$P_{in} = 2.038$ atm

WS-20 For ~~Task~~ 7th class

Task

(1) Given $a = 5\times10^{-2}$ m

$d_{rel} = 9$

$d_L = 1.2\times10^3$ kg/m^3

$F_B = V g d_L$

Apparent change in weight

$= mg - F_B$

$\Rightarrow T = d_b V_b g - V_b g d_L$

$\Rightarrow V_b g [d_b - d_L]$

$\Rightarrow (a)^3 g [d_b - d_L]$

$\Rightarrow T = (5\times10^{-2})^3 \times 9.8 [9\times10^3 - 1.2\times10^3]$

$\Rightarrow 5 \times 125\times10^{-6} \times 9.8 \times 10^3 \times 7.8$

$= 9.56$ N.

$R.d = \frac{d_b}{d_w}$

$d_b = R.d \times d_w$

$= 9\times10^3$ kg/m3

(2) $W_w = \frac{1}{3} W_a$

$S.G = \frac{W_a}{\text{app loss of wt in water}}$

$\Rightarrow \frac{d_b}{d_w} = \frac{W_a}{W_a - W_w}$

$\Rightarrow \frac{d_b}{d_w} = \frac{W_a}{W_a - \frac{1}{3}W_a} = \frac{3}{2}$

$\Rightarrow \frac{d_b}{d_w} = \frac{3}{2}$

$\Rightarrow d_b = \frac{3}{2} \times d_w$

$= \frac{3}{2} \times 10^3$

$\Rightarrow d_b = 1.5\times10^3$ kg/m^3

(3) $W_a = 264$ gf ; $W_w = 221$ gf

$\Rightarrow m_a = \frac{W_a}{g} = 264$ gm

Loss of weight in water

$= W_a - W_w$

$= 264 - 221$

$\Rightarrow 43$ gf.

$V_{water} = V_w V' = V' - V$

$= 43 - 40 = 13$ cm^3

$V' = \frac{W_a - W_w}{\rho_w g} = \frac{43\,g}{1\times g}$

$V' = 43$ cm^3

$V = \frac{M_a}{d} = \frac{264}{8.8}$

$V = 30$ cm^3

(4) $R.d_w = 0.25$

$R.d_{oil} = 0.81$

$\frac{d_{oil}}{d_w} = 0.81$

$\Rightarrow d_{oil} = 0.81 d_w$

$\frac{V_{out}}{V} = \frac{d_{oil} - d_{wood}}{d_{oil}}$

$\frac{V_{out}}{V} = \frac{0.81 d_w - 0.25 d_w}{0.81 d_w}$

$= d_w \left[\frac{0.81 - 0.25}{0.81 d_w}\right]$

$\frac{V_{out}}{V} = \frac{0.56}{0.81} = 0.69$

$R.d_w = 0.25$

$\frac{d_{wood}}{d_w} = 0.25$

$d_{wood} = 0.25 d_w$

(5) Given

$d_{ice} = 917 \text{ kg/m}^3$

$d_{sea} = 1024 \text{ kg/m}^3$

$\frac{\Delta V}{V} = \frac{\Delta d}{d} = \frac{d_{sea} - d_{ice}}{d_{sea}}$

$= \frac{1024 - 917}{1024}$

$\frac{\Delta V}{V} = 0.104.$

(6) Given $l = 3\text{m}$

$b = 2\text{m}.$

Vol_ω = vol of body inside

$= l\,b\,h$

$= 3 \times 2 \times 1 \times 10^{-2}$

$Vol_{water} = 6 \times 10^{-2} \text{ m}^3$

$W_{man} = \omega_{liquid\ displaced}$

$= \rho_L Vol_{liq}$

$= 10^3 \times 6 \times 10^{-2}$

$\Rightarrow 60 \text{ kgf}$

(7) Given $m = 240\text{kg}$ | $d_{ice} = 9 \times 10^2 \text{ kg/m}^3$, $\rho_{sea} = 1020 \text{ kg/m}^3$

Volume $= \frac{M}{d_{ice}} = \frac{M}{900}$

$M_{ice} = 900\,V.$

weight of displaced sea water

$= \rho_{sea} V g$

$\Rightarrow 1020\,V g$

$\omega_B + \omega_{ice} = \omega_{seawater}$

$\Rightarrow 240g + 900Vg = 1020\,Vg$

$\Rightarrow 240 + 900V = 1020V$

$\Rightarrow 240 = 1020V - 900V$

$\Rightarrow 120V = 240$

$\Rightarrow V = 2\text{ m}^3$

$M_{ice} = 900 \times V$

$= 900 \times 2 = 1800 \text{ kg}$

(8) $d_{oil} = 800 \text{ kg/m}^3$

$d_{Hg} = 13,600 \text{ kg/m}^3$

$\omega_{sphere} = \omega_{oil} + \omega_{Hg}$

$\Rightarrow d_{sp} V g = d_{oil} V_{oil} g + d_{Hg} Vol_{Hg} g$

$\Rightarrow d_{sp} V = d_{oil} \frac{V}{2} + d_{Hg} \frac{V}{2}$

$\Rightarrow d_{sp} = \frac{d_{oil} + d_{Hg}}{2} = \frac{800 + 13,600}{2}$

$\Rightarrow d_{sphere} = \frac{14,400}{2} = 7,200 \text{ kg}$

(9) $T_a = \omega_a = 60\text{N}$

$T_\omega = \omega_\omega = 40\text{N}$

$S.Gr = \frac{\omega_{air}}{\omega_a - \omega_\omega}$

$= \frac{60}{60 - 40} = \frac{60}{20}$

$S.Gr = 3$

(10)

$\omega_a = 210\text{ gm}$; $\omega_L = 180\text{ gm}$

$\omega_L = 120\text{ gm}.$

Relative density of liquid

$R.d = \frac{\omega_a - \omega_L}{\omega_a - \omega_\omega}$

$R.d = \frac{210 - 120}{210 - 180} = \frac{90}{30}$

$R.d.L = 3$

$\frac{d_L}{d\omega} = 3$

$\Rightarrow d_L = 3 \times d\omega$

$\Rightarrow d_L = 3 \text{ gm/cc}.$

$R.d.body = \frac{\omega_a}{\omega_a - \omega_\omega}$

$\Rightarrow \frac{d_B}{d\omega} = \frac{210}{210 - 180}$

$\Rightarrow \frac{d_B}{d\omega} = \frac{210}{30} = 7$

$\Rightarrow d_B = 7\,d\omega$

$= 7 \text{ gm/cc}.$

(15) $a = 5\text{cm} = 5 \times 10^{-2}\text{ m}$

(i) $\omega_{body} = F_B$

$\Rightarrow \rho_b V_b g = \rho_L V_{disp} g$

$\Rightarrow \rho_b V_b = \rho_L A x$

$\Rightarrow 7.2 \times 5^3 = 13.6 \times 5^2 \times x$

$\Rightarrow 7.2 \times 5 = 13.6\,x$

$\Rightarrow x = 2.35\text{cm}.$

(ii) $a = 5\text{cm} = 5 \times 10^{-2}\text{ m}$

$\omega_b = F_B$

$\Rightarrow V \rho_b g = V_{Hg} \rho_{Hg} g + \rho_w V_w g$

$\Rightarrow V \rho_b = A x \rho_{Hg} + A(5-x) \rho_w$

$\Rightarrow 5^3 \times 7.2 = 5^2 \times x \times 13.6 + 5^2 (5 - x)$

$\Rightarrow 5 \times 7.2 = 13.6\,x + 5 - x.$

$\Rightarrow 36 = 12.6\,x + 5$

$\Rightarrow x = \frac{31}{12.6} = 2.46\text{ cm}$

(16) $d_{ice} = 917 \text{ kg/m}^3$

$d_w = 1000 \text{ kg/m}^3$

V → ice volume.

$\Rightarrow w_{ice} = w_{liquid}$

$\Rightarrow V d_{ice} g = V_{in} d_w g$

$\Rightarrow V d_{ice} = V_{in} d_w$

$\Rightarrow V_{in} = \frac{V d_{ice}}{d_w}$

$V_{out} = V - V_{in}$

$= V - \frac{d_{ice} V}{d_w}$

$V_{out} = V\left[1 - \frac{d_{ice}}{d_w}\right]$

$\frac{V_{out}}{V} = \left[1 - \frac{917}{1000}\right]$

$\frac{V_{out}}{V} = \frac{83}{1000} = 0.083$

(17) Given $r = 30 \text{ cm}$

$= 30 \times 10^{-2} \text{ m}$

$d_{air} = 1.9 \text{ kg/m}^3$

$F_B = d_{air} V g$

$= 1.9 \times \frac{4\pi}{3} r^3 \times 10$

$= 1.9 \times \frac{4 \times 3.14}{3} \times (30 \times 10^{-2})^3 \times 10$

$\Rightarrow 214.776 \times 10^{-2}$

$= 2.14776 \text{ N}$

L TASK

(1) $V_{Aw} = \frac{V_A}{2}$; $V_{Bw} = \frac{2}{3} V_B$

$F_B = \rho_L V_{in} g$

For A

$w_A = \rho_w V_{in} g$

$\Rightarrow \rho_A V_A g = \rho_w \frac{V_A}{2} g$

$\Rightarrow d_A = \frac{\rho_w}{2}$

For B

$w_B = F_B$

$\Rightarrow d_B V_B g = d_w \frac{2}{3} V_B g$

$\Rightarrow d_B = \frac{2}{3} d_w$

$\frac{d_A}{d_B} = \frac{\frac{d_w}{2}}{\frac{2}{3} d_w} = \frac{3}{4}$.

(2) $w_a = 200 \text{ gm}$

$w_L = 180 \text{ gm}$

$w_w = 175 \text{ gm}$

$\text{Rod} = \frac{\text{Loss of wt body in liquid}}{\text{Loss of wt body in water}}$

$\text{Rod} = \frac{w_a - w_L}{w_a - w_w} = \frac{200 - 180}{200 - 175}$

$\text{Rod} = \frac{20}{25} = \frac{4}{5}$

$\Rightarrow \frac{d_b}{d_w} = \frac{4}{5} \Rightarrow d_b = \frac{4}{5} d_w$

$\Rightarrow d_b = \frac{4}{5} \times 10^3$

$= \frac{4}{5} \times 200$

$= 800 \text{ kg/m}^3$

(3) $w_a = 24 \text{ gm}$

$w_w = 21 \text{ gm}$

$S.G = 1.01$

$\Rightarrow S.G = \frac{w_a - w_L}{w_a - w_w}$

$\Rightarrow 1.01 = \frac{24 - w_L}{24 - 21}$

$\Rightarrow 1.01 = \frac{24 - w_L}{3}$

$\Rightarrow 3.03 = 24 - w_L$

$\Rightarrow w_L = 20.97 \text{ gm}$

(4) $d_k = 0.8 \text{ gm/cc}$; $d_w = 1 \text{ gm/cc}$

According to Pascal's law

$P_w = P_k$

$\Rightarrow \rho_w g V_w = \rho_k g V_k$

$\Rightarrow \rho_w h_w = \rho_k h_k$

$\Rightarrow 1 \times 10 = 0.8 \times h_k$

$\Rightarrow h_k = \frac{10}{0.8} = \frac{100}{8}$

$\Rightarrow h_k = 12.5 \text{ cm}$

$S.G = \frac{d_L}{d_w}$

$\Rightarrow d_L = S.G \times d_w$

$\therefore T + F_B = mg$

$\Rightarrow 55g + \rho_L V_{in} g = d_B V g$

$\Rightarrow 55 + 0.6 d_w V = d_B V$

$\Rightarrow 55 = d_B V - 0.6 d_w V$

$\Rightarrow d_B V \left[1 - \frac{0.6}{d_B}\right] = 55$

$\Rightarrow m\left[1 - \frac{0.6 \times 1}{S.G}\right] = 55$

$\Rightarrow 60\left[1 - \frac{0.6}{S.G}\right] = 55$

$\Rightarrow 12\left[1 - \frac{0.6}{S.G}\right] = 11$

$\Rightarrow 1 - \frac{0.6}{S.G} = \frac{11}{12}$

$\Rightarrow \frac{0.6}{S.G} = 1 - \frac{1}{12}$

$\Rightarrow S.G = 7.2$

(10) Acc to Pascal's law

$P_{oil} = P_w$

$\Rightarrow d_o h_o g = d_w h_w g$

$\Rightarrow d_o \times 20 = \frac{50}{1000} \times 15$

$\Rightarrow d_o = 750 \text{ kg/m}^3$

(14) $w_a = 25gf$; $w_w = 20gf$

$d_L = 0.8 \text{ gm/cc}$.

$S.G = \frac{w_a - w_L}{w_a - w_w}$

$\Rightarrow \frac{d_L}{d_w} = \frac{25 - w_L}{25 - 20}$

$\Rightarrow \frac{0.8}{1} = \frac{25 - w_L}{5}$

$\Rightarrow 0.8 \times 5 = 25 - w_L$

$\Rightarrow w_L = 25 - 4$

$\Rightarrow w_L = 21gf$

(6) $w_a = 12.9 \text{ gm}$

$w_w = 11.3 \text{ gm}$

$S.G = \frac{w_a}{w_a - w_w}$

$S.G = \frac{12.9}{12.9 - 11.3}$

$S.G = \frac{12.9}{1.6}$

$S.G = 8.06$

(7) $t = 5m$; $d_{ice} = 900 \text{ kg/m}^3$

$d_{im} = \frac{9}{10} l$.

$w = F_B$

$\Rightarrow Mg = d_L V_{in} g$

$\Rightarrow d_{ice} V_{ice} = d_w V_{in}$

$\Rightarrow d_{ice} A \times l = d_w A l_{in}$

$\Rightarrow 900 \times l = 1000 l_{in}$

$\Rightarrow 9l = 10 l_{in}$.

$L_{rope} = l - l_{in}$

$= l - \frac{9}{10} l$

$= \frac{1}{10} l = 0.5m$

(8) wt of liquid displaced $= F_B$

$\Rightarrow d_B V g = d_o V_{in} g + d_w V_{im} w g$

$\Rightarrow M_B = 0.8 \times A \times h_o + 1 \times A \times h_w$

$= 0.8 \times 10^2 \times 8 + 1 \times 10^2 \times 2$

$= 0.8 \times 100 \times 8 + 100 \times 2$

$\Rightarrow 640 + 200$

$\Rightarrow 840 \text{ gm}$

(9) $w_B = F_B$

$\Rightarrow \rho_b V g = \rho_L V_{in} g$

$\Rightarrow \rho_b V = \rho_L \frac{V}{2}$

$\Rightarrow \frac{\rho_b}{\rho_L} = \frac{1}{2}$.

App wt of the body $= F_B$

$\Rightarrow \rho_b V [g + a] = \rho_L V_{in} g$

$\Rightarrow \frac{\rho_L}{2} V \left[g + \frac{g}{3}\right] = \rho_L V_{in} g$

$\Rightarrow \frac{1}{2} V \frac{4g}{3} = V_{in} g$

$\Rightarrow \frac{2}{3} V = V_{in}$

$\Rightarrow \frac{V_{in}}{V} = \frac{2}{3}$.

(15) $w_w = 400gf$; $m = 400gm$.

$d_{iron} = 7.8 \text{ gm/cc}$.

$S.G = \frac{d_B}{d_w} = \frac{w_a}{w_a - w_w}$

$\Rightarrow 7.8 = \frac{w_a}{w_a - 400}$

$\Rightarrow (w_a - 400) 7.8 = w_a$.

$\Rightarrow 7.8 w_a - 400 \times 7.8 = w_a$

$\Rightarrow 7.8 w_a - w_a = 400 \times 7.8$

$\Rightarrow 6.8 w_a = 400 \times 7.8$

$\Rightarrow w_a = \frac{400 \times 7.8}{6.8}$

Volume $= \frac{m}{d_B} = \frac{400 \times \frac{7.8}{6.8}}{7.8}$

Volume $= \frac{400}{6.8} =$

$= 58.8 \text{ cm}^3$

(17) $d_{imp} = 1032 \text{ kg/m}^3 \rightarrow V$

$d_{pure} = 1080 \text{ kg/m}^3 \rightarrow U$

Imp = milk + water

$\Rightarrow d_{imp} = \frac{\text{mass of impure milk}}{\text{Vol}_{imp}}$

$\Rightarrow d_{imp} V_{imp} = m_{milk} + m_w$

$= d_m V_m + d_w V_w$

$[\because V_w = V - U]$

$\Rightarrow d_{imp} V_{imp} = d_m U + d_w (V-U)$

$\Rightarrow d_{Imp} V = d_m U + d_w [V] - d_w U$

$\Rightarrow d_{imp} V - d_w V = (d_m - d_w) U$

$\Rightarrow V[d_{Imp} - d_w] = (d_m - d_w) U.$

$\Rightarrow \frac{V}{U} = \frac{d_m - d_w}{d_{imp} - d_w} = \frac{1080-1000}{1032-1000}$

$\Rightarrow \frac{V}{U} = \frac{80}{32} = 2.5$

$\Rightarrow \frac{U}{V} = \frac{1}{2.5} = 0.4$

(18) $d = 9.3 \text{ g/cc}$

$w_a = 38.25 \text{ gm}$

$w_w = 33.865 \text{ gm}$

$V = \frac{M}{d_g} = \frac{38.25}{9.3}$

$= 4.12 \text{ cm}^3$

$F_B = w_a - w_w$

$= 38.25 - 33.865$

$F_B = 4.385$

wt of water displaced = F_B

$\Rightarrow \rho_w V_{in} g = 4.385$

$\Rightarrow V_{in} = \frac{4.385}{\rho_w g} = \frac{4.385}{9.8} = 0.45$

$V_{cavity} = V - V_{in}$

$= 4.12 - 0.45$

$= 3.66$