for oil & $K_{av.} = 2075$ MPa for water. Assume the container does not change vol. neglect hydrostatic press.

Ans. 0.630 mm

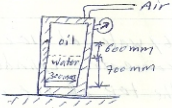


Fig. 2

Q3/ Calculate the density of water vapor at 350 KPa and 20°C if gas constant (R) is 0.462 KPa.m^3/kg.K

Ans. 2.59 kg/m^3

Q4/ A large plate moves with speed v_0 over a stationary plate on a layer of oil (see Fig-3). If the velocity profile is that of a parabola, what is the shear stress on the moving plate from the oil? If a linear profile is assumed, what is the shear stress on the upper plate?

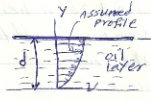


Fig-3

Ans: $\tau = \mu v_0/(2\delta)$, $\tau = \mu(v_0/\delta)$

Q5/ Assuming a boundary-layer velocity distribution as shown in Fig-4 which is a parabola having its vertex 3 in from the wall, calculate the shear stresses for $y = 0, 1, 2$ and $3''$. Use $\mu = 0.00835 \ lbf.s/ft^2$

Ans. 0.4, 0.267, 0.134, 0 lbf/ft^2

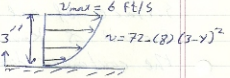
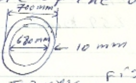


Fig-4

Q6/ Water at 10°C is poured into a region between concentric cylinders until water appears above the top of the open end Fig-5. If the P measured by a gage 42 cm below the open end is 4147.38 Pa gage, what is the curvature of the water at the top?

Ans: 2.73 mm



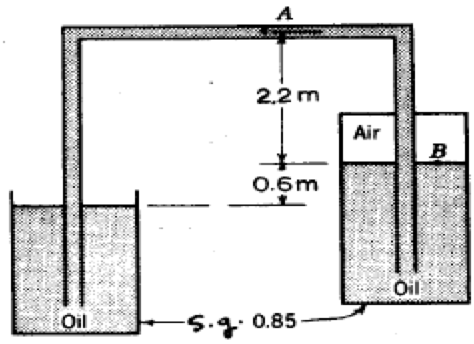
Top view

Fig-5

Sheet No.2 Lect. Two 2nd Year Fluid Flow

Q1- The tube shown in Fig.1 is filled with oil. Determine the pressure heads at A & B in m-water.

Fig.1



Q2-Calculate the pressure, in KPa, at A, B, C and D IN Fig.2

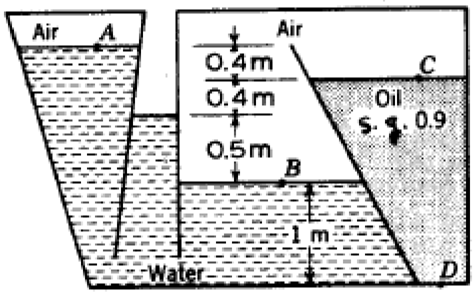


Fig.2

Q3- The air-oil-water system shown in Fig.3 is at 70^{o}F. If gage A reads 16.1 1b/in^2 abs and gage B reads 2 1b/in^2 less than gage c, determine: (a) the specific weight of the oil and (b) the reading of gage C.

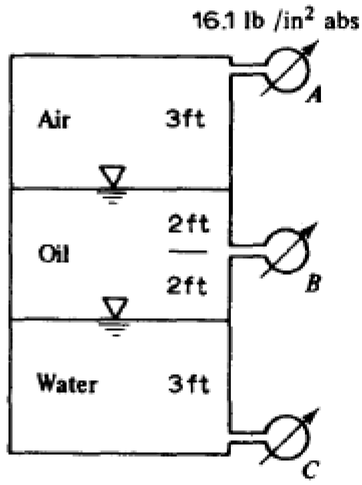
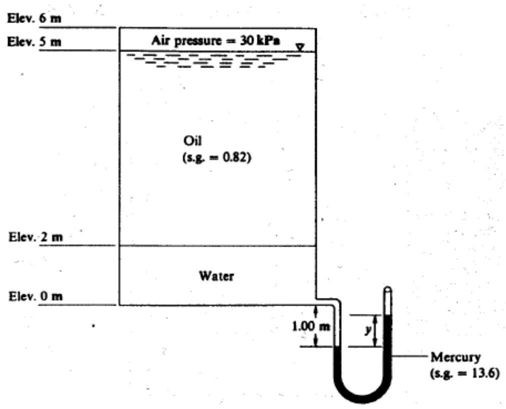


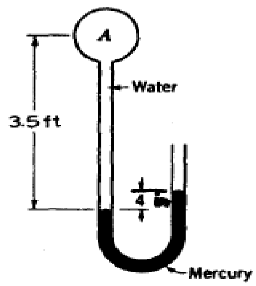
Fig.3

Q4-A manometer is attached to a tank containing three fluids, as shown in Fig.4. What will be the difference in elevation of the Hg- column in the manometer (y)?

Fig.4



Q5- In Fig.5, the monometer reads 4-in when atm. pressure is 14.7 psia. If the absolute pressure at A is doubled, what is the new manometer reading? Fig.5



Q6- A manometer is attached to a pipe containing oil, as shown in Fig.6. Calculate the pressure at point A.

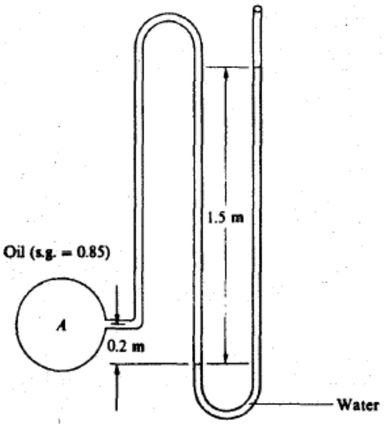
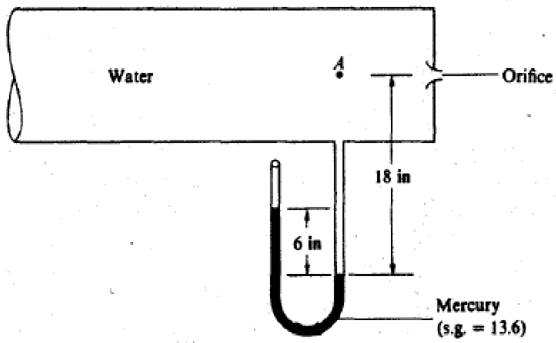


Fig.6

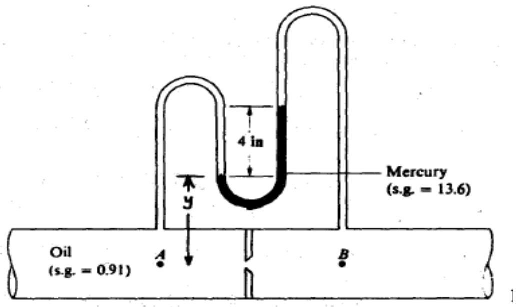
Q7- A manometer is attached to a pipe to measure pressure, as shown in Fig.7. Calculate the pressure at point A.

Fig.7



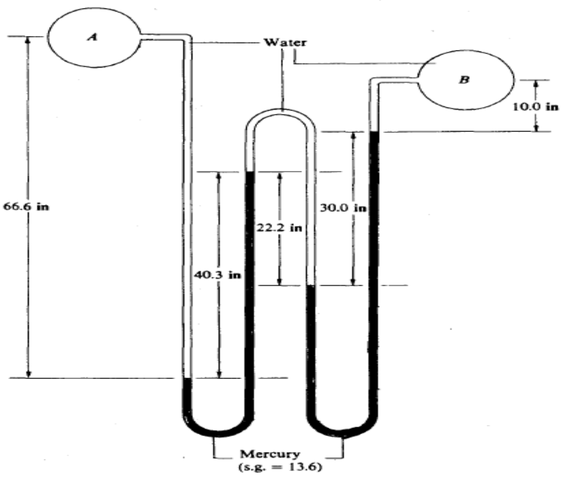
Q8- A differential manometer is attached to a pipe, as shown in Fig.8. Calculate the pressure difference between points A & B.

Fig.8



Q9- Calculate the pressure difference between A & B for the setup shown in Fig.9

Fig.9



Q10- Find the difference in pressure tanks A & B in Fig.10 if d_1=330mm, d_2=160mm , d_3=480mm, & d_4=230mm.

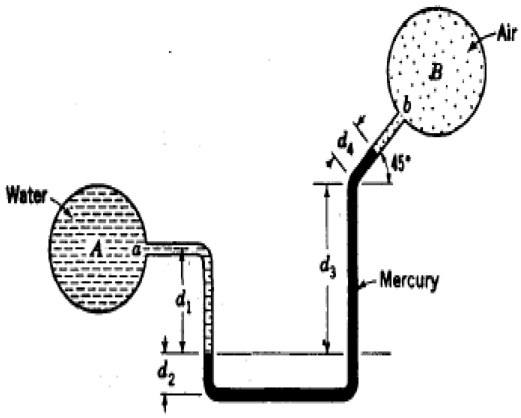


Fig.10

Sheet No2 Lect.2

Sheet No.3 Lect. Three 2nd Year Fluid Flow

Q1- 1.4 in Text-book Vol.1 6th ed.

Q2- 1.5 in Text-book Vol.1 6th ed.

Q3- 1.7 in Text-book Vol.1 6th ed.

Q4- 1.8 in Text-book Vol.1 6th ed.

Q5- 1.13 in Text-book Vol.1 6th ed.

Q7- 1.17 in Text-book Vol.1 6th ed.

Q8- 1.18 in Text-book Vol.1 6th ed.

Q9- A partially submerged body is towed in water. The resistance R to its motion depends on the density, viscosity of water,(ρ , μ), length *l* of the body, velocity u, of the body and g due to gravity. Show by Rayligh's method that the R to motion can be expressed in the form: $R = \rho L^2 u^2 \phi[(\frac{\mu}{\rho L u}),(\frac{\lg}{u^2})]$

Q10-The pressure drop Δp in a pipe of diameter d and length *l* depends on the density and viscosity of fluid flowing, ,(ρ , μ), mean velocity u of flow and average height of protuberance t. Show by Rayligh's method that the pressure drop can be expressed in the form: $\Delta p = \rho u^2 \phi\{\frac{l}{d},\frac{\mu}{ud\rho},\frac{t}{d}\}$

Q11- Repeat Q10 by Buckingham's π-theorem.

Q12-Using Buckingham's π-theorem, obtain an expression for the discharge Q over a rectangular weir. The discharge depends on the head H over the weir , g, length of weir crest L, height of the weir over the channel bottom Z and the kinematic viscosity ν of the liquid., Ans. $Q=KLH^{3/2}$

Sheet No.3 Lect. Three 2^{nd} Year Fluid Flow

Q1- 1.4 in Text-book Vol.1 6^{th} ed.

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