Tai Booker
MET 330
HW 1.2
Chapter 3

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

True. Gage Pressure = Absolute pressure − Atmos. pressure

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

False. The atmospheric pressure depends upon the density, specific weight, and temp. of the air. All of these variables can change depending on your elevation above sea level.

8 and 9. The pressure in a certain tank is −55.8 Pa (abs).

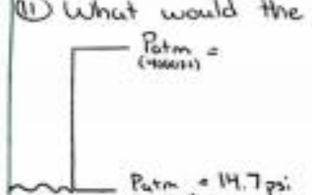
False. The absolute pressure must be a positive value as a perfect vacuum is 0 kPa absolute.

10. The pressure in a certain tank is −150 kPa (gage)

False. Absolute pressure is the sum of atmospheric pressure and gage pressure. A perfect vacuum would have an absolute pressure of zero psi. The earth has an atmospheric pressure of about 101 kPa. Since the gage pressure of −150 kPa would result in a negative absolute pressure, this statement is false.

HW 1.2 | # 11, 13, 41, 62 | Chris Betton Team 7

(11) What would the atmospheric pressure be @ 4,000 ft above sea level?



Assumptions:
- $\Delta P = \gamma h$ does not apply for gases because γ of a gas changes w/ pressure.
- An increase of 1,000 ft gives a uniform change of 3.4 kPa/0.5 psi.

$\therefore P_{atm\,(4k\,ft)} = P_{atm\,(sea\,level)} - \Delta P = 14.7\frac{lb}{in^2} - \left(.5 psi \cdot \frac{4000 ft}{1000 ft}\right)$

$= 14.7\frac{lb}{in^2} - 2\frac{lb}{in^2}$

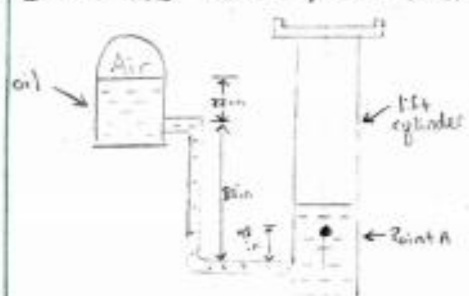
$= \boxed{12.7 psi}$

(13) Expressed as a gage pressure, what is the pressure @ the surface of a glass of milk?

If the surface of the milk is exposed to the atmosphere, the pressure there is $0 Pa_{(gage)}$

$\therefore \boxed{P_{gage} = 0 Pa_{(gage)}}$

(41) What must the air pressure be if the pressure @ point A must be at least 180 psig?



Given: $P_A = 180 psig$, $sg_{oil} = 0.90$

Find: P_{air}

$sg_{oil} = \frac{\gamma_{oil}}{\gamma_{water}}$

$P_{Air} = P_A - \Delta P$ where $\Delta P = \gamma_{oil} \cdot h$, $\gamma_{oil} = sg_{oil} \cdot \gamma_{water}$

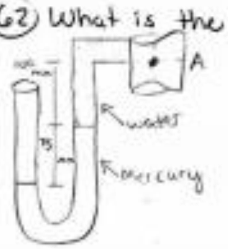
$\therefore P_{Air} = P_A - h \cdot sg_{oil} \cdot \gamma_{water}$, $h = 32 in + (80 in - 48 in)$

$h = 64 in$

$P_{Air} = 180\frac{lb}{in^2} - \left(64 in \cdot 0.90 \cdot 62.4\frac{lb}{ft^3}\right)\left(\frac{1 ft^3}{12^3 in^3}\right)$

$P_{Air} = 180 - 2.081472 \left(\frac{lb}{in^2}\right) = \boxed{177.9 \frac{lb}{in^2}}$

(62) What is the pressure @ point A in $kPa_{(gage)}$?



Given: $sg_{Hg} = 13.54$, $\gamma_{water} = 9.81\frac{kN}{m^3}$, $\Delta P = \gamma h$, $P_a = \frac{kN}{m^2}$

$P_A = P_{atm} - \Delta P$, $\Delta P = \gamma_w h_w + \gamma_{Hg} h_{Hg}$

$P_A - P_{atm} = -(\gamma_w \cdot h_w + \gamma_{Hg} \cdot h_{Hg})$, $\gamma_{Hg} = sg_{Hg} \cdot \gamma_{H_2O} = 13.54\left(9.81\frac{kN}{m^3}\right) = 132.8274\frac{kN}{m^3}$

$P_{A(gage)} = -\left(\left(9.81\frac{kN}{m^3} \cdot .1 m\right) + \left(132.8274\frac{kN}{m^3} \cdot .075 m\right)\right)$

$= -10.94 kPa$

$= \boxed{10.94 kPag}$

HW 1.2 | TEAM 7 | MELANIE CRUZ CONTEE

CH. 3 #83, 90, 94

83. A BAROMETER INDICATES THE ATMOSPHERIC PRESSURE TO BE 30.65in OF MERCURY (Hg). CALCULATE THE ATMOSPHERIC PRESSURE IN psia.

GIVEN:

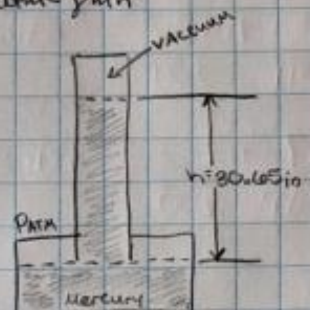
$h = 30.65 in$

$\gamma_m = 848.7 lb/ft^3$

(SECTION 3.7 OF TEXTBOOK)

(APPENDIX K FOR CONVERSIONS)

$P_{atm} = \gamma_m h$



SOLUTION:

$P_{atm} = \gamma_m h$

$= \frac{848.7 lb}{ft^3} \times 30.65 in \times \frac{1 ft^3}{1728 in^3}$

$P_{atm} = 15.1 psia$ ANSWER

90. THE PRESSURE IN A VACUUM CHAMBER IS −68.2kPa. EXPRESS THIS PRESSURE IN mmHg.

GIVEN:

$p = -68.2 kPa$

$= -68200 Pa$

$\frac{133.3 Pa}{mmHg}$ (APPENDIX K)

CONVERSION:

$\frac{-68200 Pa}{133.3 Pa} = \frac{133.3 Pa}{mmHg} \times \frac{1}{133.3 Pa}$

$p = -511.5 mmHg$ ANSWER

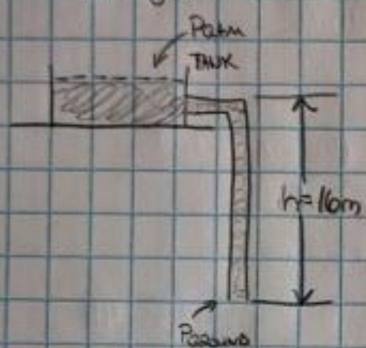
94. A PASSIVE SOLAR WATER HEATER IS TO BE INSTALLED ON THE ROOF OF A MULTI-STORY BUILDING. THE HEATER TANK IS OPEN TO ATMOSPHERIC PRESSURE AND IS MOUNTED 16m ABOVE GROUND LEVEL. IN THE STATIC (NON-FLOWING) STATE, WHAT GAGE PRESSURE, IN KPa, MUST THE PLUMBING LINE BE DESIGNED TO WITHSTAND IF IT IS CONNECTED ALL THE WAY DOWN TO GROUND LEVEL?

Given:

$\gamma = 9.81\ kN/m^3$ (APPENDIX E)

$h = 16m$

$\Delta p = \gamma h$



Solution:

$\Delta p = \gamma h$

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

$\boxed{\Delta p = 156.96\ kPa}$ REQUIRED GAGE PRESSURE IN THE PLUMBING LINE