TEST MODULE 1

ROY SHEPARD

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BOY SHEPARD TEST #1

(1) PURPOSE

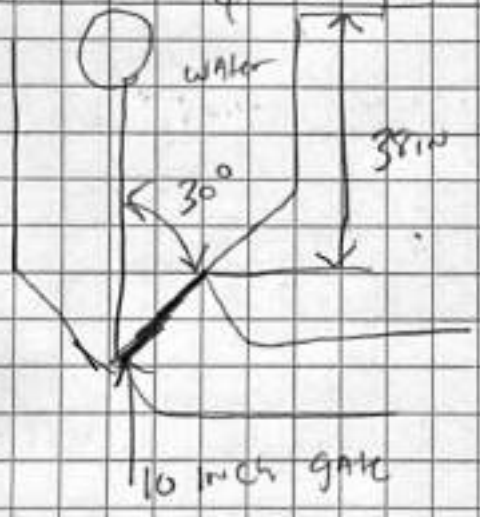
a) A CIRCULAR GATE SEALS the PIPE to STOP the FLOW and when WATER LEVEL REACHES BEING A FULLY SUBMERGED SPHERICAL BUOY OPENS the GATE

b) HOW LARGE SHOULD the BUOY be to PERFORM the FUNCTION?

c) IS the BUOY STABLE while PULLING the GATE OPEN

D) CREATE EXCEL WORKBOOK

DRAWINGS & DIAGRAMS



SOURCES:

MET 330 CLASS NOTES & EXAMPLES OLD DOMINION UNIVERSITY
Applied Fluid Mechanics 8th edition Pearson Education
Mott, R. L. Hoover

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DESIGN CONSIDERATIONS:

- NEUTRAL BUOYANCY
- STABLE
- CABLE FORCE
- $F_b = W = F_c$

DATA & VARIABLES

$H = 38$ IN $\cos\theta = 30°$

$D = 10$ IN $\gamma_w = 62.4$ @ 60°F

PROCEDURE

a) FIND THE FORCE IN THE CABLE IT TAKES TO OPEN THE GATE WITH 38 INCHES OF WATER

b) USE THAT FORCE TO DETERMINE BUOY SIZE

c) NEXT DETERMINE IF THAT SIZE WILL BE STABLE

[illegible]

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CALCULATIONS:

a) $h_c = 38 + x = 38 + 5\cos(30) = 42.33\,in$

$L_c = h_c / \cos 30^\circ = 48.88\,in$

$F_R = \gamma h_c A$

$A = \pi(10)^2/4 = 78.54\,in^2$

$F_R = \frac{62.4}{ft^3} \cdot \frac{42.33in \cdot 78.54\,in^2}{1728\,in^3/ft^3}$

$F_R = 120.1\,lb$

$I_c = \frac{\pi(10)^4}{64} = 490.9\,in^4$

$L_p - L_c = \frac{I_c}{L_c A} = \frac{490.9\,in^4}{(48.88\,in)(78.54\,in^2)} = 0.128\,in$

$\Sigma M_H = 0 = F_R(5.128) - F_c(5.00)$

$F_c = \frac{(120.1\,lb)(5.128in)}{5.00} = 123.2\,lb$ = Cable Force

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b) $F_z = W = F_b$ For Neutral Buoyancy

$F_b = 123.12 lb$

Find Buoy volume

$$F_b = \gamma_w V \quad = \quad V = \frac{F_b}{\gamma_w}$$

$$V = \frac{123.12 lb}{62.4 lb/ft^3} = 1.97 ft^3$$

Next Find Diameter

$$V = \frac{4}{3}\pi r^3 \quad = \quad r = \left(3\frac{V}{4\pi}\right)^{1/3}$$

$$r = \left(3\frac{1.97}{4\pi}\right)^{1/3} = 0.78 ft$$

$$D = 2r = 2(0.78) = 1.56 ft$$

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TITLE

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C. STABLE?

Cg = Cb = STABLE

All spheres Are Stable because Cb and Cg Share the SAme spot.

Summary

a) the Force Needed to open the gate on the pipe is 123.1b

b) To open the gate with A buoy You need to have A volume of 1.97ft³ which is equal to a diameter of 1.56ft

c) Since the buoy share the SAme Center of buoyancy as Center of Gravity All spheres are considered Stable.

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Materials: Unknown For buoy submerged in water

Analysis:

I Notice As the Angle get large the buoy gets smaller this is because the force needed to move the gate is less because the movement is less. As for As being stable All sphere will be stable because Cbuoy Cg share the sput in a sphere.

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Problem 2

Purpose:

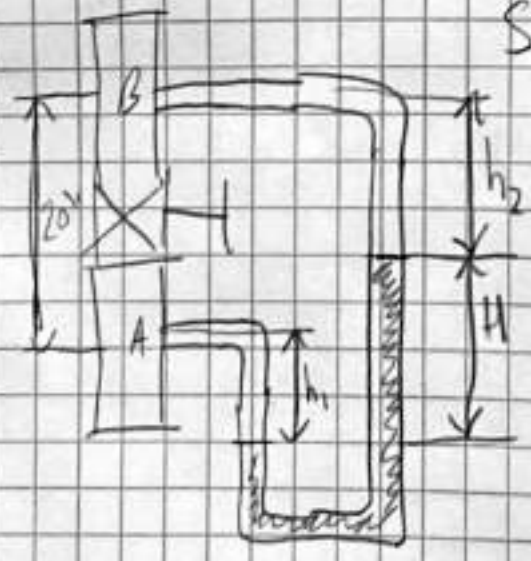
a) A manometer UTube is used to measure pressure difference Across A Valve Valves pressure difference @ a Flow rate OF 3.387 ft^3/ 3.393 PSI

b) What will the Utube manometer reading be

c) what would the pressure difference be if there is no Flow.

Drawings & Diagrams

Sg = 13.54



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PROJECT

blem 2

RSE:

Manometer UTube is used to measure
ssure difference Across A valve
es pressure difference for a flow
OF 3.387 ft³/s 3,353 PSI
at will the Utube manometer reading be?
At would the pressure difference
if there is no flow.

ms & Diagrams

SG=13.54

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DATE

PROPRIETARY INFORMATION

PROJECT

Solves: • MET 330 Class Notes & Example
OLD Dominion University
• Applied Fluid mechanics 8th Edition pearson
Mott, R, Utorick
• Ref problem 3.69

Design considerations:

• Find h1 • Find h2
• Find H

DATA & VARIABLE

$h_1 = ?$ $h_2 = ?$ $H = ?$ $\gamma_w = 62.4\ lb/ft^3$

$\gamma_m = 847\ lb/ft^3$

3353 PSI = 488.592

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PROPRIETARY INFORMATION

TITLE

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Procedure:

a) Create Formula to find h

b) Solve Formula

c) Adjust pressure to 0

Calculations:

a) $20in + h_1 = H + h_2 = 20 - H = H_2$

$$P_A + \gamma_w h_1 - \gamma_m H - \gamma_w h_2 = P_B$$

$$P_A - P_B = \gamma_w h_2 - \gamma_w h_1 + \gamma_m H$$

$$P_A - P_B = \gamma_w (h_2 - h_1) + \gamma_m H$$

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$$P_A - P_B = \gamma_w(20-H) + \gamma_m H$$

$$488.592 = \gamma_w 20 - \gamma_w H + \gamma_m H$$

$$488.59 = (62.4)(20) - 62.4H + 847H$$

$$488.59 = 1,248 - 62.4H + 847H$$

$$-759.41 = 784.6H$$

$$\frac{-759.41}{784.6} = H$$

$$-0.96 = H$$

$$H = 0.96$$

D) $20 - H = 20 - 0.96 = 19.04\,in$

C) $P_A - P_B = \gamma_w h_2 - \gamma_m H_1 + \gamma_m H$

$= 62.4(19.04) - 847(19.04) + 847(0.96)$

$=$

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SUMMARY:

I used example 3.6.5 to get through most of this question I was unsure what values to use. I am not entirely sure my formulas are correct. I also rewatched video dated Sept 11th problem 100 times to get this. Having no or minimal values appeared to be a real burden formula. All of our coursework examples gave us the numbers we needed

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MATERIALS:

WATER
Mercury

ANALYSIS:

I don't think
Correct based o
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Temperature
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MATERIALS:

WATER
Mercury

ANALYSIS:

I Don't think I solved the problem Correct BASED ON MY VALUES, BUT I DO KNW BASED OFF OF EXPERIENCE that YOU STILL EXPERIENCE a PRESSURE difference WHEN THER IS NO FLW that IS BECAUSE YOU HAVE AN OPEN DITCH AND AN OPEN TOP TANK. SO WITH that SAID Atmospheric Temperature and Density will play A role ON pressure between the two traps.

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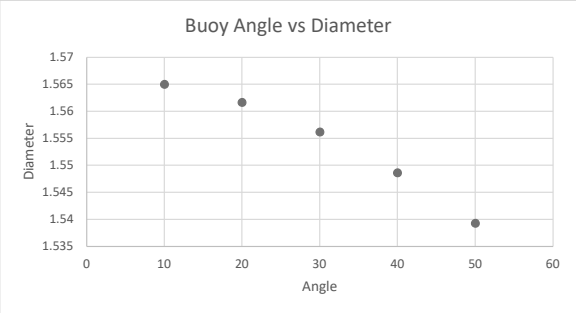
Angle	Angle in Radians	hc	lc	A	Fr	Ic	LP-LC	FC	Fb=W=Fc	V	r			d	Stable Y/N
30	0.523598776	42.33013	48.87862	78.53982	120.055	490.8739	0.127868	123.1252	123.1252	1.973161	0.157019	0.471057	0.778081	1.556161	Y
20	0.34906585	42.69846	45.43876	78.53982	121.0997	490.8739	0.137548	124.4311	124.4311	1.994088	0.158684	0.476053	0.780822	1.561643	Y
10	0.174532925	42.92404	43.58621	78.53982	121.7394	490.8739	0.143394	125.2308	125.2308	2.006904	0.159704	0.479113	0.782491	1.564982	Y
40	0.698131701	41.83022	54.60548	78.53982	118.6372	490.8739	0.114457	121.353	121.353	1.944759	0.154759	0.464277	0.774329	1.548659	Y
50	0.872664626	41.21394	64.11751	78.53982	116.8893	490.8739	0.097477	119.1681	119.1681	1.909746	0.151973	0.455918	0.769654	1.539308	Y



PA-PB	Gamma Water	Gamma Mercury	H results			
488.592	62.4	847	1248	759.408	784.6	0.967892
500	62.4	847	1248	748	784.6	0.953352
400	62.4	847	1248	848	784.6	1.080806
300	62.4	847	1248	948	784.6	1.208259
200	62.4	847	1248	1048	784.6	1.335712