HW 2.1 Ch #5

8. $Sg = 0.90$ $W = 14.6\ lb$ $V_d = 40\ in^3$

$F_b = \gamma_f V_d$ $Sg = \frac{\gamma_f}{62.4\ lb/ft^3}$

$\gamma_f = 0.90 \times 62.4\ lb/ft^3 = 56.16\ lb/ft^3$

$V_d = 40\ in^3 \times \frac{0.00058\ ft^3}{1\ in^3} = 0.0232\ ft^3$

$F_b = (56.16)(0.0232) = 1.3029\ lb$

$F_b - W + F_e = 0$

$F_e = W - F_b = 14.6 - 1.3029 = \boxed{13.297\ lb}$

24. $D = 450\ mm = 0.45\ m$ $h = 750\ mm = 0.75\ m$

$T = 95^\circ C$ $\gamma_c = 9.44\ kN/m^3$

$V_c = \frac{\pi}{4} D^2 h = \frac{\pi}{4}(0.45)^2(0.75) = 0.1193\ m^3$

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

$V = 0.1193 + 0.159t$

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

$9.44(0.1193 + 0.159t) = [6.45 \times 0.1193] + [84.0 \times 0.159t]$

$t = \frac{0.3567}{11.855} = 0.03\ m = \boxed{30\ mm}$

41. $W = 450000$ lb $H = 8$ ft $B = 20$ ft $L = 50$ ft

$y_{cg} = 8$ ft $\gamma = 60$ lb/ft^3

$V_d = 50 \times 20 \times (x) = 1000(x)$ ft^3

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

$64000(x) = 450000$

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

$y_{cg} = \frac{x}{2} = \frac{7.03}{2} = 3.515$ 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

$y_{mc} = y_{cb} + MB = 3.515 + 4.742 = \boxed{8.257 \text{ ft}}$

$y_{mc} > y_{cg}$ so it will be stable in sea water

61. $h = 1.8\ m \quad W = 2.4\ m \quad L = 5.5\ m$

displaced $h = 1.5\ m$

$A_{total} = A_{rec} + A_{triangle} = (1.2 \times 2.4) + (\frac{1}{2} \times 2.4 \times 0.6) = 3.6\ m^2$

$A_{sub} = A_{rec} + A_{triangle} = (0.9 \times 2.4) + (\frac{1}{2} \times 2.4 \times 0.6) = 2.88\ m^2$

$$\gamma_{cg} = \frac{A_1 \gamma_1 + A_2 \gamma_2}{A_{total}} = \frac{(\frac{1}{2} \times 2.4 \times 0.6) \times \frac{2h}{3} + (1.2 \times 2.4)(0.6 + \frac{1.2}{2})}{3.6}$$

$\gamma_{cg} = 1.04\ m$

$$\gamma_{cb} = \frac{A_1 \gamma_1 + A_2 \gamma_2}{A_{sub}} = 0.8875\ m$$

$V_d = A_{sub} \times B = 2.88(5.5) = 15.84\ m^3$

$$I = \frac{BH^3}{12} = \frac{5.5(2.4)^3}{12} = 6.336\ m^4$$

$$MB = \frac{I}{V_d} = \frac{6.336}{15.84} = 0.4\ m$$

$\gamma_{mc} = \gamma_{cb} + MB = 0.8875 + 0.4 = \boxed{1.2875\ m}$

$\gamma_{mc} > \gamma_{cg}$ so it is stable in water