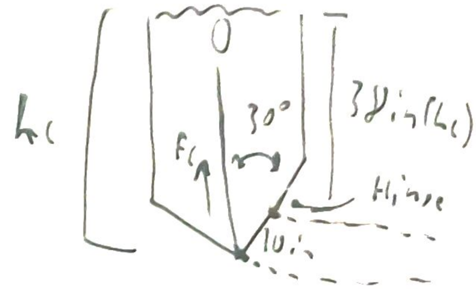
Test 1

Temp$_w$ = 60°F Vol$_w$ = 3.387 ft³/s Len$_{sp}$ = 11 ft Len$_{dp}$ = 2500 ft

$F_R = \gamma h_c A$ $\gamma = 62.4\,lb/ft^3$ $F_b = \gamma_f V_d$

A-1) Size of buoy? Solve for Volume



$h_c = 38 + y$
$= 38 + 5\cos 30°$
$= 42.33$ in

$r = 5$
$d = 10$
$\theta = 30°$

$L_c = \frac{h_c}{\cos 30°} = \frac{42.33}{\cos 30°} = 48.88$ in

$F_b = \gamma_f V_d$
$F_R = \gamma h_c A$

$A = \frac{\pi (10)^2}{4} = 78.54\,in^2$

$I_b = \frac{\pi d^4}{64} = \frac{\pi (10)^4}{64} = 490.9$

$F_R = (62.4\,lb)\left(\frac{42.33 \cdot 78.54}{1728}\right)$

$F_R = 120.1\,lb$
Force about Hinge

$L_b - L_c = \frac{I_b}{L_c A} = \frac{(490.9)}{(48.88)(78.54)} = 0.128$

$= F_r(r + (L_b - L_c)) - F_b r$

$F_b = \frac{F_r(r + (L_b - L_c))}{r}$

$= \frac{(120.1)(5.128)}{5}$

$= 123.2$ lb
Force required by buoy

$F_b = \gamma_l V_d$ $V = \frac{4}{3}\pi r^3$

$r = \sqrt[3]{\frac{3V}{4\pi}}$

$V_d = \frac{F_b}{\gamma_l}$

$= \frac{123.2}{62.4\,lb} = 1.974\,ft^3$

$r = \sqrt[3]{\frac{3(1.974)}{4\pi}}$

$r = 0.7782$ ft

$\boxed{d = 1.556\,ft}$

A-2) The buoy is stable since the submerged crossection shows the center of gravity lower than bouyancy

A-3) N/A (Instructions)

A-4) 1. See Excel spreadsheet
2. Yes, the stability of the buoy would change based on size because a larger buoy would have a larger cross sectional area. This would mean a greater seperation from the center of gravity and the center of buoyancy.

Analysis Part A:

The results of the problem matched what I had expected and make logical sense. I did make an error in the process as I ~~interpreted~~ interpredid the size as volume and not diameter. This was corrected but slowed down making the spread-sheet. The specific reason I think these results make sense is that the process follows a logical ~~pro~~ system of thought and the outcome would work given the initial constraints.

Part B

$FR = 3.387\,ft^3/s$ $P = 3.393\,psi$ $d = 20in = 1.6ft$

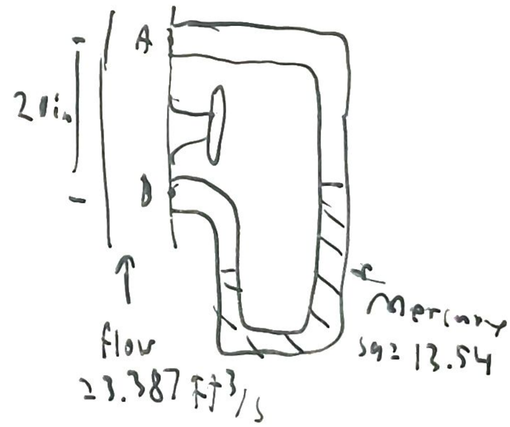
B-1)

$\Delta P = \gamma h$ $\gamma = SW$

$h = \Delta$ elevation

$\gamma_w = 62.4\,lb/ft^3$

$3.393 = (62.4)$



$P_A = P_1 + \gamma_m h - \gamma_w h_w$

$= (3.393) + (844.9)h - (62.4)(1.6)$

$h = \dfrac{(3.393) + (62.4)(1.6)}{844.9}$

$= 0.122$

$0.122(12)$

$= \boxed{1.47\,in}$

$P_1 = 3.393$

$\gamma_m = (13.54)(62.4)$

$= 844.896$

$\gamma_w = 62.4$

$h_w = 1.6\,ft$

B-2) $\Delta P = \gamma h$ $h = 20 in$ $\gamma_m = 132.8$ $\gamma_w = 9.81$

$$P_A = P_1 + \gamma_m h_m - \gamma_w h_w \qquad P_1 = 0$$

$$= \cancel{0 + 844.896 - (62.4)(20)}$$ Wrong Formula
Wrong Approach

$$P_A - P_B = \gamma_m \overset{1.6ft}{\cancel{(20)}} - \gamma_w (1.6)$$
$$= (1.6)(\gamma_m - \gamma_w)$$
$$= (1.6)(844.896 - 62.4)\left(\frac{1}{1728}\right)$$
$$= (1.6)(782.5)\left(\frac{1}{1728}\right)$$
$$= \frac{(1251.994)}{(1728)} = \boxed{0.724\ lb/in^2}$$

B-3) N/A Instructions

B-4) N/A See Attached Excel Spreadsheet (Sheet 2Y Part B)

Analysis Part B

In Section B, the probeem was to identify the displacment of Mercury in a U-tube manometer and then the pressure in zero flow rate conditions. This set of problems was interesting to figure out. It did not reqnire lots of calculations but was challenging to identify tho correct process. I made a mistake on the first part when trying to put in values of varieing units leading to inaccurate answers that did not make sense. These answers make Sence when put into the context of the given values and dimmensions. Nothing seems ~~out~~ of place and all are plausible.