Test 1

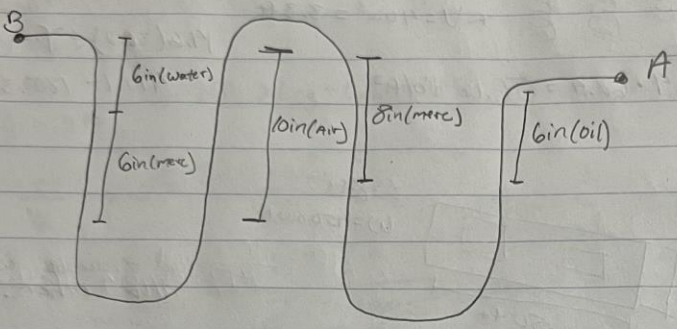
Nicholas Albano

MET330

Problem 1

Test 1 MET 330 Nicholas Albano

1.



Data: $sg_{oil} = .9$

$sg_{merc} = 13.54$

6in = .5ft
10in = .83ft
8in = .66ft

Find $P_A - P_B$.

$\Delta p = \gamma \cdot h$

$\gamma_{water} = 62.4\ lb/ft^3$

$\gamma_{oil} = .9 \cdot 62.4 = 56.16\ lb/ft^3$

$\gamma_{merc} = 13.54 \cdot 62.4 = 844.896$

$\gamma_{Air} = .0764\ lb/ft^3$

$$P_A + \gamma_{oil} \cdot .5ft - \gamma_{merc} \cdot .66ft + \gamma_{Air} - \gamma_{merc} \cdot .5ft - \gamma_{water} \cdot .5ft = P_B$$

$$P_A + 56.16(.5) - 844.896(.66) + .0764(1) - 844.896(.5) - 62.4(.5) = P_B$$

$$P_A + 28.08 - 557.63 + .0764 - 422.448 - 31.2 = P_B$$

$$P_A + 983.12 = P_B$$

$$\boxed{P_A - P_B = 983.12\ lb/ft^2}$$

Part 2: 5in = .416ft
7in = .58ft
9in = .75ft

$$P_A + 56.16(.416) - 844.896(.58) + \gamma_{Air} - 844.896(.416) - 62.4(.416) = P_B$$

$$P_A + 23.36 - 490.03 + .0764 - 351.47 - 25.95 = P_B$$

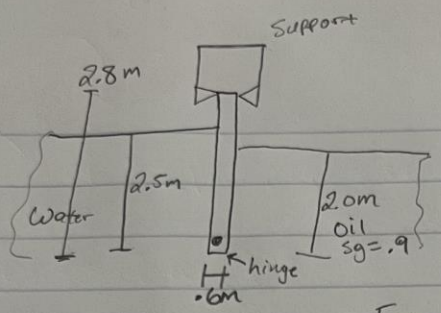
$$P_A - 844.01 = P_B \rightarrow P_A - P_B = \boxed{844.01\ lb/ft^2}$$

Specific Weight(lb/ft3)			Measurment Conversions							
Water	62.4		6in = .5ft							
Oil(.9*62.4)	56.16		8in = .66ft							
Mercury(13.54*62.4)	844.896		10in = .88ft							
Air	0.0764									
Pa-Pb(data from right to left)		Pa + 56.16(.5) - 844.896(.66) + .0764 - 844.896(.5) - 62.4(.5) = Pb								
After Calc. and Rearrangment		Pa-Pb = 983.12 lb/ft3								
PART 2										
Measurment Conversions										
5in = .416ft		Pa-Pb(right to left)		Pa + 56.16(.416) - 844.896(.58) + .0764 - 844.896(.416) - 62.4(.416) = Pb						
7in = .58ft										
9in = .75ft		After Calc.		Pa-Pb = 844.01 lb/ft3						

Procedure: For the first part of the procedure, I converted the units from inches to feet. I also needed the pressure of each material used so I used the formula using its specific weight multiplied by the height of each. For the specific weight of oil and mercury I used its specific gravity times the specific weight of water. For the small air pocket, I used the specific weight of air times 1 because it doesn't change with elevation. I would have used 14 psi, but it gives me a big and negative final answer. Once I have all the weight, I multiply them by the height of the material. Going down is positive and up is negative. Plugging in all the numbers I get 983.12 lb/ft3. For part two I assumed the decrease of one inch in all measurements and did the same calculations. For this I got 844.01 lb/ft3.

Problem 2

2.



Find net force, Force on hinge, Force on the support:

Data:

$\gamma_{water} = 9.81 \frac{KN}{m^3}$ $\quad F = \gamma \cdot h_c \cdot A$

$\gamma_{oil} = .9 \cdot 9.81 = 8.82 \frac{KN}{m^3}$

$F_1 = 9.81 \cdot \frac{2.5}{2} \cdot (2.5 \cdot .3) = \underline{9.19\ KN}$ $\quad L_p = \frac{2}{3} \cdot 2.5 = 1.6\ m$

$F_2 = 8.82 \cdot \frac{2}{2} \cdot (2 \cdot .3) = \underline{5.29\ KN}$ $\quad L_p = \frac{2}{3} \cdot 2 = 1.3\ m$

net Force $= 9.19 - 5.29 = \boxed{3.9\ KN \rightarrow}$

$F_{net} \cdot (2.5 - 1.6) = F_{supp} \cdot 2.8 \rightarrow \quad F_{supp} = \frac{F_{net} \cdot (2.5 - 1.6)}{2.8} = \boxed{1.25\ KN}$

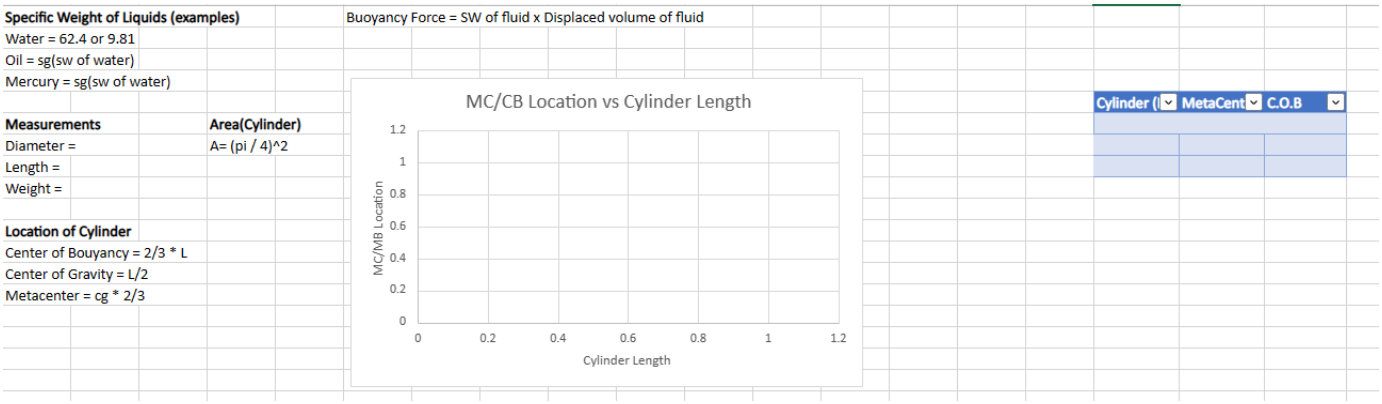
$M_s = 0 \rightarrow F_1(1.66) - F_2(1.33) - F_H(2.8) = 0$

$\frac{15.25 - 7.03}{2.8} = FH \quad \boxed{F_{Hinge} = 2.93\ KN}$

Given Data	Specific Weight (kN/m3)		
Gate = .6m wide	Oil = .9(9.81) = 8.82		
Support Height = 2.8m	Water = 9.81		
Water Height = 2.5m			
Oil Height = 2.0m			
Oil sg = .90			
Water sg = 9.81kN/m3			
Force on the wall from the left	F1 = 8.82 * 2.5/2 * (2.5*.3) = 9.19kN	Net Force = 3.9kN pointing to the right	
Force on the wall from the Right	F2 = 8.82 * 2/2 *(2 *.3) = 5.29kN		
Statics on the wall	Fnet * (2.5-1.6) = Fsp * 2.8	After rearragning equation	Fsp = 1.25kN
Moment from support	F1(1.66) - F2(1.33) -Fh(2.8) = 0	After rearragning equation	Fh = 2.93kN

Procedure: before starting the problem, I took the specific gravity for each substance in the problem. For water I already knew its 9.81kN/m3 and for the oil I took the sg multiplied by the sg of water to get 8.82kN/m3. For the forces on each side of the support beam I used the force formula which is sg times half of the height times area. So for force one I did sg of water times the height of water divided by two then multiplied by the are to get 9.19kN. I did the exact thing for force two but used the height and sg of oil. I used .3 instead of .6 when finding area because I remember an example in the lectures using half of the width/length. Then for net force I subtracted both forces and got 3.9kN. For Force on the support and hinge and I used statics to find the forces on both. For the support I found was 1.25kN and hinge was 2.93kN.

Problem 3



Procedure: For the excel spreadsheet I started with the basics of what was asked for. I gave examples of specific weight if those liquids were used in this problem. I also put the formula for each liquid's specific weight just for examples. Then just as a baseline I gave the measurements blank spaces as if I were going to fill them out to actually solve the problem. I also put the formula for area of cylinder which is pi/4 squared but I had some issues with my excel trying to find the symbols and plug them in so I just typed it out. From the book and from some notes I tried to find formulas for the different types of location of the cylinder for example. I had a hard time finding some of the formulas and made do with what the book gave me. Then I just gave a very basic graph and table that would be used to input the values got from the formulas on the left. I tried to understand what was asked in the problem and I gave the basic information with what I was given.

HONOR CODE

I pledge to follow the Honor Code and to obey all rules for taking exams and performing homework assignments as specified by the course instructor.

I understand that when asked to follow the Honor Code on exams or homework assignments I must follow the rules below.

1. When following the Honor Code a student must work entirely alone on exams.

2. When following the Honor Code a student may not share information about any aspect of the exam with other members of the class, other faculty members, or other people who has not already taken the exam this year, or its equivalent in future years.

3. When following the Honor Code a student must direct all questions concerning the exam or homework assignment to the course instructor or teaching assistant.

4. When following the Honor Code it is the student's responsibility to obtain clarification from the instructor if there are questions concerning the requirements of the Honor Code.

5. When following the Honor Code a student can only access websites related to ODU (such as Blackboard, etc.) while taking the test.

6. When following the Honor Code a student cannot access, neither ask for help, from websites such as coursehero, chegg, and any other similar website, while taking the test.

I understand that failure to follow this Honor Code imply that the professor will immediately report my case for academic dishonesty to the ODU Office of Student Conduct & Academic Integrity.

Student Name: Nicholas Albano

Student Signature: [signature]

Date: 6/2/23