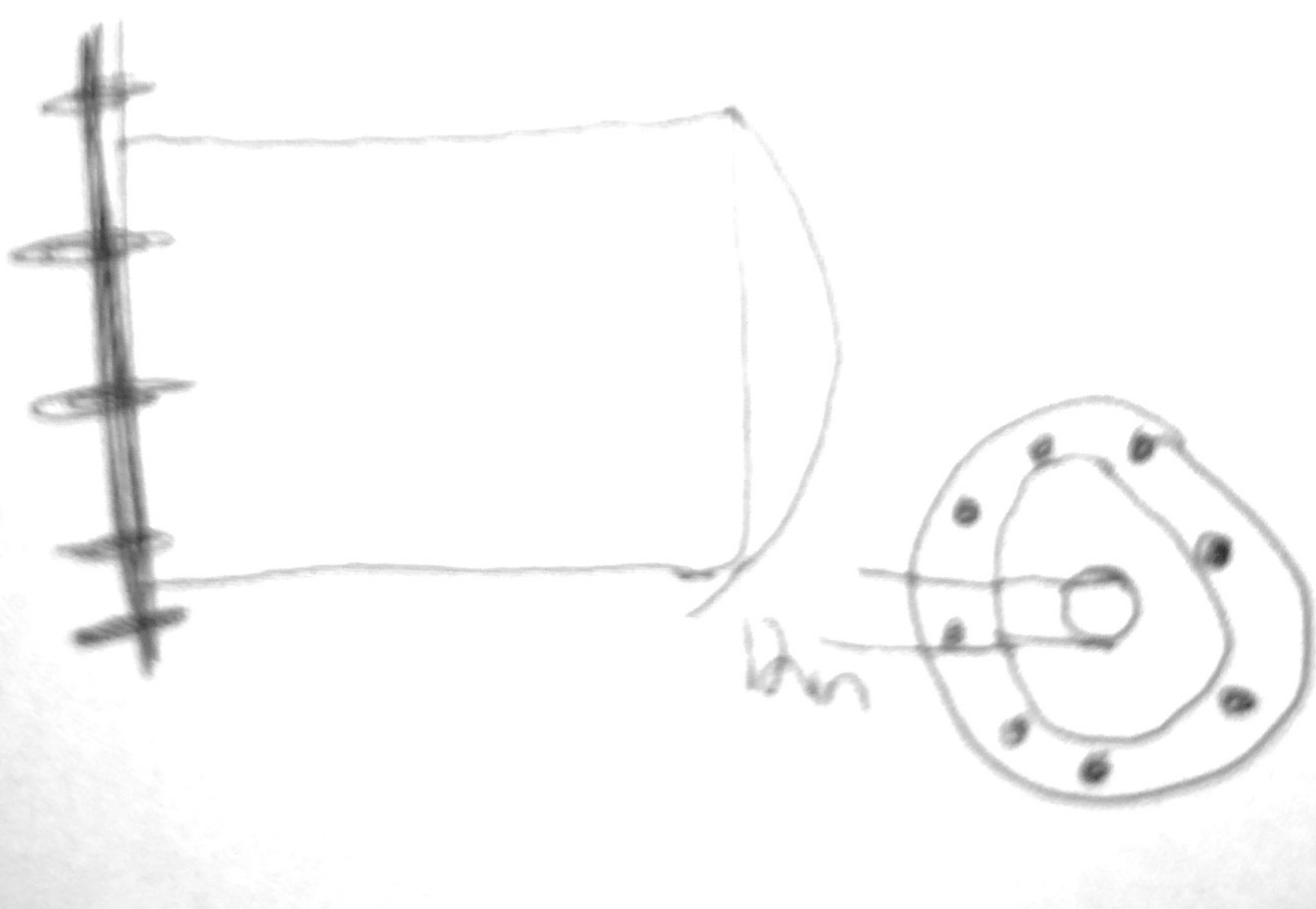
4.2) I.D. 30in

Internal pressure: 14.4psig

$14.4 \times \frac{\pi}{4} \times d^2$

$14.4 \times \frac{\pi}{4} \times 30^2$

$= 10178.76$ pounds



ch4: 2,10 ch5: 8

4.10) $D_t = 500mm$
$h = 1.8m$
$D_v = 75mm$

$F = pA$

$A = \frac{\pi}{4}(0.075)^2 = 4.417 \times 10^{-3} m^2$

$\gamma_w = 9.81 kN/m^3$

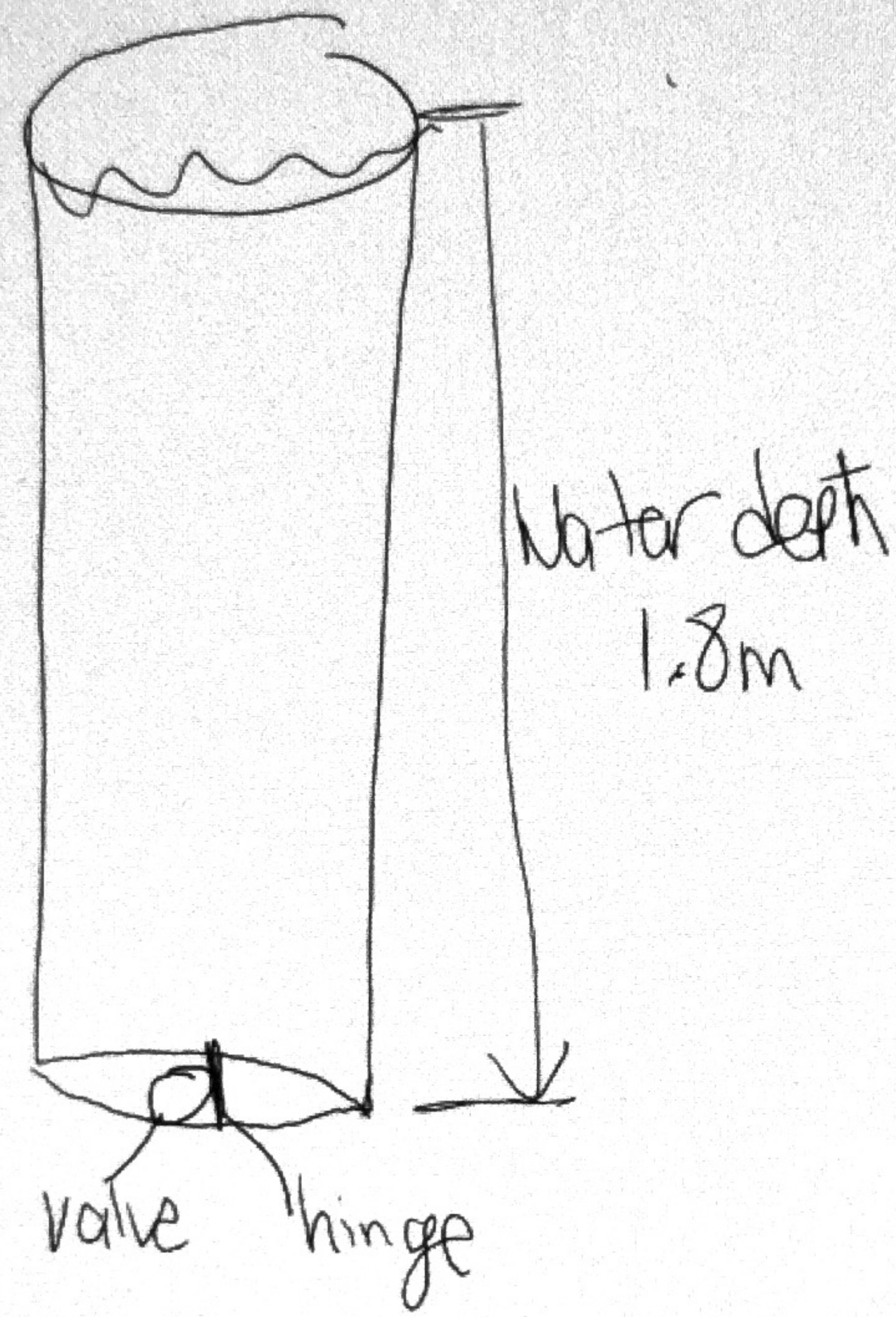
$p = (9.81)(1.8m) = 17.658 \ kN/m^2$

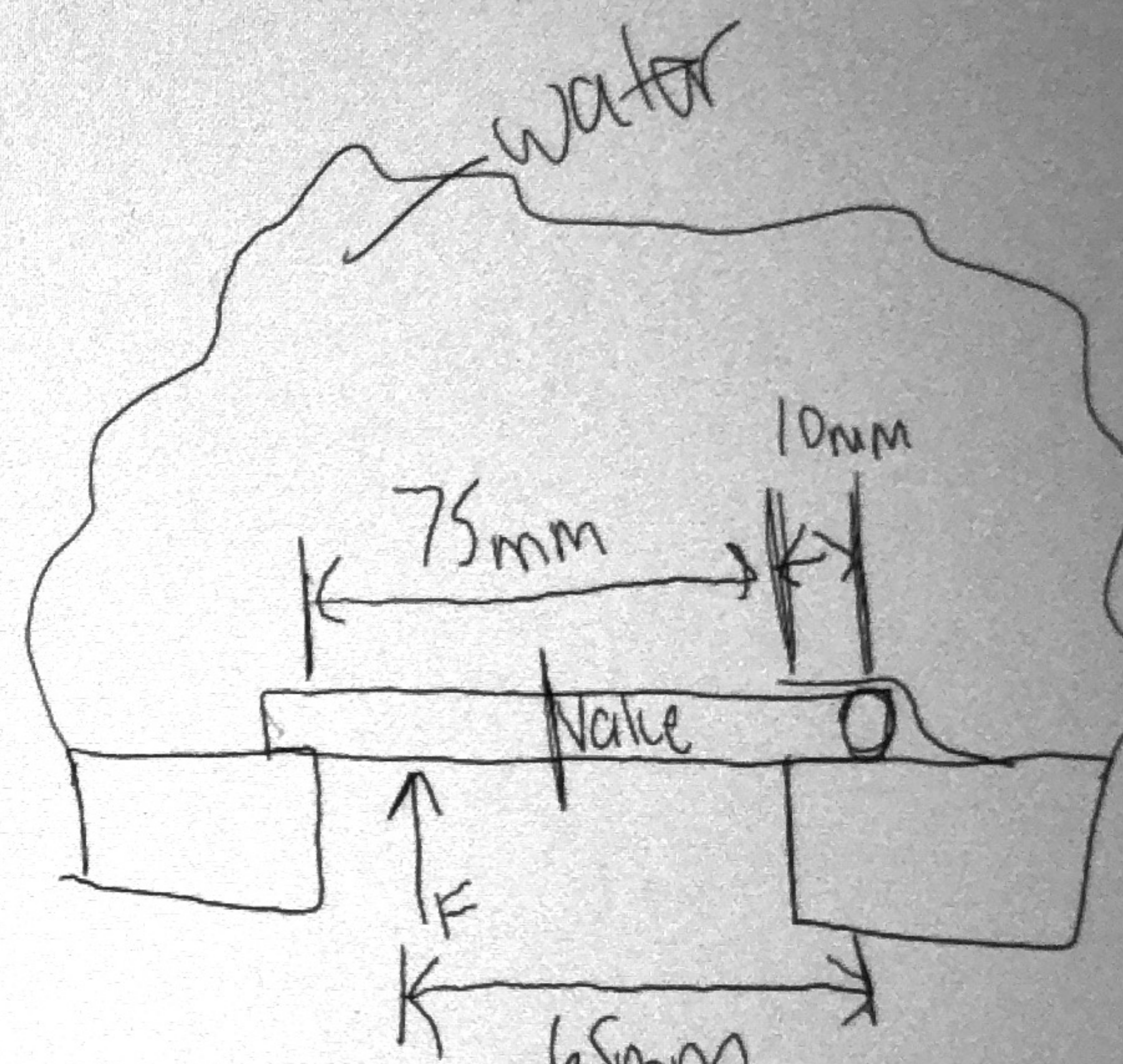
$F = (17.658)(4.417 \times 10^{-3})$
$= 0.0779 kN$
$= 77.9 N$

$x = 47.5mm = 75/2 + 10$

$F = \frac{77.9(47.5)}{65}$

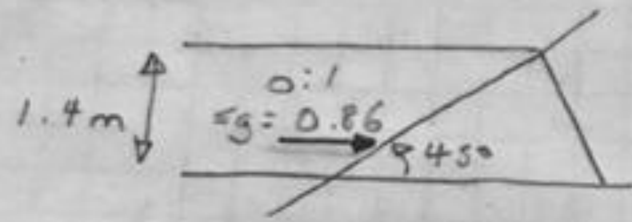
$\underline{\underline{F = 57N}}$




14.6 lb pump

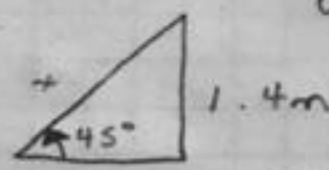
(4.17) If the wall in the figure is 4m long, calculate the total force on the wall due to the oil pressure. Also determine the location of the center of pressure and show the resultant force on the wall.




$F_R = p_{avg} \times A$

$p_{avg} = \gamma\,(l/2)$

TABLE A.1
$\gamma_{water} = 9.81\ \frac{kN}{m^3}$




SOH CAH TOA

$\gamma_{oil} = 0.86\ (9.81\ kN/m^3)$

$\gamma_{oil} = 8.437\ \frac{kN}{m^3}$

$l = 1.4m$

$p_{avg} = 8.437\ \frac{kN}{m^3}\left(\frac{1.4m}{2}\right) = 5.906\ \frac{kN}{m^2}$

$\sin(45^\circ) = \frac{1.4m}{x} \qquad x = 1.980\ m$

$F_R = 5.906\ \frac{kN}{m^2}\ (1.980\cancel{m})(4\cancel{m}) = 46.776\ kN$

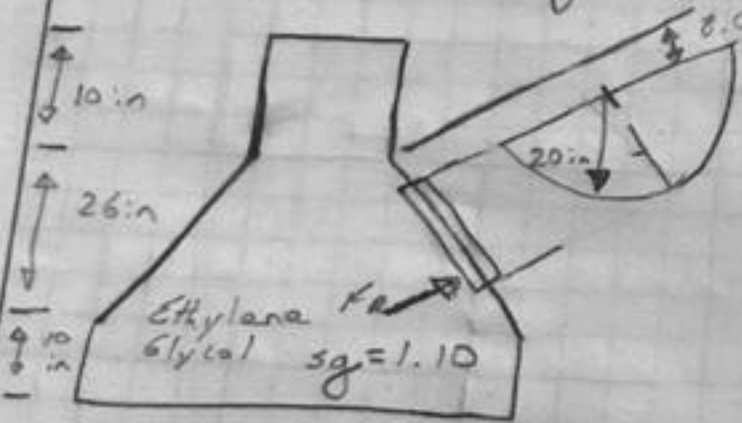
$F = \boxed{46.78\ kN}$

center of pressure = 1/3 from Bottom

$\frac{x}{3} = 1.980m/3 = 0.66\ m$

$1.980m - 0.66m = \boxed{1.32m}$

4.28 Compute the magnitude of the resultant force on the indicated area and the location of the center of pressure. Show the resultant force on the area and clearly dimension the location.




- Tank is symmetrical

$$\frac{4R}{3\pi} = \frac{4(20\,in)}{3\pi} = \text{centroid} = 8.493\,in$$

$$8.493\,in + 8\,in = 16.493\,in$$

$$\frac{10}{\cos 30°} = 11.55\,in + 16.493\,in = 28.043\,in$$

$$h_c = 28.043\,in \cos(30°) = 24.286\,in$$

$$\gamma = 1.10 \times 62.4\,\#/ft^3 = 68.64\,\#/ft^3$$

$$F = 68.64\,\#/ft\left(24.286\,in \cdot \frac{1\,ft}{12\,in}\right)\left(\frac{\pi}{2}\right)\left(20\,in \cdot \frac{1\,ft}{12\,in}\right)^2$$

$$= 605.799\,\#$$

$$= \boxed{605.80\,\#}$$

$$I_c = \left(\frac{\pi}{8} - \frac{8}{9\pi}\right)(20)^4 = 17561.1\,in^4$$

$$28.043\,in + \frac{17561.1\,in^4}{28.043\,in \times \frac{\pi}{2} \cdot (20\,in)^2}$$

$$= \boxed{29.02\,in}$$ from the surface

42. $y = \frac{D}{2}\cos\theta = \frac{10}{2}\cos 30^\circ = 4.33 \text{ in}$

$L_c = \frac{h_c}{\cos\theta} = \frac{42.33}{\cos 30^\circ} = 48.87 \text{ in}$

$h_c = 38 + y = 38 + 4.33 = 42.33 \text{ in}$

$A = \frac{\pi D^2}{4} = \frac{\pi \times 10^2}{4} = 78.54 \text{ in}^2$

$F_R = \gamma h_c A = 62.4\left(\frac{42.33}{12}\right)\left(\frac{78.54}{12^2}\right) = 120.05 \text{ lb}$

$I_c = \frac{\pi D^4}{64} = \frac{\pi \times 10^4}{64} = 490.87 \text{ in}^4$

$L_p - L_c = \frac{490.87}{(48.87 \times 78.54)} = 0.128 \text{ in}$

$\left(120.05 \times \left[\frac{10}{2} + 0.128\right]\right) - \left(F_c \times \frac{10}{2}\right) = 0$

$5F_c = 615.62$

$\boxed{F_c = 123.12 \text{ lb}}$

54. $A = \frac{\pi D^2}{8} = \frac{\pi (36)^2}{8} = 508.93 \text{ in}^2$

$V = A W = (508.93)(60) = 30535.8 \text{ in}^3$ or $17.67 \text{ ft}^3$

$\gamma = (0.79)(62.4) = 49.296 \text{ lb/ft}^3$

$W = (49.296)(17.67) = \boxed{871.06 \text{ lb}}$

$\bar{X} = 0.212 D = 0.212(36) = \boxed{7.632 \text{ in}}$

$h_c = 48 + \left(\frac{36}{2}\right) = 66 \text{ in}$

$F_H = (49.296)(3)(5)(5.5) = \boxed{4066.92 \text{ lb}}$

$h_p = 5.5 + \frac{(3)^2}{(12)(5.5)} = \boxed{5.63 \text{ ft}}$

$F_R = \sqrt{(871.06)^2 + (4066.92)^2} = \boxed{4159.156 \text{ lb}}$

$\phi = \tan^{-1}(871.06/4066.92) = \boxed{12.09^\circ}$

$F_R = 4159.156 \text{ lb}$

$F_V = 871.06 \text{ lb}$

$F_H = 4066.92 \text{ lb}$

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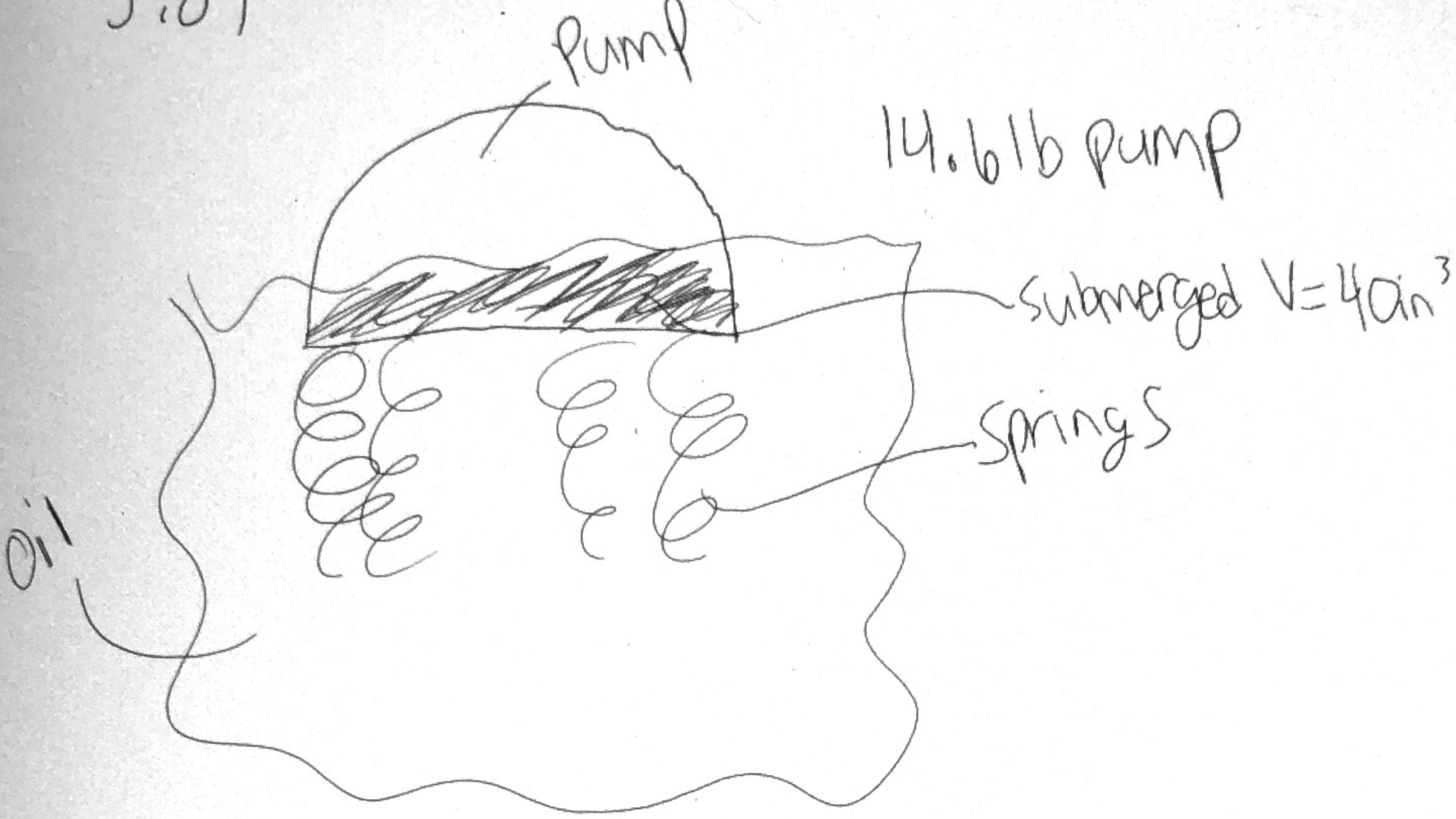
Met 330 New Section 1 +

5.8)




$g = 32.2\ ft/s^2$

$\gamma_{oil} = 0.9(62.4) = 56.16\ lb/ft^3$

$40in^3 = (40/12^3)\ ft^3$

$V_d = 40in^3 \left(\frac{0.000578 ft^3}{1 in^3}\right)$

$V_d = 0.0232\ ft^3$

$F_b = \gamma_f V_d F_b$

$= (56.16)(0.0232) F_B$

$= 1.3029 lb$

$\Sigma F = 0 \quad F_B - W + F_e = 0$

$F_e = W - F_b$

$F_e = 14.6 - 1.3029$

$F_e = 13.3\ lbs$

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(5.24) A brass weight is to be attached to the bottom of the cylinder, so that the cylinder will be completely submerged and neutrally buoyant in water at 95°C. The brass is to be a cylinder with the same diameter as the original cylinder shown. What is the required thickness of the brass?

$D = 0.45\,m \quad l = 0.75\,m \qquad V = \frac{\pi}{4}(0.45\,m)^2(0.75\,m)$

$= 0.119\,m^3$

$\frac{\pi}{4}(0.45\,m)^2(t\,m)$

$= 0.159\,t\,m^3$

$\gamma_c = 6.45\,kN/m^3$

$\gamma_w = 9.44\,kN/m^3$

$V = 0.119\,m^3 + 0.159\,t\,m^3$

$\gamma_w V = \gamma_c V_c + \gamma_b V_b$

$9.44\frac{kN}{m^3}(0.119\,m^3 + 0.159\,t\,m^3)$

$= 6.45(0.119\,m^3) + 84(0.159\,t)$

$t = \boxed{0.3\,m}$

41. $V_d = 50 \times 20 \times (X) = 1000(X)\ ft^3$

$F_b = 64 \times 1000(X) = 64000(X)\ lb$

$X = \frac{450000}{64000} = 7.03\ ft$

$Y_{cb} = \frac{X}{2} = \frac{7.03}{2} = 3.515\ ft$

$F_b = 64000(7.03) = 449920\ lb$

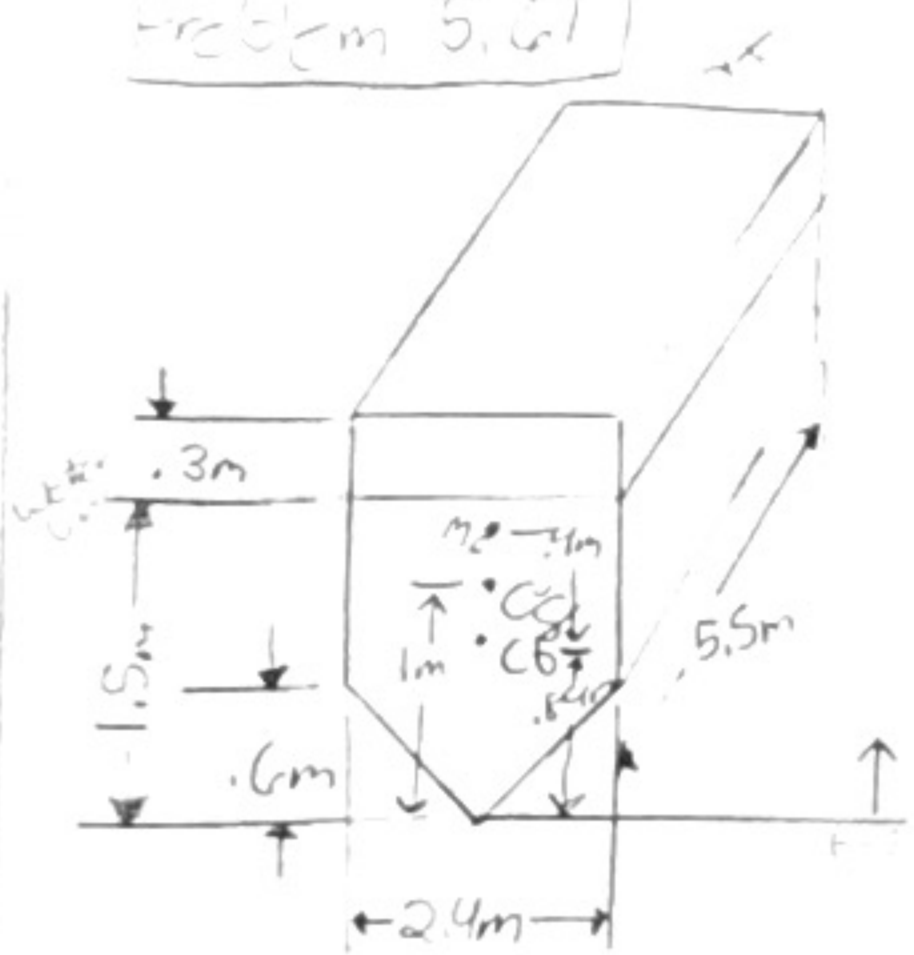
$V_d = (1000)(7.03) = 7030\ ft^3$

$I = \frac{LB^3}{12} = \frac{(50)(20)^3}{12} = 33.33 \times 10^3\ ft^4$

$MB = \frac{I}{V_d} = \frac{33.33 \times 10^3}{7030} = 4.742\ ft$

$Y_{mc} = 3.515 + 4.742\ ft = \boxed{8.257\ ft}$

Problem 5.61




$$Y_{cb} = \frac{(A_T \cdot cl_T) + (A_H \cdot cl_H)}{A_T + A_H}$$

$$Y_{cb} = \frac{(\frac{1}{2} \cdot .6m \cdot 2.4m \cdot \frac{1}{3} \cdot .6m) + (.9m \cdot 2.4m \cdot 1.05m)}{(\frac{1}{2} \cdot .6 \cdot 2.4) + (.9 \cdot 2.4)}$$

$$\boxed{Y_{cb} = .84m}$$

$$Y_{cg} = \frac{(A_T \cdot cl_T) + (A_h \cdot cl_h)}{A_T + A_h}$$

$$Y_{cg} = \frac{((\frac{1}{2} \cdot .6 \cdot 2.4) \cdot (\frac{1}{3} \cdot .6)) + ((1.2 \cdot 2.4) \cdot (1.2 \cdot \frac{1}{2} + .6))}{(\frac{1}{2} \cdot .6 \cdot 2.4) + (1.2 \cdot 2.4)} \quad \boxed{Y_{cg} = 1m}$$

$$V_d = \Sigma V_{ocm} = (.5 \cdot .6 \cdot 2.4 \cdot 5.5) + (.9 \cdot 2.4 \cdot 5.5) = \boxed{15.84m^3}$$

$$\bar{I}_x = \frac{1}{12} b h^3 = \frac{1}{12} \cdot 5.5m \cdot (2.4m)^3 = \boxed{6.34m^4}$$

$$MB = \frac{\bar{I}_x}{V_d} = \frac{6.34m^4}{15.84m^3} = \boxed{0.4m} \quad Y_{mc} = Y_{cb} + MB = 0.84m + 0.4m = \boxed{1.24m}$$

$$1.24m > 1m \therefore Y_{mc} > Y_{cg} \therefore \boxed{\text{object is stable}}$$