Homework 1.2

MET 330

Due 09/12/19

Group 14

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HW 1.2

Problem 1: From the solved problems in class, I learned that pascal's paradox states that the pressure changes with elevation $\Delta P = \gamma h$. Pressure within a fluid is positive as you go down and is negative in the upword direction. H must be in the vertical direction. Pressure will be the same moving horizontally.

Pressure is the same at the bottom of all containers if the same fluid is in all the containers. If the density of a fluid is not given in the problem it can be found in the back of the book. When solving the problems, it does not matter which end you begon at. Both ways will result in the same answers.

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

7) As long as you stay on the surface of Earth, the atmospheric pressure will be 14.7 psia. False The magnitude of the atmospheric pressure varies with location and with climate conditions.

8) The pressure in a certain tank is -55.8 Pa (abs). False Absolute pressure is positive.

9) The pressure in a certain tank is -55.8 Pa (abs). False Absolute pressure is positive. Same at #8 on ebook?

10) The pressure in a certain tank is -150 kPa (gage). False Pressure -150 kPa (gage) is negative.

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

$P_{atmosphere} = 14.7$ psia h = elevation = 4000 ft

$\gamma_{air} = 0.0764\ lb/ft^3$

$P = \gamma h \rightarrow P = (0.0764\ lb/ft^3)(4000\ ft)\left(\frac{1\,ft^2}{(12\,in)^2}\right) = 2.12$ psia

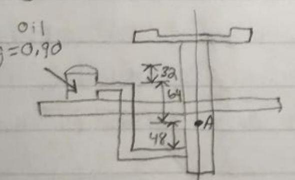
$P = P_{atm} - \Delta P \rightarrow P = 14.7$ psia $- 2.12$ psia $=$ **12.6 psia**

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

$P_{gage} = P_{abs} - P_{atm}$ $P_{abs} = P_{atm} + \rho g(0) \rightarrow P_{abs} = P_{atm}$

so if $P_{abs} = P_{atm}$ then pressure at the surface **= 0**

41) A diagram shows a 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?



$\Delta P = \gamma_{oil} h$ $Sg = \frac{SW\ oil}{SW\ water}$

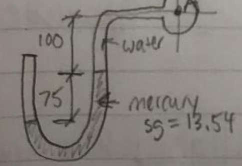
$h = 64$ in $0.9 = \frac{SW\ oil}{62.4\ lb/ft^3}$

$SW\ oil = (0.90)(62.4\ lb/ft^3)\left(\frac{1\,ft^3}{(12\,in)^3}\right) = 0.033\ lb/in^3$

$\Delta P = (0.033\ lb/in^3)(64\ in) = 2.112\ lb/in^2$

$P_{Air} = 180$ psig $- 2.112$ psig $=$ **177.9 psig**

62) Calculate the pressure at point A in kPa (gage)



$P_1 - 0.075m\ \gamma_{Hg} - 0.1m\ \gamma_{H2O} = P_A$

$\gamma_{H2O} = 9.81\ kN/m^3$

$0 - 0.075m\,(13.54) - 0.1m\,(9.81) = P_a$

$P_a = -1.99$ kPa

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83) A barometer indicates the atmosphere pressure to be 30.65 in of mercury. Calculate the atmospheric pressure in psia. Pressure 1 inch of mercury = 0.491154 psia

$P_{atm} = 30.65 \text{ in Hg} \times \left(\frac{0.491154 \text{ psia}}{1 \text{ in of Hg}}\right) = \boxed{15.05 \text{ psia}}$

90) The pressure in a vacuum chamber is -68.2 kPa. Express this pressure in mmHg. -68.2 kPa = -68200 Pa

1 Pa = 0.0075 mm of mercury $-68200 \times 0.0075 = \boxed{-511.5 \text{ mmHg}}$

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 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?

$\Delta P = \gamma h$ $h = 16\text{m}$ $\gamma_{water} = 9.81 \text{ kN/m}^3$

$\Delta P = (9.81 \text{ kN/m}^3)(16 \text{ m}) = \boxed{156.96 \text{ kPa}}$

Hw 1.2

1 Write a paragraph or two on what you learned

2 Chapter 3: 6-10, 11, 13, 41, 62, 63, 90, 94

1 We learned about pascals paradox $\Delta P = \gamma h$. otherwise known as the "gamma h" equation. We also learned about how pressure in a fluid is positive as you descend and negative as you ascend but is the same if you move horizontal. Density of fluids can be found in the back of the book if not given in the problem

3.6 True

3.7 False because atmospheric pressure changes with location or elevation

3.8 False because absolute pressure is positive

3.9 False because absolute pressure is positive

3.10 False negative gage pressure

3.11 $P_{atm} = 14.7\,psia$ $\Delta h = 4000\,ft$

$\gamma_{air} = 0.0764\,lb/ft^3$

$\Delta p = \gamma h$

$0.0764\,lb/ft^3 \cdot 4000\,ft = 305\,lb/ft^2 \cdot \frac{1\,ft}{12\,in} = 2.12\,psia$

$P = P_{atm} - \Delta P = 14.7\,psia - 2.12\,psia =$

$\boxed{12.6\,psia}$

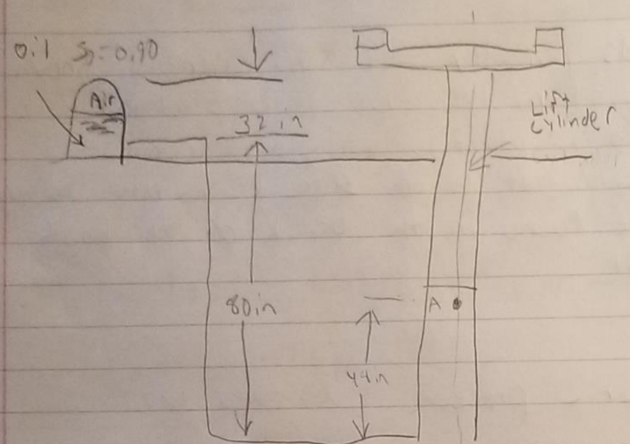
3.13 $P_{gage} = P_{abs} - P_{atm}$

Open to atmosphere

$P_{abs} = P_{atm}$

Surface pressure = 0

3.41



$\Delta P = \gamma_{oil} h$ $s_{g\,oil} = 0.90$

$s_g = \frac{\gamma_{oil}}{\gamma_{water}}$ ∴ $0.9 = \frac{\gamma_{oil}}{62.4\ lb/ft^3}$ $= \gamma_{oil} = 56.2\ lb/ft^3 \cdot \frac{1}{12}$

$0.0325\ \frac{lb}{in^3} \cdot 64\ in = 2.09\ psi$

$180 - 2.08 = \boxed{177.9\ psi}$

3.62 $P_1 - 0.075\,m\,\gamma_{Hg} - 0.1\,m\,\gamma_{H_2O} = P_A$

$0 - 0.075m \cdot 113.54 - 0.1 \cdot 9.81 = -1.99\ kPa$

3.63 1 in Hg = 0.49 psia

P_{atm} = 30.65 in Hg

$\frac{30.65 \text{ in Hg} \cdot 0.49}{1 \text{ in of Hg}} = 15.02$ psia

3.90 1 Pa = 0.0075

P = -68.2 kPa

-68.2 · 0.0075 = -0.5115 · 1000 = 511.5 mmHg

3.94 h = 16m $\gamma_w = 9.81\ KN/m^3$

$\Delta P = \gamma h$

P = 9.81

$P = 9.81\ KN/m^3 \cdot 16m = 156.96\ kPa$

Muhammed Yapraşan

Part 1 V7

Pressure in a fluid increases as we go down. Pressure decreases as we go up. It's like going in on a swimming pool. Atmosphere pressure is always going to be 0 kPa. When we're discussing about the pressure - elevation equation ($\Delta p = \gamma h$), the gamma (γ) can change based on the elevation like moving into the atmosphere. Pressure changes in a vertical plane. Horizontal never changes in pressure.

During Tuesday's lecture, we learned more about Hydrodynamics. We began to discuss about streamlines, streamlines are a path traced by a massless particle moving with the flow which are fluid particles. Velocity is tangent to streamline point. Conservation of mass law was discussed. The mass flow rate is the rate of mass passing through an area. Velocity will always be perpendicular to area. In conservation of mass law, the change in mass equals the rate of change over time. $(\dot{m}_{in} - \dot{m}_{out}) = \frac{dm}{dt}$

Nathaniel Yupanqui

Problem 90 9/7

The pressure in a Vacuum chamber is -68.2 kPa. Express this pressure in mm Hg

Given

$P = -68.2 kPa$

Hg of 1 Pa = 0.0075 mm

$= -68.2 kPa \left(\frac{1000}{kPa}\right)(0.0075 mm)$

$= \boxed{-511.5 \text{ mm Hg}}$

Vacuum chamber

Problem 94

A passive solar water heater is to be installed on the roof of a multi-story building. The heater tank is open to atm 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

gage pressure - elevation equation

$\Delta p = \gamma h$

Given $\gamma_w = 9.81 kN/m^3$ (water) $h = 16m$

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

$\Delta p = 156.96 kN/m^2$

$= \boxed{156.96 \text{ kPa}}$

(gage)