HOMEWORK MODULE 1

HW 1.1 THROUGH 1.4

ROY SHEPARD

$\boxed{1.48}$ Ron SHEPARD HW#1

F = 18,000 lb D = 2.5 in

$P = \frac{F}{A}$

$A = \frac{\pi}{4}(D)^2 = \frac{\pi}{4}(2.5)^2 = 4.90\ in^2$

$P = \frac{18000}{4.90} = 3666.7\ lb/in^2 = \boxed{3666.7\ psi}$

$\boxed{1.58}$

Bulk modulus @ Atm pressure and 68°F

3590,000 psi / 24,750 MPa

$(\Delta V)/V = \frac{1.00}{100} = -0.01$

$E = -\frac{\Delta p}{(\Delta V/V)} = \Delta p = -E[(\Delta V/V)]$

$= -(3,590,000)(-0.01) = \boxed{35,900\ psi}$

$\Delta p = -E[(\Delta V)/V] = -(24,750)(-0.01) = \boxed{247.5\ MPa}$

$\boxed{1.63}$ $D = .5$ $L = 42.0$

$E = \frac{-P}{(\Delta V)/V} = \frac{-P}{\Delta V}$ $P = \frac{F}{A}$ $V = A \times L$

$\Delta V = -A(\Delta L)$

$$E = \frac{-\left(\frac{F}{A}\right)}{\frac{-A(\Delta L)}{AL}} = \frac{F}{A} \times \frac{AL}{-A(\Delta L)} = \frac{FL}{A(\Delta L)} = \frac{F}{\Delta L} = \frac{EA}{L}$$

$$A = \frac{\pi d^2}{4} = \frac{\pi (0.5)^2}{4} = 0.196\,in^2$$

$$\frac{F}{\Delta L} = \frac{EA}{L} = \frac{189000 \times 0.196}{42} = \boxed{883\,lb/in}$$

$\boxed{1.76}$ $1\,lbf$ $g = 32.2\,ft/s^2$

$$m = \frac{W}{g} = \frac{1}{32.2} = 0.031\,lbf \cdot s^2/ft$$

$$\boxed{= 0.031\ slugs}$$

$1lbf = 4.48N$

$$W = 1lbf = \frac{4.448\,N}{1\,lbf} = \boxed{4.48N} \quad m = \frac{4.48}{9.81} = 0.453\,N \cdot s^2/m$$

$$\boxed{m = 0.453\,kg}$$

1.52 D = 150 mm 2.25 N empty
Filled 200 mm = 35.4 N need Sg

$r = \frac{150}{2} \times \frac{1\,m}{1000\,mm} = 0.075\,m$

$200 \times \frac{1\,m}{1000\,mm} = 0.2\,m$

$35.4 - 2.25 = 33.15\,N$ weight of oil

$33.15\,N \times \frac{1\,kN}{1000\,N} = 0.03315\,kN$

Volume
$V = \pi r^2 h = \pi \times 0.075^2 \times 0.2 = 3.534 \times 10^{-3}$

$\gamma_{oil} = \frac{wt}{V} = \frac{33.15}{3.534 \times 10^{-3}} = 9380.31\,N/m^3 \cdot \frac{1}{1000}$
$9.38\,kN/m^3$

$\gamma_{water} @ 4°C = 9.81\,kN/m^3$

$S_g = \frac{\gamma_{oil}}{9.81\,kN/m^3}$

$= \frac{9.38}{9.81} = \boxed{0.956}$

1.107 $Sg = 0.79$

$\rho = Sg \times \rho_{water} @ 4°C$

$= .79 \times 1.94 = \boxed{1.53 \text{ slugs/ft}^3}$

$1.53 \times \frac{0.515}{1} = \boxed{0.79 \text{ g/cm}^3}$

$\boxed{2.17}$

Dilatant Fluids
Bingham Fluids
Electrorheological Fluids
Thixotropic Fluids

$\boxed{2.18}$ Viscosity of water @ 40°C

$\mu = 6.5 \times 10^{-4}\ Pa \cdot s$

$\boxed{2.27}$ Viscosity of Hydrogen @ 40°C

$\mu = 1.8 \times 10^{-7}\ lb \cdot s/ft^2$

$\boxed{2.35}$ Viscosity of SAE 30 oil @ 210°F

$\mu = 2.2 \times 10^{-4}\ lb \cdot s/ft^2$

$\boxed{2.61}$ Steel ball 1.6mm

$SG = 0.94$ Steel weighs $77\ kN/m^3$

Fall 250 mm

Time 10.4 s

$D = 1.6\ mm = 1.6 \times 10^{-3}\ m$

$$S_g = \frac{SW\ of\ oil}{SW\ of\ water}$$

$$\gamma_f = (0.94)(9.81)\ kN/m^3 = 9.22\ kN/m^3$$

$$F_b = \gamma_f V = 9.22\left(\frac{\pi (1.6 \times 10^{-3})^3}{6}\right)$$

$$F_b = 9.22(2.14 \times 10^{-9}) = 1.97 \times 10^{-8}\ kN$$

$$V = \frac{D}{t} = \frac{0.25\ m}{10.4\ s} = 0.024\ m/s$$

$$W = \gamma V = (77)(2.14 \times 10^{-9})$$
$$= 1.647 \times 10^{-7}\ kN$$

$$W - F_b - F_d = 0$$
$$= (1.647 \times 10^{-7}) - (1.97 \times 10^{-8}) - F_d = 0$$

$$F_d = 1.453 \times 10^{-7}\ kN$$

$$\mu = \frac{Fd}{3\pi u D}$$

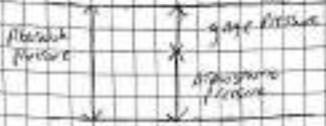
$$\frac{1.457 \times 10^{-7}}{3\pi(0.024)(1.6\times10^{-3})} = 4.014 \times 10^{-4}\ kN\cdot s/m^2$$

$$= .4014\ N\cdot s/m^2$$

$$\boxed{= .4014\ Pa\cdot s}$$

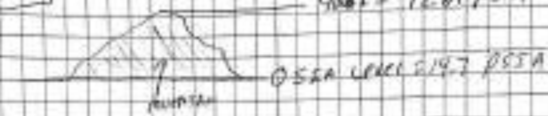
MET 330 Homework 2 6, 10, 11, 13

3.6 $P_{ABS} = P_{gage} + P_{atm}$



$\boxed{\text{TRUE}}$

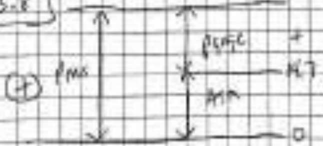
3.7



Atmospheric pressure changes as the density, specific weight and temperature changes

$\boxed{\text{FALSE}}$ 14.7 is only true @ sea level.

3.8



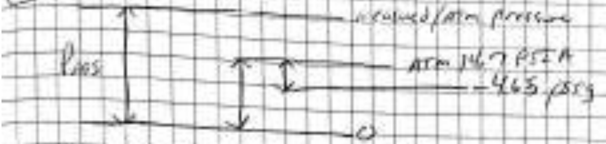
$\boxed{\text{FALSE}}$

(+)

(−) not negative not possible for ABS

− ~~5~~ Pa (abs)

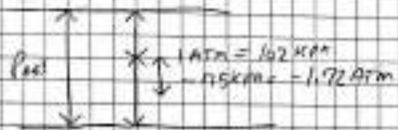
3.9 — 4.65 psig in TANK



This is True This mean the TANK is in a Vacuum or there is variation in ATM pressure.

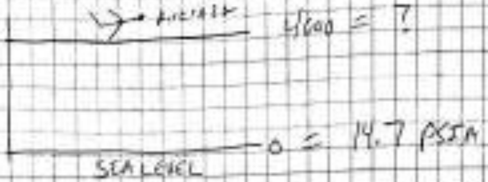
True

3.10 — 175 kPa (gage) in TANK



True Theoretically this can happen, physically I don't think so I think the TANK would collapse if this happened in a real world application

$\boxed{3.11}$



$h = 4000\ ft$ $\qquad \gamma = 0.0764\ lb/ft^3$

$P_{ATM} = 14.7\ PSIA$

$\Delta P = \gamma h$

$\Delta P = (0.0764)(4000)$

$\Delta P = 305.6\left(\frac{1\,ft}{12\,in}\right)$

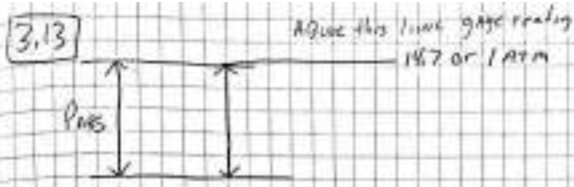
$\Delta P = 2.12\ PSIA$

$P = P_{ATM} - \Delta P$

$= 14.7 - 2.12$

$= \boxed{12.58\ PSIA}$

$\boxed{3.13}$



Milk Diagram

$$P_{Atm} + P_{gage} = P_{abs}$$

$$P_{abs} - P_{Atm} = P_{gage}$$

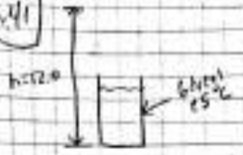
we know $P_{abs} = P_{Atm}$

$$\boxed{P_{gage} = 0}$$

ROY SHEPARD MET 330 HW 3

CH3 41, 62, 83, 90, 94 CH4 2, 10, 12, 28, 42, 54

$\boxed{3.41}$



$\Delta P = \gamma h$ $\gamma = 10.79\ kN/m^3$

$\Delta P = (10.79)(12)$

$= 129.48\ kPa$

$P =$ Surface pressure $+ \Delta P$

$0 + 129.48\ kPa = \boxed{129.48\ kPa}$

$\boxed{3.62}$

$P_A + \gamma_w h_w + \gamma_{Hg} h_{Hg} = P_{atm}$

$P_A = -(\gamma_w h_w + \gamma_w\, sg_{Hg} h_{Hg})$

$P_A = -(9810 \times 0.1 + 9810 \times 13.54 \times 0.075)$

$\boxed{P_A = -10.943\ kPa}$

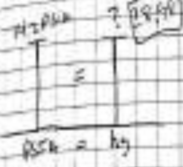
$\gamma_w = 9810\ N/m^3$

$Sg_{Hg} = 13.54\ sg_{Hg}$

$h_w = 0.1m$

$h_{Hg} = 0.075m$

3.23

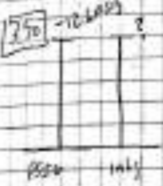


$P_{ATM} = 14.2$ PSIA $\gamma_m = 844.9$ lb/ft^3 = 0.49 lb/in^3

$P_{ATM} = \gamma_m h$

$h = \frac{P_{TM}}{\gamma_m} = \frac{14.2}{0.49} = \boxed{28.98 \text{ in}}$

3.50

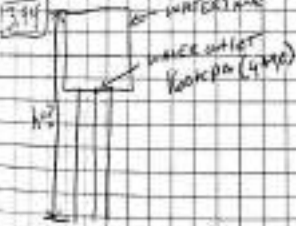


1 PSI = 2.036 inHg

$P = (-12.6)(2.036)$

$\boxed{P = -25.7 \text{ inHg}}$

3.54



$\Delta p = \gamma h$

$160 = 9.81 h$

$\boxed{h = 16.31 \text{ m}}$

$\gamma = 9.81$ kN/m^3

$\Delta P = 160$ kPa

Ch4 problems 2,10,14,24

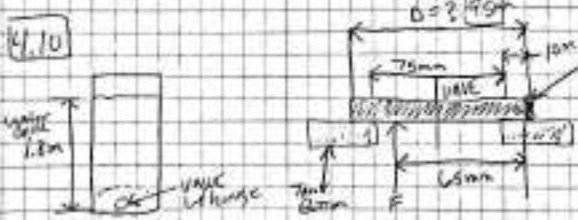
$\boxed{4.2}$

D = 30
p = 23.6 psig

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

$$F = pA = (23.6)(706.86) = \boxed{16,681.90 \text{ lb}}$$

$\boxed{4.10}$



$D = 10 + 75 + 10 = 95\text{mm}$ $\gamma_w = 9.81 \text{ kN/m}^3$

$D = 95\text{mm} = 0.095\text{m}$

$$A = \frac{\pi D^2}{4} = \frac{\pi (0.095)^2}{4} = 7.08 \times 10^{-3} \text{ m}^3$$

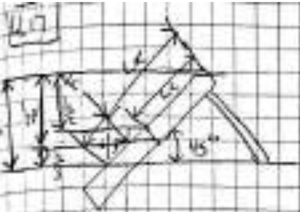
$$p = \gamma_w h = (9.81)(1.8) = 17.66 \text{ kN/m}^2$$

$$F = pA = (17.66)(7.08 \times 10^{-3}) = 0.125 \text{ kN} = 125\text{N}$$

$$\Sigma M_{hinge} = 0 \quad (125)\left(\frac{95}{2}\right) - F_0 (65) = 0$$

$$\boxed{F_0 = 91.35\text{N}}$$

$\boxed{2.7}$



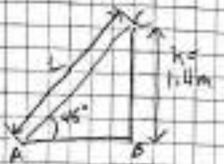
$S_G = 0.86$

$\ell = 4m$

$h = 1.4$

$\Theta\ 45°$

$\gamma_w = 9.81$



$\sin\theta = \frac{h}{L} \therefore L = \frac{h}{\sin\theta}$

$\frac{1.4}{\sin 45°} = \boxed{L = 1.98}$

$A = L \times \ell = 1.98 \times 4$

$A = 7.91\ m^2$

$\gamma_o = S_{go} \times \gamma_w$

$= 0.86 \times 9.81$

$= 8.44\ kN/m^3$

$F_R = \gamma\left(\frac{h}{2}\right)A$

$8.44\left(\frac{1.4}{2}\right) \times 7.91$

$\boxed{F_R = 46.7\ kN}$ Resultant Force

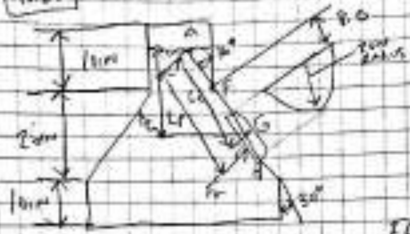
$\frac{h}{3} = \frac{1.4}{3} = 0.466\ m$

$\frac{L}{3} = \frac{1.98}{3} = 0.66\ m$

$L_P = L - \frac{L}{3} = 1.98 - 0.66 = \boxed{L_P = 1.32\ m}$ Location of pressure

$h_P = h - \frac{h}{3} = 1.4 - 0.466 = \boxed{h_P = 0.934\ m}$ Vertical Depth

$\boxed{4.28}$ $\qquad S_g = 1.10$



$\bar{Y} = \frac{4R}{3\pi}$

$\bar{Y} = \frac{4(20)}{3\pi} = 8.49$ in

$FG = 8 + \bar{Y} = 8 + 8.49 = 16.49$ in

$\cos 30° = \frac{FE}{AF} \qquad AF = \frac{FE}{\cos 30°}$

$= \frac{10}{\cos 30} \qquad AF = 11.55$

$L_c = AF + FG = 11.55 + 16.49 = 28.04$ in

$h_c = L_c \cos 30° = 28.04(\cos 30) = 24.28$ in

$\gamma = SG \times \gamma_w = 1.10 \times 62.4 = 68.64$ lb/ft^3

$F_R = PA$

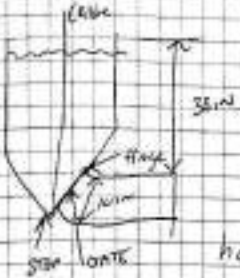
$F_R = 68.64\left(24.28 \frac{1}{12}\right)\frac{\pi}{2}\left(20 \times \frac{1}{12}\right)^2 = 605.5$ lb

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

$L_p = L_c + \frac{I_c}{L_c A} = 28.04 + \frac{17561.1}{28.04\left(\frac{\pi}{2} \times 20^2\right)} = \boxed{29.02 \text{ in}}$

$L_p - L_c = 29.02 - 28.04 = \boxed{0.98 \text{ in}}$

4.42



$V = \frac{D}{2}\cos\theta$

$V = \frac{10}{2}\cos(30) = 4.33\,in$

$L_c = \frac{h_c}{\cos\theta} \quad \frac{42.33}{\cos 30} = 48.87\,in$

$h_c = 38 + V = 38 + 4.33 = 42.33\,in$

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

$F_R = \gamma h_c A \quad \frac{62.4}{} \times \left(\frac{42.3}{12}\right)\left(\frac{78.54}{12}\right) = 120.05\,lb$

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

$L_P - L_C = \frac{I_c}{L_c A} = \frac{490.87}{(48.87 \times 78.54)} = 0.128\,in$

$\sum M_H = 0 \quad F_R \times \left[\frac{D}{2} + (L_P - L_c)\right] - \left(F_c \times \frac{D}{2}\right) = 0$

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

$5F_c = 615.62$

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

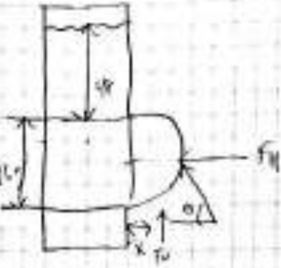
4.54

$h_1 = 48\,in$

$D = 36\,in$

$S_g = 0.79$

$w = 60$



$A = \frac{\pi D^2}{8}$

$\frac{\pi (36)^2}{8}$

$= 508.93\,in^2$

$V = Aw = (508.93)(60) = 30535.8\,in^3 = 17.67\,ft^3$

$\gamma_f = (S_g)\,62.4\,lb/ft^3$

$= 0.79(62.4) = 49.296\,lb/ft^3$

$F_V = \gamma V = (49.296)(17.67) = \boxed{871.06\,lb}$

$\bar{x} = 0.212D = 0.212(36) = \boxed{7.632\,in}$

$h_c = h_1 + \frac{S}{2} = 48 + \left(\frac{36}{2}\right) = 66\,in$

$1 = 0.083\,ft$, $36 = 3\,ft$, $60 = 5\,ft$, $66 = 5.5\,ft$

$F_H = \gamma S w h_c = (49.296)(3)(5)(5.5) = \boxed{4066.92\,lb}$

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

$F_R = \sqrt{F_V^2 + F_H^2} = \sqrt{(871.06)^2 + (4066.92)^2} = \boxed{4159.15\,lb}$

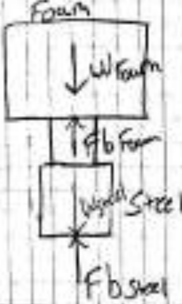
$\phi = \tan^{-1}(F_V/F_H)\quad \tan^{-1}(871.06)(4066.92)$

$\boxed{\phi = 12.09°}$

ROY STE...

8, 24, 41, 61

(8)



Given: Steel cube
size: 100mm
weight: 80 N

Foam
weight: 470 N/m³

Assume positive direction upward

Static equilibrium $F_{b\,steel} + F_{b\,foam} - W_{steel} - W_{foam} = 0$

force of steel cube

$\gamma_w = 9.81 \times N/m^3$

$F_{b\,steel} = \gamma_w \cdot V_d$

Find V_d: $V_d = l^3 = 100^3 = 10^6\ mm^3 \times \frac{1\ m^3}{10^9\ mm^3} = 0.001\ m^3$

$\rightarrow F_{b\,steel} = 9.81 \times 10^3 (0.001) = 9.81\ N$

buoyant force of foam

$F_{b\,foam} = \gamma_w \cdot V_{foam}$

weight of foam

$W_{foam} = \gamma_{foam} \cdot V_{foam}$

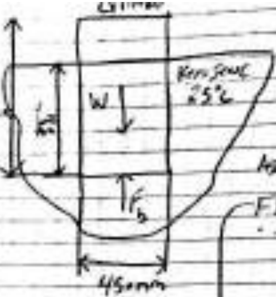
$\rightarrow F_{b\,steel} + \gamma_w \cdot V_{foam} = W_{steel} + \gamma_{foam} \cdot V_{foam}$

$$V_{foam} = \frac{W_{steel} - F_{b\,steel}}{\gamma_w - \gamma_{foam}}$$

$$\frac{80 - 9.81}{9.81 \times 10^3 - 470} = 0.007515$$

$$\boxed{= 7.515 \times 10^{-3}\ m^3}$$

$\boxed{5\text{-}22}$



$D = 450\,mm = 0.45\,m$

$L = 750\,mm = 0.75\,m$

$S = 600\,mm = 0.6\,m$

Assume positive direction is up

$F_b - W = 0$

Find buoyant force

$F_b = \gamma_f \cdot V_d$

$F_b = (8.07) \cdot (0.0954)$

$= 770\,N = 0.770\,kN$

Find weight of cylinder

$W = \gamma \cdot V = 0.1193 \cdot \gamma$

$F_b = W$

$0.770 = 0.1193 \cdot \gamma$

$$\boxed{\gamma = 6.45 \frac{kN}{m^3}}$$

Specific weight of cylinder

$\gamma_f = 8.07 \frac{kN}{m^3}$

Find V_d:

$V_d = \frac{D^2 \cdot \pi}{4} \cdot S$

$\frac{(0.45)^2 \cdot \pi}{4} (0.6)$

$= 0.0954\,m^3$

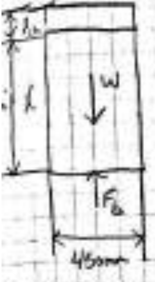
Find volume:

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

$\frac{(0.45)^2 \cdot \pi}{4} (0.75)$

$= 0.1193\,m^3$

23 USE Figure From 5-22



$D = 450\text{ mm} = 0.45\text{ m}$

$L = 750\text{ mm} = 0.75\text{ m}$

$T_w = 95°C$

Assume positive direction up

$$F_b - W = 0$$

Find buoyant force

$$F_b = \gamma_f \cdot V_d$$

$$\gamma_f = 9.44 \frac{kN}{m^3}$$

Find V_d:

$$V_d = \frac{D^2 \cdot \pi}{4} \cdot x$$

$$= \frac{0.45 \cdot \pi}{4} \cdot x$$

Weight of cylinder

$$W = \gamma \cdot V = 0.7694$$

Find Volume

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

$$\frac{(0.45)^2 \cdot \pi}{4} (0.75)$$

$$= 0.1193\text{ m}^3$$

$$F_b = W$$

$$9.44\left(\frac{(0.45)^2 \cdot \pi}{4}\right) \cdot x = 0.7694$$

$$x = 0.513\text{ m} = 513\text{ mm}$$

From 5-22

$$\gamma = 6.45 \frac{kN}{m^3}$$

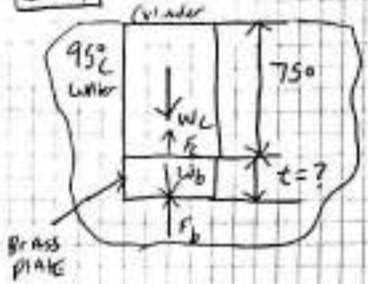
Height of cylinder above water

$$X_c = L - X$$

$$= 750 - 513$$

$$\boxed{= 237\text{ mm}}$$

$\boxed{5\text{-}24}$



$D = 450\,mm = 0.45\,m$

$L = 750\,mm = 0.75\,m$

$T_w = 95°C$

$\gamma_b = 84 \frac{kN}{m^3}$

$\gamma = 6.115 \frac{kN}{m^3}$

SEE 5-22

$\gamma_f = 9.44 \frac{kN}{m^3}$

$F_b + F_c - W_c - W_b = 0$

Weight of cylinder

$W_c = \gamma \cdot V$

$= (6.45)(0.1193)$

$= 0.77\,kN$

Find volume

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

$V = \frac{(0.45)^2 \pi}{4} (0.75)$

$= 0.1193\,m^3$

Weight of brass

$W_b = \gamma_b \cdot V_b$

$= 84 \cdot (0.159t)$

$= 13.36 \frac{kN}{m}$

Find brass volume

$V_b = \frac{D^2 \pi}{4} \cdot t$

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

$0.159t$

buoyant force cylinder

$F_c = \gamma_f \cdot V_d$

$(9.44)(0.1193) = 1.126\,kN$

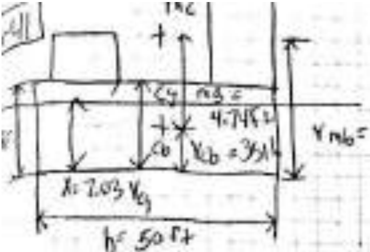
buoyant force of brass

$F_b = \gamma_f \cdot V_d = (9.44)(0.159t) = 1.5 \frac{kN}{m} t$

$1.5t + 1.126 - 0.77 - 13.36t = 0$

$t = \frac{0.356\,kN}{11.86\,\frac{kN}{m}} = 0.03\,m = \boxed{30\,mm}$

A11



$W = 450000\ lb$
$Y_{cg} = 8ft$
$a = 20ft$
$b = 50ft$
$h = 8ft$
$\gamma_f = 64 \frac{lb}{ft^3}$

Stable = $Y_{mc} > Y_{cg}$
Unstable = $Y_{mc} < Y_{cg}$

Find metacenter

$Y_{mc} = Y_{cB} + MB$

equilibrium equation $F_b = W$

$W = \gamma_f \cdot a \cdot b \cdot x$

Find center buoyance

$X = \frac{W}{\gamma_f \cdot a \cdot b} \frac{450000}{(64)(20)(50)} = 7.03ft$

$Y_{cB} = \frac{x}{2} = \frac{7.03}{2} = 3.515ft$

Find moment of interia at fluid surface

$I = \frac{b h^3}{12} = \frac{(50)(20)^3}{12} = 33333.3\ ft^4$

Find displaced fluid:

$V_d = (a)(b)(x) = (20)(50)(7.03) = 7030\ ft^3$

FIND MB

$MB = \frac{I}{V_d} = \frac{33333.33}{7030} = 4.74ft$

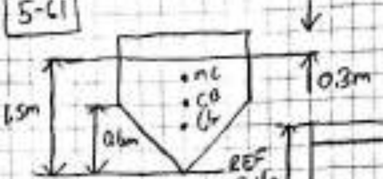
FIND METACENTER position

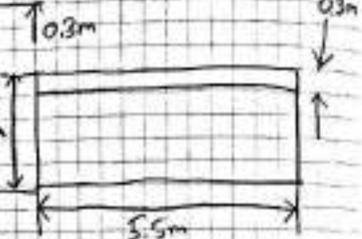
$Y_{mc} = Y_{cB} + MB$

$= 3.515 + 4.74 = \boxed{8.255ft}$

$Y_{mc} > Y_{cg}$ $\boxed{\text{STABLE}}$

5-61





GIVEN:

$H = 0.6m$
$h = 1.8m$
$L = 5.5m$
$B = 2.4m$
$X = 1.5m$

Find metacenter

$y_{mc} = y_{cb} + MB$

$y_{mc} > y_{cg}$ = stable
$y_{mc} < y_{cg}$ = unstable

Find centroid of triangle

$$y_{triangle} = H - \frac{H}{3} = 0.6 - \frac{0.6}{3} = 0.4m$$

$$y_{rectangle} = H + \frac{X-H}{2} = 0.6 + \frac{1.5-0.6}{2} = 1.05m$$

$$A_{triangle} = \frac{H \cdot B}{2} = \frac{0.6 \cdot 2.4}{2} = 0.72m^2$$

$$A_{rectangle} = (X-H) \cdot B = (1.5-0.6) \cdot 2.4 = 2.16m^2$$

Find CB:

$$y_{cb} = \frac{A_{rectangle} \cdot y_{rectangle} + A_{triangle} \cdot y_{triangle}}{A_{rectangle} + A_{triangle}}$$

$$= \frac{2.16 \cdot 1.05 + 0.72 \cdot 0.4}{2.16 + 0.72} = 0.888m$$

Find CG : CG = CB

Find Area

$$A_{triangle} = \frac{H \cdot B}{2} = \frac{0.6 \cdot 2.4}{2} = 0.72\ m^2$$

$$A_{rectangle} = h \cdot B = 1.2 \cdot 2.4 = 2.88\ m^2$$

$$Y_{cg} = \frac{A_{rectangle} \cdot y_{rectangle} + A_{triangle} \cdot y_{triangle}}{A_{rectangle} + A_{triangle}}$$

$$= \frac{2.88 \cdot 1.2 + 0.72 \cdot 0.4}{2.88 + 0.72} = 1.04\ m$$

Moment of I rectangular form

$$I = \frac{L \cdot B^3}{12} = \frac{5.5 \cdot 2.4}{12} = 6.33\ m^4$$

Total displaced volume

$$V_d = \frac{B \cdot H}{2} \cdot L + (x - H) \cdot B \cdot L$$

$$= \frac{2.4 \cdot 0.6}{2} \cdot 5.5 + (1.5 - 0.6) \cdot 2.4 \cdot 5.5$$

$$= 15.84\ m^3$$

$$MB = \frac{I}{V_d} = \frac{6.33}{15.84} = 0.4\ m$$

Find y_{mc}

$$y_{mc} = y_{CB} + MB = 0.888 + 0.4 = \boxed{1.288\ m}$$

$\boxed{\text{S.ABK}}$