Fluid Mechanics HW 1.2 Ben Smithson

3.6 Absolute pressure will always be greater than gage pressure. True because the formula is Gage = absolute - atmospheric

G = ab - atm

3.7 As long as you stay on the surface of Earth, the atmospheric pressure will be 14.7 psia. True because sea level pressure = 14.7 psia.

P = 14.7 psia

3.8 The pressure in a certain tank is -53.6 Pa (abs). False because pressure cannot be negative in its value.

-55.6

$P_{gage} = -4.65\,psig$ $P_{atm} = 14.7\,psia$

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

$P_{abs} = -4.65\,psig + 14.7\,psia$

$P_{abs} = 10.05\,psi$

*TRUE. The absolut pressure is above 0, therefore the gauge pressure obtainable.

3.10

$P_{gage} = -175\,kPa\ (gage)$

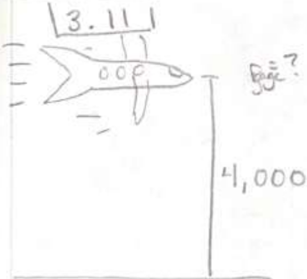
$P_{atm} = 101\,kPa$

$P_{abs} = -175\,kPa - 101\,kPa$

$P_{abs} = -74\,kPa$

*FALSE! Absolute Pressure cannot be below 0, therefore the gauge pressure cannot be acheived.

3.11



$\Delta p = \gamma_{air} h$

$P_{gage} = \Delta P - P_{atm}$

$P_{atm} = 14.7\,psi$

$4{,}000\,ft = h \left(\frac{12\,in}{1\,ft}\right) = 48{,}000\,in$

$\gamma_{air} = \frac{0.0765\,lb}{ft^3} \left(\frac{1\,ft}{12\,in}\right)^3 = 4.43 \times 10^{-5}\,lb/in^3$

$\Delta p = 4.43 \times 10^{-5}\,lb/in^3\,(48{,}000\,in)$

$\Delta p = 2.13\,psi$

$p = 14.7\,psi - 2.13\,psi$

$p = 12.57\,psi$

HW 1.2

01/25/2024
Group 6
Angela Sicaja

3-(13) What is the pressure at the surface of a glass of milk?

$P_{absolute} = P_{gage} + P_{atm}$ $P_{atm} = 0$ gage

$P_{absolute} = P_{atm}$

$P_{gage} = P_{atm} - P_{atm} = 0 - 0$

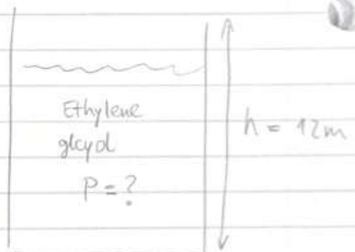
$\boxed{P_{gage}(milk) = 0}$ (gage)

3-(41)

$h_2 = 12.0\ m$ sg(Ethylene glycol) = 1.13

$T = 25°C$ $\rho_{water} = 1000\ kg/m^3$

$P = ?$



$P = \rho_{EG} g h$

$sg = \frac{\rho_{EG}}{\rho_w}$

$\rho_{EG} = sg \cdot \rho_w$

$\rho_{EG} = 1.13 \cdot 1000\ kg/m^3$

$\rho_{EG} = 1130\ kg/m^3$

$P = 1130\ kg/m^3 \cdot 9.81\ m/s^2 \cdot 12m$

$\boxed{P = 133\ 024\ Pa = 133.024\ kPa}$

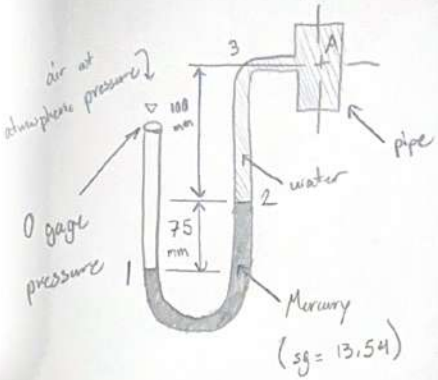
1/24/2024 Pg 1

MET 330

HW 1.2

3.62) Water is in the pipe shown.

Calculate the pressure at point A in kPa (gage)



$100 \text{ mm} = 0.1 \text{ m}$

$75 \text{ mm} = 0.075 \text{ m}$

$\Delta_p = \gamma h$

$P_1 - \gamma_{mercury}(0.075 \text{ m}) - \gamma_{water}(0.175 \text{ m}) = P_A$

$P_A = P_1 - \gamma_{mercury}(0.075 \text{m}) - \gamma_{water}(0.175 \text{m})$

$P_1 = P_{atm} = 0 \text{ Pa (gage)}$

$\gamma_{mercury} = (sg_{mercury})(9.81 \text{ kN/m}^3)$

$= (13.54)(9.81 \text{ kN/m}^3)$

$= 132.8 \text{ kN/m}^3$

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

$P_A = (0 \text{ Pa}_{gage}) - (132.8 \text{ kN/m}^3)(0.075 \text{m}) - (9.81 \text{ kN/m}^3)(0.175 \text{m})$

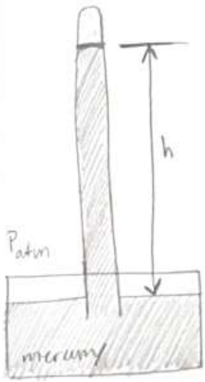
$P_A = (0 \text{ Pa}_{gage}) - (9.96 \text{ kN/m}^2) - (1.72 \text{ kN/m}^2)$

$P_A = -11.68 \text{ kN/m}^2$

$\boxed{P_A = -11.68 \text{ kPa}_{gage}}$

$\text{kN/m}^2 = \text{kPa}_{gage}$

3.83) What would be the reading of a barometer in inches of mercury corresponding to an atmospheric pressure of 14.2 psia?



$$0 + \gamma_m h = P_{atm}$$

$$P_{atm} = \gamma_m h$$

$$h = \frac{P_{atm}}{\gamma_m}$$

$$h = \frac{14.2 \ lb/in^2}{\left(\frac{848.7 \ lb}{1728 \ in^3}\right)}$$

$$= \left(14.2 \frac{lb}{in^2}\right)\left(\frac{1728 \ in^3}{848.7 \ lb}\right)$$

$$= 14.2\left(\frac{1728 \ in}{848.7}\right)$$

$$\boxed{h = 28.91 \ in}$$

psia = lb/in^2

$P_{atm} = 14.2$ psia

$\gamma_m = 848.7 \ lb/ft^3$

$$\left(\frac{848.7 \ lb}{ft^3}\right)\left(\frac{ft^3}{1728 \ in^3}\right)$$

↓

$$\gamma_m = \frac{848.7 \ lb}{1728 \ in^3}$$

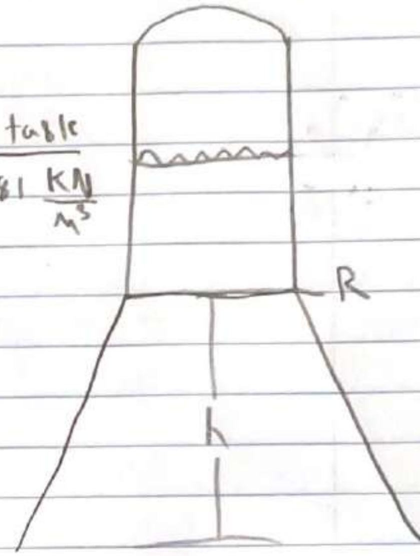
3.90)
$P = -12.6\ psi$

From textbook
$1.0\ inHg = 0.491\ psi$

$$-12.6\ psi \left(\frac{1\ inHg}{0.491\ psi}\right) = \boxed{-25.67\ inHg}$$

3.94) $P = 160\ kPa$

From table
$\gamma_w = 9.81\ \frac{kN}{m^3}$



$\Delta P = \gamma h$

$P = \gamma_{water} h$

$$h = \frac{P}{\gamma_{water@4°c}}$$

$$h = \frac{160\ kPa}{9.81\ \frac{kN}{m^3}} = \frac{160\ \frac{kN}{m^2}}{9.81\ \frac{kN}{m^3}} \rightarrow \boxed{h = 16.3\ m}$$