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MET 330 Homework 1.2 1/27/22

3.6 The value for absolute pressure will always be greater than that for the gage pressure.

True

p(abs) = p(gage) + p(atm)

3.7 As long as you stay on the surface of Earth the atmospheric pressure will always be 14.7 psia.

False because the atmospheric pressure on the top of a mountain will be lowere due to the higher elevation

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

False, absolute pressure cannot be negative

3.9 The pressure in a tank is -55.8 Pa(abs).

False, absolute pressue connot be negative

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

True

3.11 What would be the atomospheric pressure at 4000 ft above sea level

$\Delta p = -0.5$ psi / 1000 ft

$\Delta p = 14.7 - (0.5 \cdot 4)$

$\Delta p = 12.7$ psi

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

$p = 0$ kPa (gage) @ the surface

3.41 An air compressor maintains pressure above the oil in the reservoir. What must the pressure be if the air pressure at point A must be 180 psig

point A

$P_A = 180$ psig

$P_A = (180 \text{ psi})(12^2) = 25920 \text{ lb/ft}^2$ $\quad 1 \text{ psi} = 144 \text{ lb/ft}^2$

64 in $\Rightarrow$ ft $= 64/12 = 5.33$ ft

$0.90 = \frac{\gamma_{oil}}{62.4}$ $\quad \gamma_{oil} = (62.4)(0.9)$

$\gamma_{oil} = 56.16 \text{ lb/ft}^3$

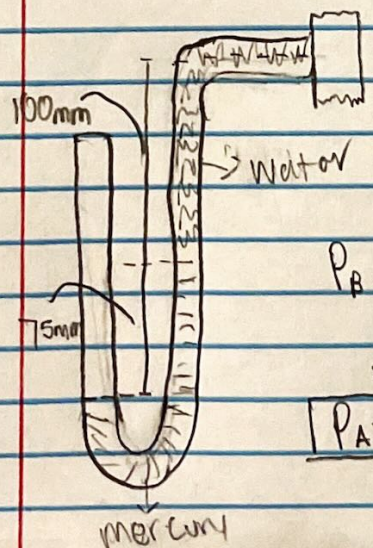
$P = P_A - (\gamma_{oil} \cdot h)$

$P = 25920 \text{ lb/ft}^2 - (56.16 \text{ lb/ft}^3 \cdot 5.33 \text{ ft}) \left(\frac{\text{lb}}{\text{ft}^3}\right) \frac{\text{ft}}{1} \text{ lb/ft}^2$

$P = 25920 \text{ lb/ft}^2 - 299.33 \text{ lb/ft}^2$

$P = 25620 \text{ lb/ft}^2$

3.62 Water in figure shown. Calculate the pressure at point A in kPa (gage)



$sg_m = 13.54$ $\quad \gamma_m = sg \cdot 9.81 \text{ kN/m}^3$

$100 \text{ mm} = 0.10 \text{ m}$ $\quad = 13.54 \cdot 9.81 = 132.8 \text{ kN/m}^3$

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

$P_B = 0 \text{ kPa (gage)} + [(132.8 \text{ kN/m}^3)(0.075 \text{ m})] + [(9.81 \text{ kN/m}^3)(0.10 \text{ m})]$

$= P_A$

$= 0 \text{ kPa (gage)} - 9.96 \text{ kPa (gage)} - 0.981 \text{ kPa (gage)}$

$P_A = -10.94 \text{ kPa (gage)}$

3.83 A barometer indicates the P_{atm} = 30.65 in of mercury. Calculate the atmospheric pressure in psia

$P_{atm} = \gamma_m h \Rightarrow \gamma_m = 848.7 \text{ lb/ft}^3$

$30.65 \text{ in} \left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 2.55 \text{ ft}$

$P_{atm} = (848.7 \text{ lb/ft}^3 \cdot 2.55 \text{ ft}) = 2164.2 \text{ lb/ft}^2$

$2164.2 \text{ lb/ft}^2 \left| \frac{1 \text{ psi}}{144 \text{ lb/ft}^2} \right.$

$P_{atm} = 15.02 \text{ psia}$

3.90 Pressure in a vacuum chamber is -68.2 kPa. Express this pressure in mm Hg

$1.0 \text{ mm Hg} = 133.3 \text{ Pa}$

$-68.2 \text{ kPa} = -68200 \text{ Pa}$

$-68200 \text{ Pa} \left| \frac{1.0 \text{ mm Hg}}{133.3 \text{ Pa}} \right.$

$P = -511.6 \text{ mm Hg}$

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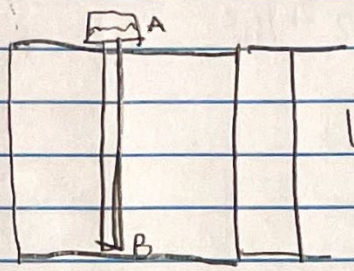
3.94 Solar water heater on roof 16m above the ground. Tank is open to P_{atm}. In static state, what gage pressure, in kPa, must the plumbing line be designed to withstand if connected all the way to the ground?



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

$P_B = 0 \text{ kPa(gage)} + (9.81 \text{ kN/m}^3 \cdot 16 \text{ m})$

$\boxed{P_B = 157 \text{ kPa}}$