p132 43, 47, 49, 75, 83

(43) $\frac{m_s v^2}{r} = \frac{G m_s m_E}{r^2}$

$$v = \sqrt{\frac{G m_E}{r}} = \sqrt{\frac{(6.67\times10^{-11}\ N m^2 kg^{-2})(5.98\times10^{24}\ kg)}{(6300\times10^3\ m + 6380\times10^3\ m)}}$$

$$v = 6300\ ms^{-1}$$

(47) $\frac{m v^2}{r} = \frac{G m m}{r^2}$

$$v = \sqrt{\frac{Gm}{r}} = \sqrt{\frac{(6.67\times10^{-11}\ N m^2 kg^{-2})(5.98\times10^{24}\ kg)}{(6380\times10^3\ m + 8850 m)}}$$

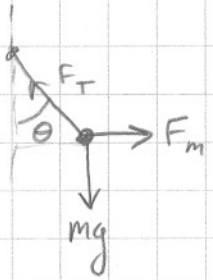
$$v = 7900\ ms^{-1}$$

(49) $\frac{m 4\pi^2 r}{T^2} = \frac{G m m_E}{r^2}$

$$T = \sqrt{\frac{4\pi^2 r^3}{Gm}} = \sqrt{\frac{4\pi^2 (73000\times10^3)^3}{(6.67\times10^{-11}\ N m^2 kg^{-2})(5.7\times10^{26}\ kg)}} = 2.0\times10^4\ s$$

$$= \sqrt{\frac{4\pi^2 (170000\times10^3)^3}{(6.67\times10^{-11}\ N m^2 kg^{-2})(5.7\times10^{26}\ kg)}} = 7.1\times10^4\ s$$

(75) (a)



x: $F_T \sin\theta = F_m$

y: $F_T \cos\theta = mg$

$F_T = \frac{mg}{\cos\theta}$

$\frac{mg}{\cos\theta}\sin\theta = F_m$

$mg\tan\theta = F_m$

$F_m = \frac{G m m_M}{D_m^2}$

$mg\tan\theta = \frac{G m_M m_m}{D_m^2}$

$\theta = \tan^{-1}\left(\frac{G m_m}{g D_m^2}\right)$

cont'd

75 cont'd

Now we have to get rid of g and G

$$Mg = \frac{G M_m M_E}{R_E^2}$$

So $$\frac{G}{g} = \frac{R_E^2}{M_E}$$

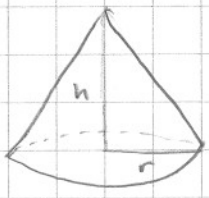
$$\therefore \quad \Theta = \tan^{-1}\left(\frac{R_E^2 M_m}{M_E D_m^2}\right)$$

(b) Volume of a Cone

$$= \frac{\pi r^2 h}{3}$$

$$= \frac{\pi (2000\text{m})^2 (4000\text{m})}{3}$$

$$= 1.676 \times 10^{10}\ \text{m}^3$$



$$m = (3000\ \text{kg m}^{-3})(1.676 \times 10^{10}\ \text{m}^3) = \underline{5 \times 10^{13}\ \text{kg}}$$

(c) $D_m = 5000\ \text{m}$

$$\Theta = \tan^{-1}\left(\frac{R_E^2 M_m}{M_E D_m^2}\right) = \tan^{-1}\left(\frac{(6380 \times 10^3\ \text{m})^2 (5 \times 10^{13}\ \text{kg})}{(5.98 \times 10^{24}\ \text{kg})(5000\ \text{m})^2}\right)$$

$$\underline{\Theta = 8 \times 10^{-4}\ \text{degrees}}$$

(83) (a) $\frac{mv^2}{r} = \frac{G m_1 m_2}{r^2}$

$$v = \sqrt{\frac{G m_E}{r}} = \sqrt{\frac{(6.67\times10^{-11}\ N m^2 kg^{-2})(5.98\times10^{24}\ kg)}{(11000)(1.852\times10^3 m) + 6380\times10^3 m}}$$

$$v = 3861\ ms^{-1} = \underline{3900\ ms^{-1}}$$

(b) $v = \frac{2\pi r}{T}$

$$T = \frac{2\pi r}{v} = \frac{2\pi\left((11000)(1.852\times10^3 m) + 6380\times10^3 m\right)}{3861\ ms^{-1}}$$

$$T = \underline{4.4\times10^4\ s}$$