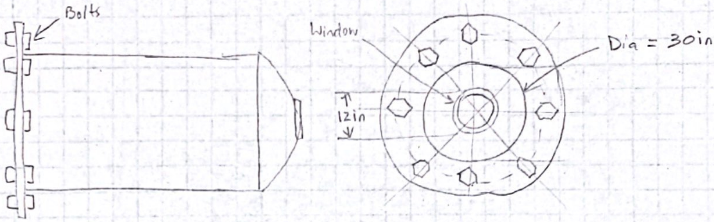
(2).



Given : Tank dia = 30 in
internal pressure = 14.4 psig or 14.4 lb/in^2

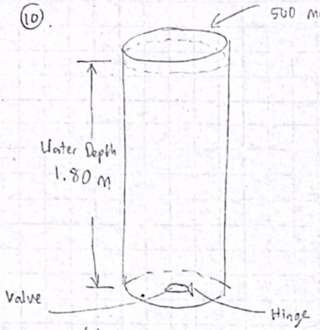
Calculate total force

We know $p = \frac{F}{A} \Rightarrow F = pA$

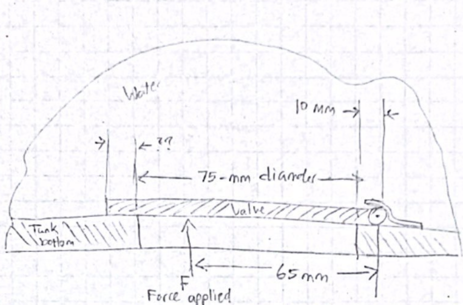
$A = \frac{\pi D^2}{4} = \frac{\pi (30)^2}{4} = 706.86\ in^2$

$F = pA = 14.4\ lb/\cancel{in^2} \times 706.86\ \cancel{in^2} = \boxed{10178.76\ lb}$

(10).



(a) General view of shower tank and Valve



(b). Detail of Valve

Find Force, $F = pA$

Need Area of Valve assuming its the same on both side. $A = \frac{\pi D^2}{4}$ $D = 75 + 10 + 10 = 95$ mm

$A = \frac{\pi (95 mm)^2}{4} = 7088.22\ mm^2$

Find pressure, $p = \gamma_w h$

$\gamma_w = 9.81\ kN/m^3$ $p = (9.81\ kN/m^3)(1.80\ m) = 17.66\ kN/m^2$

$F = pA$
$= (17.66\ kN/\cancel{m^2})(7088.22\ \cancel{mm^2})\left(\frac{1\ \cancel{m}}{1000\ mm}\right)\left(\frac{1\ \cancel{m}}{1000\ mm}\right) = 0.125\ kN\left(\frac{1000 N}{1 kN}\right) = 125\ N$

Moment at hinge

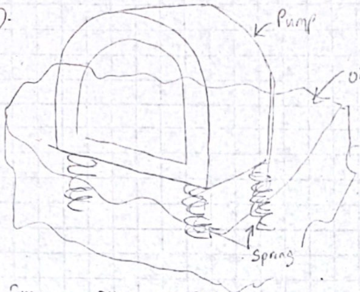
$\overset{\circlearrowleft +}{\sum M_h} = 0$

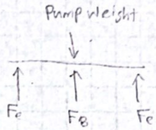
$125(95/2) - F_{open\ valve}(65) = 0$

$\frac{125(95/2)}{65} = \frac{F_{open}(\cancel{65})}{\cancel{65}}$

$F_{open\ valve} = \boxed{91.35\ N}$

(8).





Given:- Oil $sg = 0.90$
Pump weight = 14.6 lb
Volume = 40 in³

Calculate the force exerted by springs.

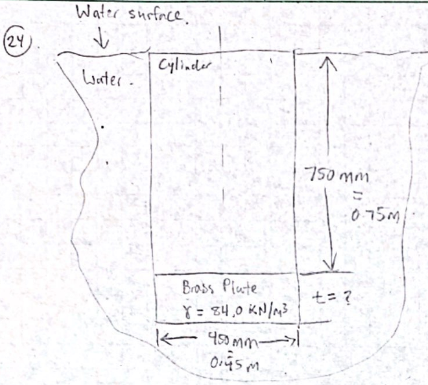
Buoyant Force $= F_B = \gamma_f V_d$

$$\gamma_f = \gamma_{oil} = sg_{oil} \times \gamma_H$$
$$= 0.90 \times 62.4 \ lb/ft^3$$
$$\gamma_f = 56.16 \ lb/ft^3$$

$$F_B = \gamma_f V_d = (56.16 \ lb/\cancel{ft^3})(40 \ \cancel{in^3})\left(\frac{1 \ \cancel{ft^3}}{1728 \ \cancel{in^3}}\right) = 1.3 \ lb$$

$$\Sigma F = 0$$
$$F_B - W + F_e = 0$$
$$F_e = W - F_B = 14.6 \ lb - 1.3 \ lb = \boxed{13.3 \ lb}$$

(24)



Given: Water temp = $T = 95°C$

$\gamma_{f @ 95°C} = 9.44\ kN/m^3$

$\gamma_{c @ 95°C} = 6.45\ kN/m^3$

Buoyant Force $= F_B = \gamma_f V_d$, Weight $= W = \gamma_c V$, Volume: $V = \frac{\pi}{4} D^2 h$

Volume of cylinder

$V = \frac{\pi}{4} D^2 h$

$= \frac{\pi}{4} (0.45m)^2 (0.75m) = 0.119\ m^3$

Volume of Brass Plate

$V = \frac{\pi}{4} D^2 h$

$= \frac{\pi}{4} (0.45\ m)^2 (t\ m) = 0.159t\ m^3$

add the two volume $V_t = V_c + V_B$

$V_t = 0.119 m^3 + 0.159 t\ m^3 =$

$\Sigma F_v = 0$

$F_b - W_c - W_b = 0$

$F_b = W_c + W_b$

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

$(9.44\ kN/\cancel{m^3})(0.119\cancel{m^3} + 0.159t\cancel{m^3}) = (6.45\ kN/\cancel{m^3} \times 0.119\cancel{m^3}) + (84\ kN/\cancel{m^3} \times 0.159t\cancel{m^3})$

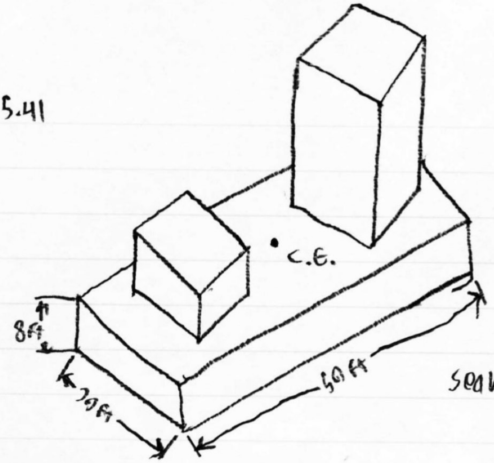
$1.123\ kN + 1.501t = 0.768\ kN + 13.356t$
$-1.123\ kN \qquad -1.123\ kN$

$1.501t = -0.355 + 13.356t$
$-13.356t \qquad -13.356t$

$\frac{-11.655t}{-11.655} = \frac{-0.355}{-11.655}$

$t = 0.030\ m$ or $\boxed{30\ mm}$

5.41



Total weight = 450000 LB
will the platform be stable in seawater?

seawater $\gamma = 64\ lb/ft^3$

$$V_D = \frac{450000\ LB}{64\ LB/ft^3} = 7031.25\ ft^3$$

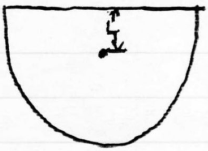
$$I = \frac{BH^3}{12} = \frac{50\ ft \cdot (20ft)^3}{12} = 33333\ ft^4$$

$$M_B = \frac{I}{V_D} = \frac{33333\ ft^4}{7031\ ft^3} = 4.74\ ft$$

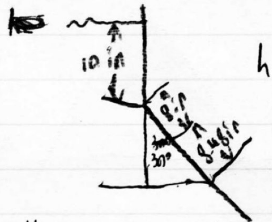
$$Y_{CB} = \cancel{20ft \cdot 50ft}\ \frac{7031.25\ ft^3}{(50ft)(20ft)} = 7.031\ ft$$

$Y_{MC} = 8ft \quad Y_{CB} + M_B = 11.771\ ft$

$Y_{MC} < Y_{CB} + M_B$, so the Platform will NOT Be stable



$L = .424\,R = .424 \cdot 20\text{ in} = 8.48\text{ in}$

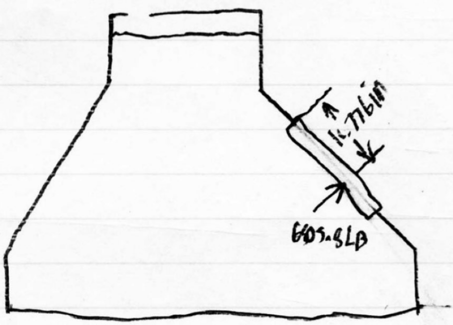


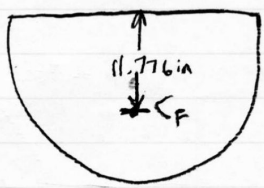
$h_c = 10\text{in} + (8\text{in} + 8.48\text{in}) \cdot \cos(30°)$
$= 10\text{in} + 14.27\text{in}$
$= 24.27\text{in}$

$F_R = \gamma h_c A = 1.1 \cdot .0361\ \text{lb/in}^3 \cdot 24.27\text{in} \cdot 628.3\text{in}^2 = \boxed{605.8\text{lb}}$

$I_c = (6.86\times10^{-3})D^4 = (6.86\times10^{-3})(40\text{in})^4 = 17562\ \text{in}^4$

$$L_p = L_c + \frac{I_c}{L_c A} = 8.48\text{in} + \frac{17562\text{in}^4}{8.48\text{in}\cdot 628.3\text{in}^2} = 8.48\text{in} + 3.296\text{in} = 11.776\text{in}$$



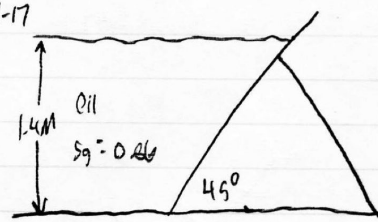


HW 2.1

Nicolas Isidro
2/24/22

4-17, 28 5-41

4-17



L = 4m

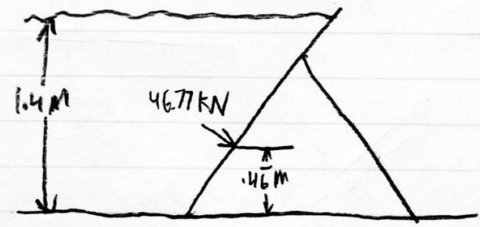
Find the total force on the wall and the location of the center of pressure and resultant force on the wall.

$F_R = p_{avg} \cdot A \quad A = 4m \cdot 1.4m \cdot \frac{1}{\cos(45)} = 7.920\ m^2$

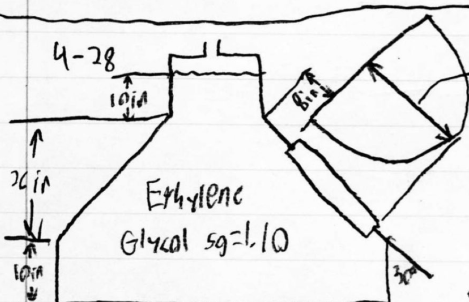
$p_{avg} = \gamma \cdot \frac{h}{2} = .86 \cdot 9.81\ kN/m^3 \cdot \frac{1.4m}{2} = 5.9056\ kN/m^2$

$F_R = 7.920\ m^2 \cdot 5.9056\ kN/m^2 = \boxed{46.77\ kN}$

Center of pressure $= \frac{h}{3} = 1.4m/3 = \boxed{.46\ m}$



4-28



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

$A = \frac{1}{2}\pi r^2 = \frac{1}{2}\pi \cdot (20in)^2 = 628.3\ in^2$

Distance to centroid of a semicircle = .424R (Appendix L)

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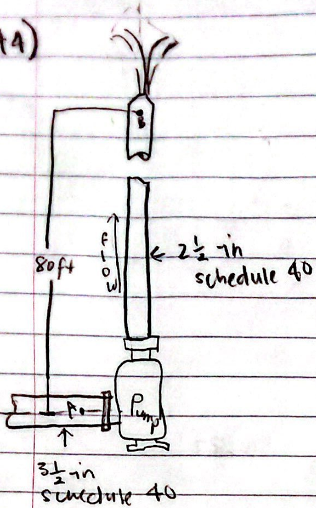
8.44)



$$V_A = \frac{Q}{A} \rightarrow \frac{0.5}{\frac{\pi}{4}\left(\frac{3.5}{12}\right)^2} = 7.28 \text{ ft/s}$$

$$V_B = \frac{0.5}{\frac{\pi}{4}\left(\frac{2.5}{12}\right)^2} = 15.03 \text{ ft/s}$$

$$\gamma_f = sg \times \gamma_w \rightarrow 1.026 \times 1.94 = 1.99 \text{ lb/ft}^3$$

$$N_R = \frac{V_B D_A \gamma_f}{\mu} \rightarrow \frac{15.03 \times \frac{2.5}{12} \times 1.99}{4 \times 10^{-5}} = 1.54 \times 10^5$$

$$\frac{D_B}{\varepsilon} \rightarrow \frac{\left(\frac{2.5}{12}\right)}{1.5 \times 10^{-4}} = 1372$$

$$f = \frac{0.25}{\left[\log\left(\frac{1}{3.7\left(\frac{D}{\varepsilon}\right)} + \frac{5.47}{N_R^{0.9}}\right)\right]^2} = 0.02$$

$$h_L = \frac{f L v_B^2}{2gD} \rightarrow \frac{0.02 \times 80 \times 15.03^2}{2 \times 32.2 \times \frac{2.5}{12}} = 27.27 \text{ ft}$$

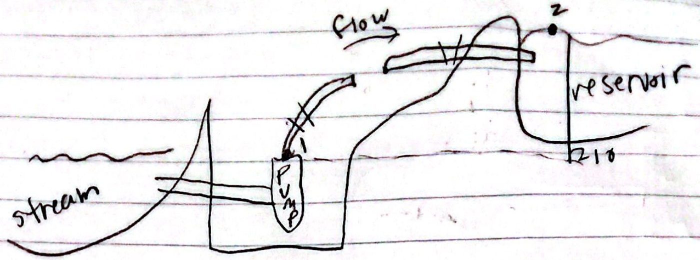
$$sg_f = 1.026 \times 62.4 = 64.02$$

$$\cancel{z_1}^{0} + h_A + \frac{P_1}{\gamma} + \frac{V_1^2}{2g} = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + h_L$$

$$\rightarrow \frac{-35}{64.02} + \frac{7.28^2}{2 \times 32.2} + h_A = \frac{25}{64.02} + \frac{15.03^2}{2 \times 32.2} + 80 + 27.27 = 174.5$$

$$P = \frac{h_A \times sg_f \times Q}{550} \rightarrow \frac{174.5 \times 64.02 \times 0.5}{500} = 10.15 \text{ hp}$$

8.46)



$$\frac{P_1}{\gamma}+z_1+\frac{V_1^2}{2g}+h_A=\frac{P_2}{\gamma}+z_2+\frac{V_2^2}{2g}+h_L$$

$$V=\frac{A}{\frac{\pi}{4}\times\left(\frac{8}{12}\right)^2}=11.46$$

$$N_R=\frac{VD}{\nu_w}\rightarrow\frac{11.46\times\frac{8}{12}}{1.21\times10^{-5}}=631404.95$$

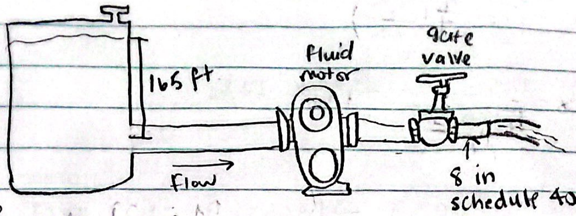
$$\frac{\varepsilon}{d}\rightarrow\frac{1.5\times10^{-4}}{\frac{8}{12}}=2.25\times10^{-4}$$

$$h_L\rightarrow0.0153\times\frac{2500}{\left(\frac{8}{12}\right)}\times\frac{11.46^2}{2\times32.2}=117$$

$$P_1=\gamma(z_2-z_1)+h_L\rightarrow62.4\times\left((210-0)+117\right)\times\frac{1}{144}=141.7\text{ psig}$$

HW # 1.4

7.30)



$$\cancel{h_A}^{0} + \frac{P_1}{\gamma} + \frac{\cancel{V_1^2}^{0}}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} - h_R + h_L + z_2$$

$$z_1 + h_R - h_L = z_2 + \frac{V_2^2}{2g} \qquad h_R = \frac{37 \times 550}{62.4 \times 2.228} = 146.37$$

$$h_L = (z_1 - z_2) - \frac{V_2^2}{2g} - h_R \qquad V = \frac{Q}{A} \rightarrow \frac{2.228}{\frac{\pi}{4}\left(\frac{8}{12}\right)^2} = 638 \text{ ft/s}$$

$$\rightarrow (165 - 0) - \frac{638^2}{2 \times 32.2} - 146.37$$

$$= 17.93 \text{ ft}$$

$h_1 =$

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