p281 1–3, 7, 9, 11, 13–18, 20, 22–25, 29, 30, 65–69, 71, 72, 76, 77

(1) $\rho_{granite} = 2.7 \times 10^3 \ kg/m^3$

$\rho = \frac{m}{V}$

$m = \rho V = (2.7 \times 10^3)(10^8) = \underline{2.7 \times 10^{11} \ kg}$

(2) $\rho_{air} = 1.29 \ kg/m^3$

$\rho = \frac{m}{V}$

$m = \rho V = (1.29)(4.8 \times 3.8 \times 2.8) = \underline{66 \ kg}$

(3) $\rho_{gold} = 19.3 \times 10^3 \ kg$

$\rho = \frac{m}{V}$

$m = \rho V = (19.3 \times 10^3)(.6 \times .28 \times .18) = \underline{580 \ kg}$

(7) (a) $P = \frac{F}{A} = \frac{mg}{A} = \frac{(\frac{60}{4})(9.8)}{(.02 \times 10^{-4})} = 7.35 \times 10^7 = \underline{7 \times 10^7 \ N/m^2}$

(b) $P = \frac{F}{A} = \frac{mg}{A} = \frac{(1500)\ 9.8}{(800 \times 10^{-4})} = 1.84 \times 10^5 \approx \underline{2 \times 10^5 \ N/m^2}$

(9) (a) $P = \frac{F}{A}$

$F = PA = (101.3 \times 10^3)(1.6 \times 2.9) = \underline{4.7 \times 10^5\ N}$

(b) since fluid pressure is the same at any height (the height difference is minimal) $\underline{F = 4.7 \times 10^5\ N}$

(11) $P = \frac{F}{A}$

$F = PA$

$m\cancel{g} = \frac{PA}{g} = \frac{4(2.4 \times 10^5)(220 \times 10^{-4})}{9.8}$

$= \underline{2200\ kg}$

(13) $P = \rho g h$ $\rho_{alcohol} = 0.79 \times 10^3\ kg/m^3$

$h = \frac{P}{\rho g} = \frac{101.3 \times 10^3}{(0.79 \times 10^3)(9.8)} = \underline{13\ m}$

(14) (a) $P = P_o + \rho g h$

$= 101.3\times10^3 + (1\times10^3)(9.8)(2)$

$P = \underline{1.2\times10^5 \text{ Pa}}$

$F = PA = (1.2\times10^5)(22\times8.5) = \underline{2.3\times10^7 N}$

(b) Fluid pressure is the same everywhere at a depth.

$\underline{1.2\times10^5 \text{ Pa}}$

(15) $\rho_{air} = 1.29 \text{ kg/m}^3$

At the top of the atmosphere, the pressure would be zero.

$P_o = 0$

At the bottom $P_o = \rho g h$

So $P_o = \rho g h$

$h = \frac{P_o}{\rho g} = \frac{101.3\times10^3}{\left(\frac{1.29}{2}\right)(9.8)} = \underline{1.6\times10^4 m}$

(16) $P_{oil} = P_{water}$

$$\rho_{oil}\, \cancel{g}\, h_{oil} = \rho_{water}\, \cancel{g}\, h_{water}$$

$$\rho_{oil} = \rho_{water} \frac{h_{water}}{h_{oil}}$$

$$\rho_{oil} = (1\times10^3)\left(\frac{.272 - .0941}{.272}\right)$$

$$\rho_{oil} = 654 \text{ kg/m}^3$$

(17) (a) $P = \rho g h$

$$= (1\times10^3)(9.8)(5 + 110\sin 58)$$

$$= \underline{9.6\times10^5 \text{ Pa}}$$

(b) It will shoot up to the same level it came down from.

$$5 + 110\sin 58 = \underline{98\text{ m}}$$

(18) $P = \rho g h$

$= (1 \times 10^3)(9.8)(38)$

$= \underline{3.7 \times 10^3 \text{ Pa}}$

(20) (a) $m = \rho V$

$= (1 \times 10^3)\left(\pi(.3 \times 10^{-2})^2\ 12\right)$

$= \underline{0.34} \text{ kg}$

(b) $P = \frac{F}{A}$

$F = PA = \rho g h A$

$= (1 \times 10^3)(9.8)(12)\left(\pi(.21)^2\right)$

$= \underline{1.6 \times 10^4 \text{ N}}$

(22) $F_B = \rho_{water} V_{rock} g$ ← weight of fluid displaced

this is the difference between the mass and the apparent mass.

$$(M_{rock} - M_a)\cancel{g} = \rho_{water} V_{rock} \cancel{g}$$

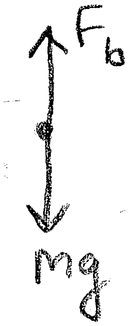
$$\rho = \frac{m}{V} \qquad V_{rock} = \frac{m_{rock}}{\rho_{rock}}$$

$$m_{rock} - m_a = \rho_{water} \frac{m_{rock}}{\rho_{rock}}$$

$$\rho_{rock} = \rho_{water} \frac{m_{rock}}{m_{rock} - m_a}$$

$$= \frac{(1\times10^3)(9.28)}{(9.28 - 6.18)} = \underline{2990\ kg/m^3}$$

(23)



$\Sigma F = 0$

$F_b = mg$

$\rho V g = mg$

$\rho_{Al} = 2.70\times10^3 \ kg/m^3$

$\rho_{Hg} = 13.6\times10^3 \ kg/m^3$

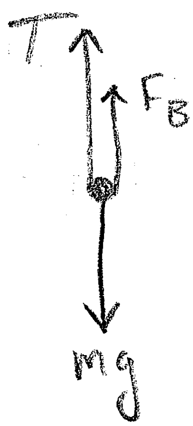
$\rho_{Hg} V_{Al_{sub}} = \rho_{Al} V_{Al_{total}}$

$$\frac{V_{Al_{sub}}}{V_{Al_{total}}} = \frac{\rho_{Al}}{\rho_{Hg}} = \frac{2.7\times10^3}{13.6\times10^3} = 0.199$$

$$\approx \underline{20\%}$$

(24)

(a)



$\rho_{steel} = 7.8\times10^3 \ kg/m^3$

$\Sigma F = 0$

$T + F_B - mg = 0$

$T = mg - \rho_w V_{ship} g$

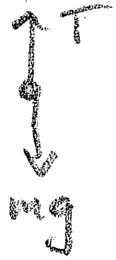
$$V_{ship} = \frac{m_{ship}}{\rho_{steel}}$$

$$= m_{ship} g - \rho_{water} \frac{m_{ship}}{\rho_{steel}} g$$

$$= m_{ship} g \left(1 - \frac{\rho_{water}}{\rho_{steel}}\right)$$

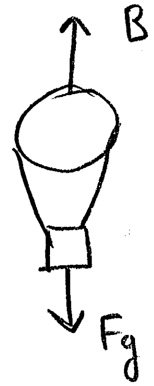
$$= 18000(9.8)\left(1 - \frac{1\times10^3}{7.8\times10^3}\right) = \underline{1.5\times10^5 \ N}$$

(b)



$T = mg = 18000(9.8) = \underline{1.8\times10^5} \ N$

(25)



$$B = F_g$$

$$\rho_f V_f \cancel{g} = \left(m_{He} + m_{balloon} + m_{cargo}\right)\cancel{g}$$

$$m_{cargo} = \rho_f\left(\frac{4}{3}\pi r^3\right) - \rho_{He}\left(\frac{4}{3}\pi r^3\right) - m_{balloon}$$

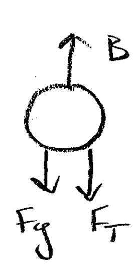
$$= \frac{4}{3}\pi(7.35\,m)^3\left(1.29\,kg\,m^{-3} - 0.179\,kg\,m^{-3}\right) - 930\,kg$$

$$= \underline{920\,kg}$$

(29) (a) $B = \rho_f V_f g = \left(1.025\times10^3\,kg\,m^{-3}\right)\left(\frac{4\pi}{3}\left(\frac{5.20\,m}{2}\right)^3\right)\left(9.81\,m\,s^{-2}\right)$

$$= \underline{7.40\times10^5\,N}$$

(b)



$$B = F_g + F_T$$

$$F_T = B - F_g = 7.40\times10^5\,N - (74400\,kg)(9.81\,m\,s^{-2})$$

$$= \underline{1.09\times10^4\,N}$$

(30) (a) $B = \rho_f V_f g$

$$= \left(1.025\times10^3\,kg\,m^{-3}\right)\left(65.0\times10^{-3}\,m^3\right)\left(9.81\,m\,s^{-2}\right)$$

$$= \underline{654\,N}$$

(b) to sink: $F_g > B$

$$F_g = mg = (68\,kg)(9.81\,m\,s^{-2}) = 667\,N$$

$\therefore$ <u>diver sinks.</u>

(65) $P = \frac{F}{A}$

$F = PA$

$F_1 = (210 \times 10^3)(\pi \times .015^2) = 148\ N$

$F_2 = (310 \times 10^3)(\pi \times .015^2) = 219\ N$

$\sim \underline{150 - 220\ N}$

(66) $p = \frac{F}{A}$ $\quad V_{ice} = Ad \quad V_{ice} = \frac{m_{ice}}{\rho_{ice}}$

$= \frac{\cancel{m_{ice}}\, g \rho_{ice} d}{\cancel{m_{ice}}} \quad A = \frac{m_{ice}}{\rho_{ice} d}$

$= (9.8)(917)(3000) = \underline{2.7 \times 10^7\ N}$

(67) $P = \rho g h$

$\Delta p = \rho g \Delta h = (1.29)(9.8)(380) = 4800$

$\frac{\Delta p}{P_0} = \frac{4800}{101.3 \times 10^3} = \underline{0.047}$

(68) (a) $P_1 = P_2$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$A_1 = \frac{F_1 A_2}{F_2} = \frac{F_1 \pi r^2}{mg} = \frac{250\pi(.09)^2}{970(9.8)}$$

$$A_1 = \underline{6.7 \times 10^{-4} m^2}$$

(b) $W = mgh = 970(9.8)(.12) = \underline{1140 \text{ J}}$

(c) $W = mgh = Fd$

$$h = \frac{Fd}{mg} = \frac{(250)(.13)}{(970)(9.8)} = \underline{3.42 \times 10^{-3} \text{ m}}$$

(d) $\frac{.12 \text{ m}}{3.42 \times 10^{-3} \text{ m}} = \underline{35 \text{ strokes}}.$

(e) $W_{in} = Fd \times N = (250)(.13)(35) = \underline{1140 \text{ J}}$

Since $W_{in} = W_{out}$ and $W = E$,
then energy is conserved.

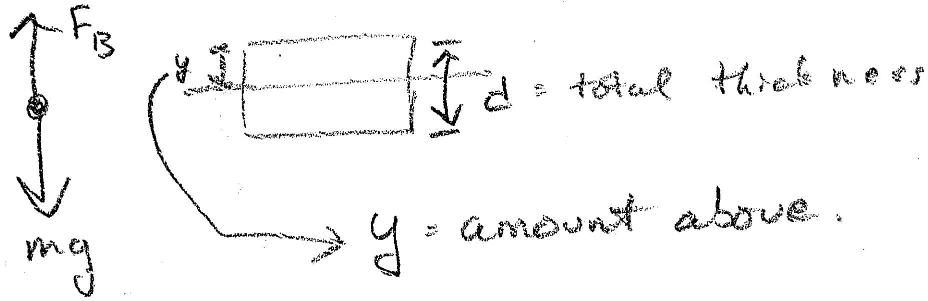
(69) $\Delta P = \rho g \Delta h = (1.05 \times 10^3)(9.8)6 = 6.2 \times 10^3$ Pa

(71) $\rho_{alcohol}\, g\, h_{alcohol} = \rho_{water}\, g\, h_{water}$

$$h_{water} = \frac{\rho_{alcohol}\, h_{alcohol}}{\rho_{water}} = \frac{0.79\times10^{-3}\,(.18)}{1.00\times10^{-3}}$$

$$\underline{h_{water} = 0.142\text{ m.}}$$

(72)



$F_B = mg$

$\rho V \cancel{g} = m\cancel{g}$

$V = A(d-y)$

$m = \rho_{cont} A d$

$\rho_{rock} \cancel{A}(d-y) = \rho_{cont} \cancel{A} d$

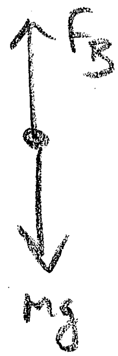
$\rho_{rock} d - \rho_{rock} y = \rho_{cont} d$

$$\cancel{\rho_{rock}}\, y = d\,\frac{(\rho_{rock} - \rho_{cont})}{\rho_{rock}}$$

$$= 35\times10^{3}\,\frac{(3300-2800)}{3300}$$

$$\underline{y = 5300\text{ m}}$$

(76)



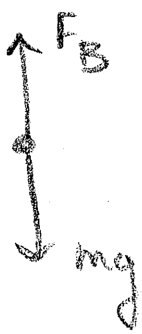
$$F_B = mg$$

$$\rho_{sw} V_{sw} g = m_{fresh} g$$

$$(1.025\times10^3)(2650 \times 8.5) = m_{fresh}$$

$$m_{fresh} = \underline{2.3\times10^7 \text{ kg}}$$

(77)



$$F_B = mg$$

$$\rho_{water} V_{wood} g = (m_{cu} + m_{wood}) g$$

$$V_{wood} = \frac{m_{wood}}{\rho_{wood}}$$

$$\frac{\rho_{water}}{\rho_{wood}} m_{wood} = m_{cu} + m_{wood}$$

$$m_{cu} = m_{wood}\left(\frac{\rho_{water}}{\rho_{wood}} - 1\right)$$

$$= .5\left(\frac{1\times10^3}{.6\times10^3} - 1\right)$$

$$\underline{m_{cu} = 0.33 \text{ kg}}$$