FLUID MECHANICS HW#1.2 MET 330 01/26/2019

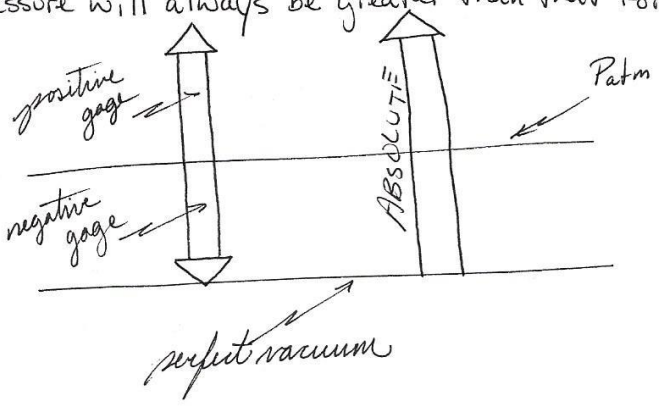
GROUP 3

- GRAHAM CHARBONEAU gchar001@odu.edu
- NOAH MARTIN nmart011@odu.edu
- DEREK WADE dwade002@odu.edu
- DARIUS SEALS dseal004@odu.edu

#3.6 The value for the absolute pressure will always be greater than that for the gage pressure. T or F

SOLUTION: $P_{abs} = P_{gage} + P_{atm}$

ANSWER: TRUE



#3.7 As long as you stay on the surface of Earth, the atmospheric pressure will be 14.7 psia. T or F

SOLUTION: I will explain my answer clearly. If the surface of the Earth on which you are standing is at sea-level, then yes the atmospheric pressure will be 14.7 psia. If you are standing on a Himalayan mountain, which is still the Earth's surface, then the atmospheric pressure will be different.

#3.8 The pressure in a certain tank is -55.8 Pa (abs).

SOLUTION: This is NOT possible! If the tank's pressure is negatively absolute, then the value is below purfect vacuum which is not possible.

#3.9 The pressure in a certain tank is -4.65 psig.

SOLUTION: This is possible! if the tank's pressure is measured with respect to the atmospheric pressure.

#3.10 The pressure in a certain tank is -150 kPa (gage).

SOLUTION: This is possible! If the tank's pressure is calculated with reference to the atmospheric pressure.

#3.11 If you were to ride in an open-cockpit airplane to an elevation of 4000 ft above sea level, what would the atmospheric pressure be if it conforms to the standard atmosphere?

SOLUTION: $P_{abs} = P_{gage} + P_{atm}$

Look at chart: $P_{atm} = 12.7$ psi @ 4000 ft above sea level

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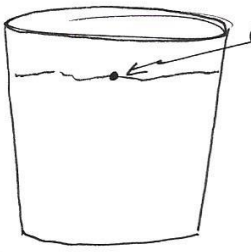
#3.13 Expressed as a gage pressure, what is the pressure at the surface of a glass of milk?

SOLUTION:



#3.41 Figure 3.19 shows a diagram of the hydraulic system for a vehicle lift. An air compressor maintains pressure above the oil in the reservoir. What must the air pressure be if the pressure at point A must be at least 180 psig?

SOLUTION:

γ = specific weight = s.g. (γ_{H_2O})

$\gamma_{oil} = (0.90)(62.43\ lbf/ft^3)$

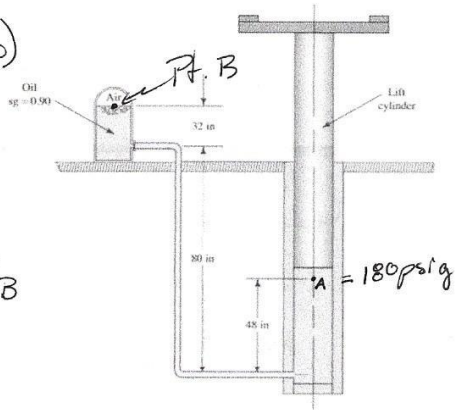
$\gamma_{oil} = 0.03249\ lbf/in^3$

$\Delta P = \gamma_{oil} \times h$

$$P_A + (0.03249)(48) - (0.03249)(80) - (0.03249)(32) = P_B$$

$$P_B = 177.9\ psig$$

FIGURE 3.19 Vehicle lift for Problem 3.41.



#3.62 Water is in the pipe shown in Fig. 3.26a. Calculate the pressure at point A in kPa (gage)

$$Pt_B - \gamma_{oil}(.075m) - \gamma_{H_2O}(0.1m) = Pt_A$$

$Pt_B = 1\ atm = 101.325\ kPa$

$\gamma_{oil} = S.g._{oil} \times \gamma_{H_2O} = (13.54)(9.81 kN/m^3) = 132.827 kN/m^3$

$\gamma_{H_2O} = 9.81\ kN/m^3$

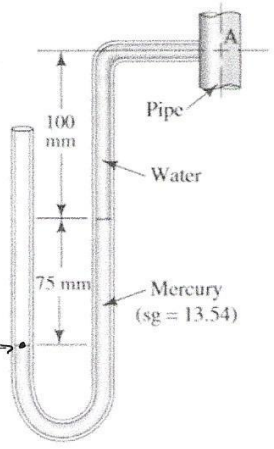


FIGURE 3.26 Problem 3.62.

$$101.325\ kPa - \left(132.827 \frac{kN}{m^2}\right)(0.075m) - \left(9.81 kN/m^3\right)(0.1m) \quad Pt_B \longrightarrow = Pt_A$$

$Pt_A = 90.382\ kPa$

#3.83 A barometer indicates the atmospheric pressure to be 30.65 in of mercury. Calculate the atmospheric pressure in psia

SOLUTION:

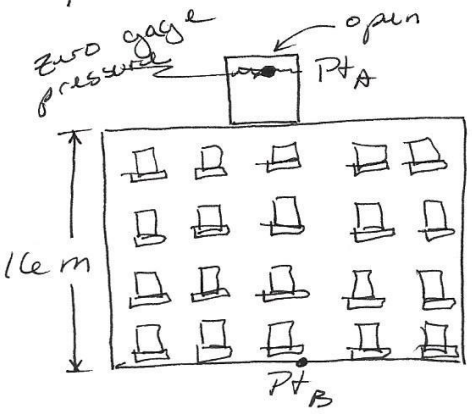
$$30.65\ in\ Hg \left|\frac{25.4\ mm}{1\ in}\right| \frac{1\ atm}{760\ mm\ Hg} \left|\frac{14.7\ psia}{1\ atm}\right| = 15.058\ psia$$

#3.90 The pressure in a vacuum chamber is -68.2 kPa. Express this pressure in mmHg.

SOLUTION:

$$-68.2\ kPa \left|\frac{1\ atm}{101.325\ kPa}\right| \frac{760\ mm\ Hg}{1\ atm} = -511.542\ mm\ Hg$$

#3.94 A passive solar water heater is to be installed on the roof of a multi-story building. The heater tank is open to atmospheric pressure and is mounted 16 m above ground level. In the static (non-flowing) state, what gage pressure, in kPa, must the plumbing line be designed to withstand if it is connected all the way down to ground level?



SOLUTION: FIND Pt_B

$$Pt_A + \gamma_{H_2O}(h) = Pt_B$$

$\gamma_{H_2O} = 9.81\ kN/m^3$

Pt_A = 0 gage pressure

$h = 16\ m$

$$Pt_B = 0 + (9.81\ kN/m^3)(16\ m)$$

$$Pt_B = 156.96\ kN/m^2 = 156.96\ kPa = Pt_B = \text{plumbing line gage pressure}$$