Fluid Mechanics

Homework #2

The following problems are from the recommended textbook: *Fluid Mechanics*, 7th Edition by Frank White.

1. Denver, Colorado has an average altitude of 5300 ft which has an atmospheric pressure of 83.4 kPa. On a US standard day, pressure gage A reads 83 kPa and gage B reads 105 kPa. Express these readings in gage or vacuum pressure, whichever is appropriate.

2. A storage tank, 26 ft in diameter and 36 ft high, is filled with SAE 30W oil at 20°C ($\rho = 1.73$ slugs/ft^3). (*a*) What is the gage pressure, in lb/in^2, at the bottom of the tank? (*b*) How does your result in (*a*) change if the tank diameter is reduced to 15 ft? (*c*) Repeat (*a*) if leakage has caused a layer of 5 ft of water ($\rho = 1.94$ slugs/ft^3) to rest at the bottom of the (full) tank.

3. A closed tank contains 1.5 m of SAE 30 oil, 1 m of water, 20 cm of mercury, and an air space on top, all at 20°C. If the pressure at the bottom of the tank is 60 kPa, what is the pressure in the air space? ($\gamma_{oil} = 8720$ N/m^3, $\gamma_{water} = 9790\, N/m^3$, $\gamma_{Hg} = 133100\ N/m^3$)

4. Pressure gage A reads 1.5 kPa (gage). The fluids are at 20°C. Determine the elevations z, in meters, of the liquid levels in the open piezometer tubes B and C. ($\gamma_{air} = 12$ N/m^3, $\gamma_{gas} = 6670\, N/m^3$, $\gamma_{gly} = 12360\ N/m^3$)

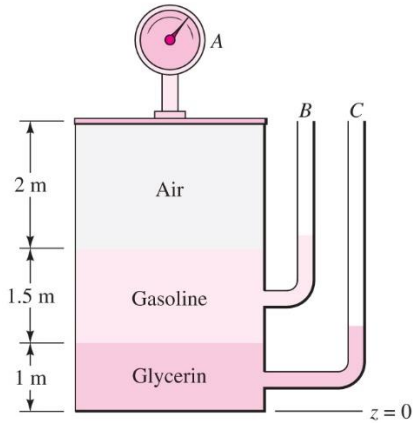


Image from Fluid Mechanics, 7th Edition by Frank White

5. The tank contains water ($\rho = 998$ kg/m^3) and oil at 20°C. What is h in cm if the density of the oil is 898 kg/m^3?

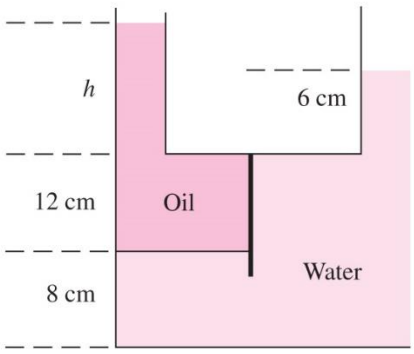
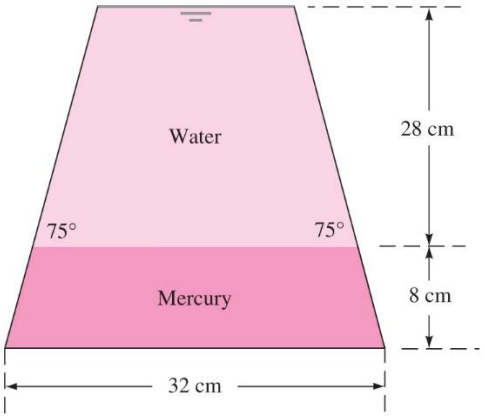


Image from Fluid Mechanics, 7th Edition by Frank White

6. If the absolute pressure at the interface between water and mercury is 93 kPa, what, in $\mathrm{lbf/ft^2}$, is (a) the pressure at the surface and (b) the pressure at the bottom of the container? ($\gamma_{water} = 9790\ N/m^3, \gamma_{Hg} = 133100\ N/m^3$)



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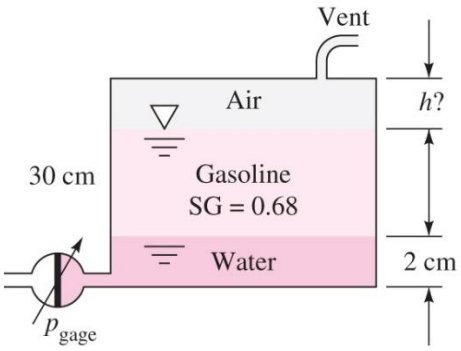
7. The fuel gage for a gasoline tank in a car reads proportional to the bottom gage pressure as shown. If the tank is 30 cm deep and accidentally contains 2 cm of water plus gasoline, how many centimeters of air remain at the top when the gage erroneously reads "full"? ($\gamma_{water} = 9790\ N/m^3$)



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