Chapter 11

11-7 From TABLE 11.1

$\rho_{gold} = 19{,}300 \text{ kg/m}^3$

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

$M_{gold} = M_{water}$

$\rho_{gold} V_{gold} = \rho_{water} V_{water}$

$19{,}300 \times (0.15 \times 0.05 \times 0.05) = 1000 V_{water}$

$= 7.2 \text{ kg} = 1000 V_{water}$

$V_{water} = 7.2 \times 10^{-3} \text{ m}^3 \times \dfrac{1 \text{ gal}}{3.785 \times 10^{-3} \text{ m}^3}$

$V_{water} = 1.9 \text{ gal}$

11-9

$$\frac{\cancel{m_s} V_s^2}{\cancel{r_p}} = \frac{G \cancel{m_s} M_p}{r_p^{\cancel{2}}}$$

$$\left(\frac{2\pi r_p}{T}\right)^2 = \frac{G M_p}{r_p}$$

$$\frac{4\pi^2 r_p^3}{G M_p} = T^2$$

but $M_p = \rho_p\left(\frac{4}{3}\pi r_p^2\right)$

$$\frac{\cancel{4}\pi^{\cancel{2}} \cancel{r_p^3}}{G \rho_p \left(\frac{4}{3}\cancel{\pi}\cancel{r_p^3}\right)} = T^2$$

$$T^2 = \frac{3\pi}{G \rho_p}$$

$\rho_p = \rho_{FE} = 7860\ kg/m^3$

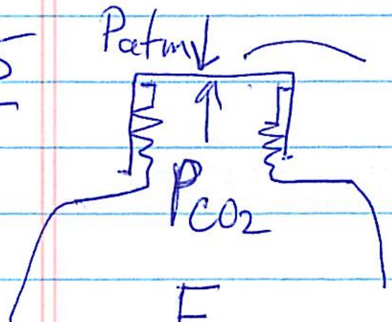
$$T = \sqrt{\frac{3 \times \pi}{6.67\times10^{-11} \times 7860}}$$

$T = 4.2\times10^3$ ~~[illegible]~~ s

11-11 $F = PA = 0.85\times10^{5}\,Pa \times 1.3\times10^{-2}\,m^{2}$

$= 1110\,N$

11-15



$A = 4.1\times10^{-4}\,m^{2}$

$F_{\substack{SCREW\\THREADS}} = P_{CO_2} A - P_{ATM} A$

$= (P_{CO_2} - P_{atm}) A$

$= (1.8\times10^{5} - 1\times10^{5}) \times 4.1\times10^{-4}$

$= 32.8\,N$

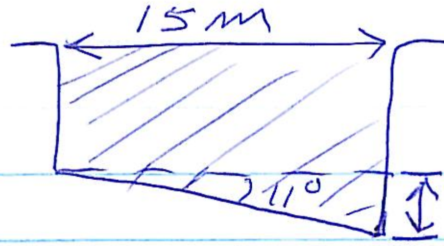
11-20 $P = P_{atm} + \rho g h$

$= 10^{5} + 1025 \times 9.8 \times 11{,}000\,m \simeq 1.11\times10^{8}\,Pa$

a) $F = PA = 1.11\times10^{8}\,Pa \times (\pi \cdot 0.1^{2}) \simeq 3.5\times10^{6}\,N$

b) $W = mg = 1.2\times10^{5}\,kg \times 9.8 = 1.2\times10^{6}\,N$

11-23



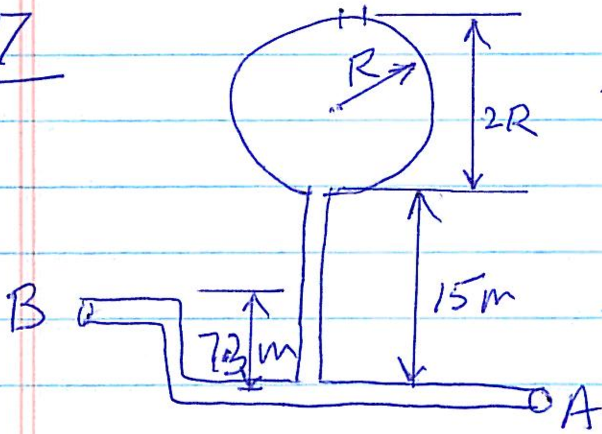
$\Delta h = 15 \tan 11 = 2.92\ m$

$P_1 = P_{atm} + \rho g h_1 \quad , \quad P_2 = P_{atm} + \rho g h_2$

$\Delta P = P_2 - P_1 = \rho g (h_2 - h_1) = \rho g \Delta h$

$\Delta P = 1000 \times 9.8 \times 2.92 = \underline{28{,}616\ Pa}$

11-27



$m = 5.25 \times 10^5\ kg$

$= \rho \cdot \frac{4}{3}\pi R^3$

$R^3 = \dfrac{3 \cdot 5.25 \times 10^5}{4\pi \cdot 1000\ kg/m^3}$

$= 125\ m^3$

$R = 5\ m$

$P_{gauge} = P - P_{atm}$

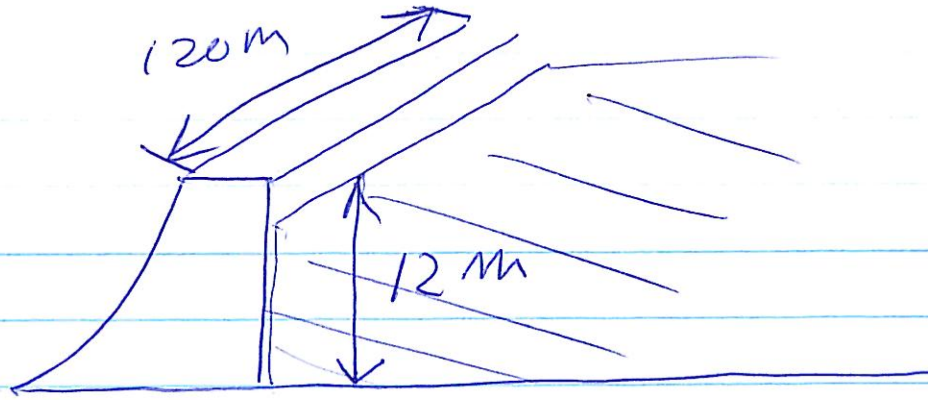
a) $P_A = P_{atm} + \rho g h_A = P_{atm} + 1000 \times 9.8 \times (25m)$

$P_{A,gauge} = \underline{2.45 \times 10^5\ Pa}$

b) $P_B = P_{atm} + \rho g h_B = P_{atm} + 1000(9.8)(25 - 7.3)$

$P_{B,gauge} = \underline{1.73 \times 10^5\ Pa}$

11-31



$$P_{TOP} = P_{ATM} \cong 1\times10^5\ Pa$$

$$P_{BOTTOM} = P_{ATM} + \rho g h$$

$$\simeq 1\times10^5\ Pa + 10^3 \cdot 9.8\times12$$

$$= 2.2\times10^5\ Pa$$

AVG PRESS

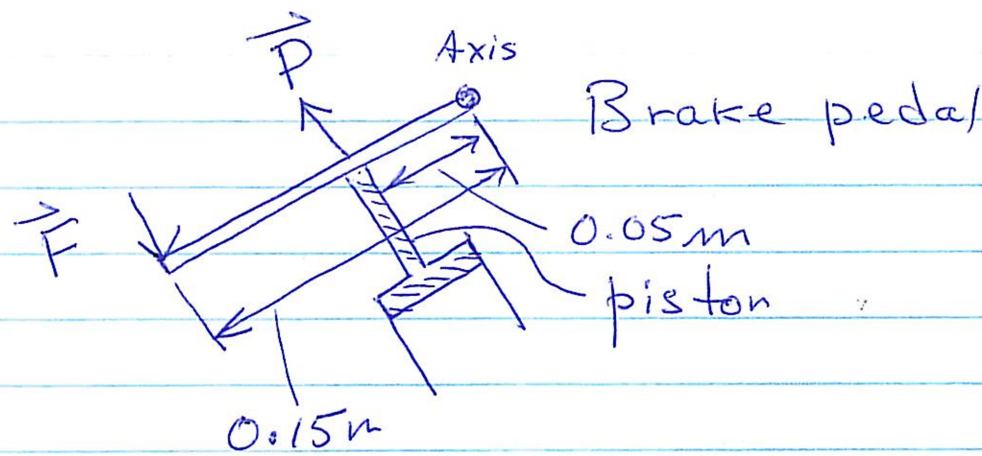
$$\overline{P} = \frac{1}{2}(P_{TOP} + P_{BOTTOM})$$

$$= 1.6\times10^5\ Pa$$

$$F = \overline{P}A = 1.6\times10^5 \times 12\times120$$

$$= 2.3\times10^8\ N$$

11-37



When $\vec{F}$ is applied to the brake pedal a force $\vec{P}$ is applied to the pedal from the piston, $-\vec{P}$ is the actual force applied to the piston. When the pedal is held down the net torque on the pedal $= 0$, so

$$F \cdot 0.15 = P(0.05)$$

OR $P = 27\,N$

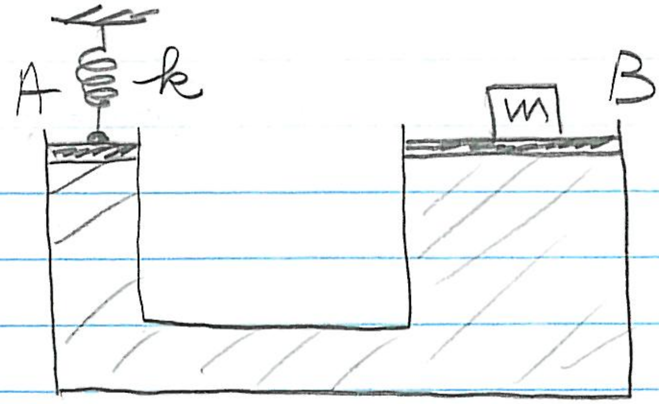
Now by Pascal's principle

$$F A_{MC} = F_p \cdot A_p$$

$$F_p = F \frac{A_{MC}}{A_p} = F\left(\frac{\pi r_{MC}^2}{\pi r_p^2}\right)$$

$$F_p = 27N\left(\frac{19}{9.5}\right)^2 = \underline{108\,N}$$

11-38



$$P_A = P_B \quad \text{(Pascal's principle)}$$

$$\frac{F_A}{A_A} = \frac{F_B}{A_B}$$

$$\frac{kx}{A_A} = \frac{mg}{A_B}$$

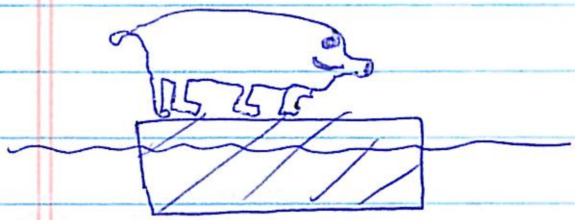
$$x = \frac{mg}{k}\,\frac{A_A}{A_B}$$

$$= \frac{40 \cdot 9.8}{1600}\left(\frac{15\,\text{cm}^2}{65\,\text{cm}^2}\right)$$

$$= \underline{0.057\ \text{m}}$$

11-40 $\rho_{ice} = 917\ kg/m^3$

$\rho_{sea\ water} = 1025\ kg/m^3$



$$W_{bear} + W_{ice} = F_{B,max}$$

↑ barely fully submerged

$$W_{bear} + \rho_{ice} V_{ice}\, g = \rho_W V_{ice}\, g$$

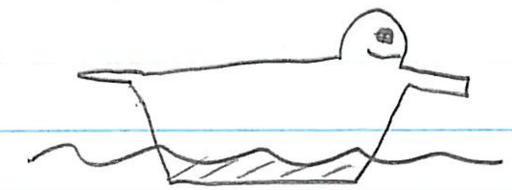
$$V_{ice} = 5.2\ m^3$$

$$W_{bear} = (\rho_W - \rho_{ice}) V_{ice}\, g$$

$$= (1025 - 917) \cdot 5.2 \times 9.8$$

$$= 5504\ N$$

11-43



$$W_{duck} = F_B$$

$$\rho_{duck} V_{duck} \cancel{g} = \rho_{water} V_{submerged} \cancel{g}$$

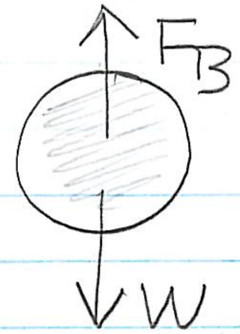
$$V_{submerged} / V_{duck} = 0.25$$

$$\rho_{duck} = \rho_{water} \times 0.25$$

$$= 1000 \times 0.25$$

$$= \underline{250 \text{ kg/m}^3}$$

11-48



$\rho_{hot\ air} = 0.93\ kg/m^3$

$\rho_{cool\ air} = 1.29\ kg/m^3$

$$m a = F_B - W$$

$$\rho_{hot} \cancel{V_b}\, a = \rho_{cool} \cancel{V_b}\, g - \rho_{hot} \cancel{V_b}\, g$$

$$a = \left(\frac{\rho_{cool} - \rho_{hot}}{\rho_{hot}} \right) g$$

$$= \frac{1.29 - 0.93}{0.93} \times 9.8\ m/s^2$$

$$= \underline{3.79\ m/s^2}$$

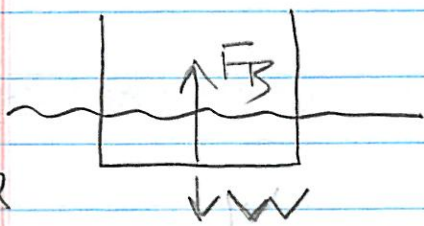
11-94 $F_B = (6.9 - 4.3)\,N = 2.6\,N$

$= \rho_{water} V_0 g$

$V_0 = 2.6/(1000 \times 9.8) = 2.65 \times 10^{-4}\,m^3$

11-97

before



$l = 0.3\,m$

$W = F_B = \rho_W (0.3)^2 (0.1)\, 9.8$

$= 88.2\,N$

after

$F_B = \rho_W V g = W + W_{water}$

$= 1000(0.3)^3 9.8 = 88.2 + 10^3 (0.3)^2 h\, g$

$= 265 = 88.2 + 882\, h$

$= 0.2\,m$