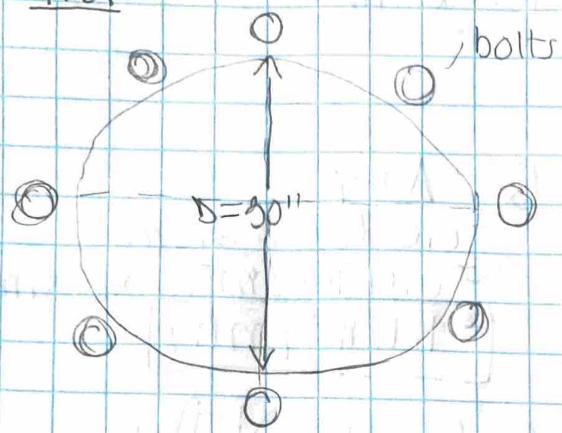
Amber Samm
MET330
Homework #2

Chapter 4:

4.2

+23.6psig



$A = \frac{\pi (D)^2}{4} = \frac{\pi (30)^2}{4} = 706.85 in^2$

$F = pA = \left(\frac{23.6 lbs}{in^2}\right) \cdot 706.85 in^2$

$= \boxed{16682 lb}$

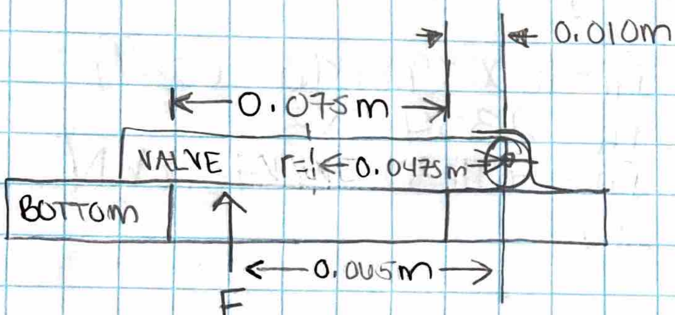
4.10

$h_{water} = 1.8m$ $d_{tank} = 0.5m$ $d_{valve} = 0.075m$

$\rho_{water} = 1000 kg/m^3$ hinge → F dist = 0.065m

$g = 9.81 m/s^2$

hinge → valve edge 0.010m

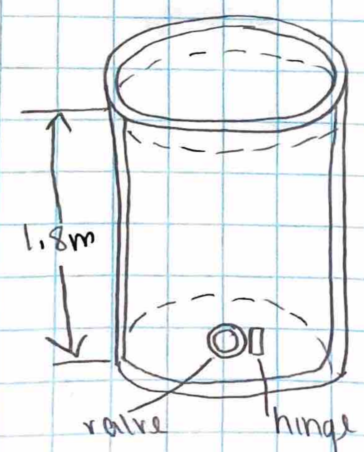


$A = \frac{\pi}{4} d^2 = \frac{\pi (0.075)^2}{4} = 0.00442 m^2$

$P = \rho \cdot g \cdot h$

$= \frac{1000 kg}{m^3} \cdot \frac{9.81 m}{s^2} \cdot 1.80 m$

$= 17,658 Pa$



$F = pA = 17658 (0.00442 m^2) = 78.01 N$

$r_c = 0.010m + \left(\frac{0.075m}{2}\right) = 0.0475m$

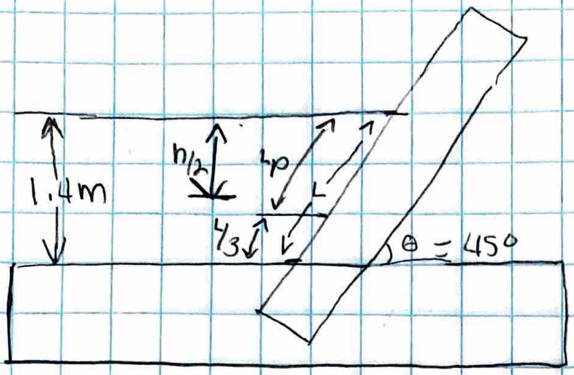
$\Sigma M_{hinge} = 0$

$F(0.065m) = (78.01N)(0.0475m)$

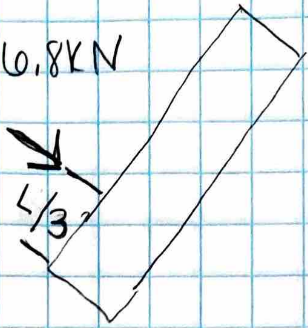
$(0.065m) F = 3.7055 N \cdot m$

$\boxed{F = 57.01 N}$

4.17



F = 46.8KN



$h = 1.4m$
$h/2 = 0.7m$
$\theta = 45°$
$h/3 = 1.4/3 = 0.467m$
$sg = 0.86$

$L = h / \sin\theta = 1.4 / (\sin(45)) = 1.98m$

$A = (1.98m)(4m) = 7.92m^2$

$\rho_{oil} = 0.86 \times 1000 = 860 kg/m^3$

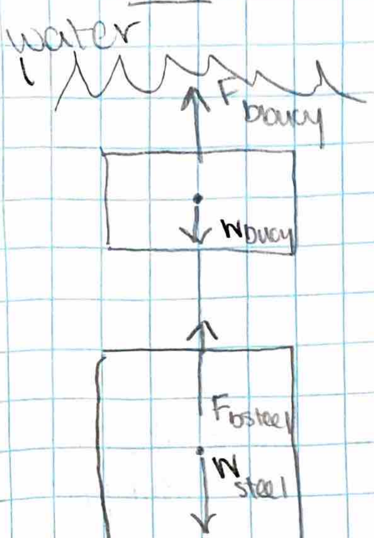
$F_R = \gamma\left(\frac{h}{2}\right)A$
$= (860 \cdot 9.81)(0.7)(7.92)$
$= 46772.5N / 1000 = \boxed{46.8KN}$

$L_p = 1.98 - 0.66 = \boxed{1.32m}$

$Y_c = \frac{h_c}{\sin(45)} = \frac{0.7}{0.7071} = \boxed{0.991m}$

Chapter 5

5.8



$s = 100mm = 0 \quad m$ $\qquad W_{cube} = 80N$

$V_{cube} = s^3 = (0.1\,m)^3 = 0.001m^3$

$sw_{buoy} = 470N/m^3 \qquad sw_{water} = 9810N/m^3$

$\Sigma F_y = 0 \quad (F_b total = W_{total})$

$V_f(\gamma_w - \gamma_p) = W_c - (V_c - \gamma_w)$

$$V_p = \frac{W_c - (V_c \cdot \gamma_w)}{\gamma_w - \gamma_p} = \frac{80N - (0.001m^3 \cdot 9810N/m^3)}{9810N/m^3 - 470N/m^3}$$

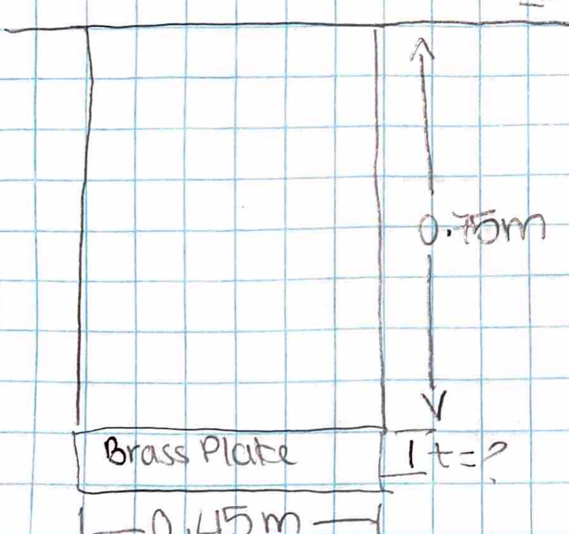
$$= \frac{80N - 9.81N}{9340N/m^3} = \frac{70.19N}{9340N/m^3} = 0.00751m^3$$

$V_f = \boxed{7.51 \times 10^{-3} m^3}$

5.24

$D = 450mm = 0.45m \qquad sw_{water}@95° = 9.44kN/m^3$

$H = 750mm = 0.75m \qquad sw_{brass} = 84.0kN/m^3$



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

$t(\gamma_{brass} - \gamma_w) = H(\gamma_{water} - \gamma_{cyl})$

$$t = H \times \left(\frac{\gamma_w - \gamma_c}{\gamma_b - \gamma_w}\right)$$

$$t = 0.75m \times \left(\frac{9.44kN/m^3 - 6.46kN/m^3}{84.0kN/m^3 - 9.44kN/m^3}\right)$$

$$t = 0.75 \times \left(\frac{2.98}{71.56}\right) = \boxed{0.03m \text{ or } 30mm}$$

Last problem:

$\gamma_{kerosene} = 8.07kN/m^3 \quad d_{submerged} = 600mm = 0.60m$

$\gamma_c \cdot V_c = \gamma_k \cdot V_{sub}$

$$\gamma_{cylinder} = 8.07kN/m^3 \cdot \left(\frac{0.60m}{0.75m}\right) = 6.46kN/m^3$$