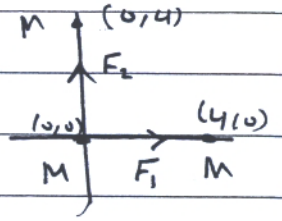
(CH # 14)

Q.2



$$F_1 = F_2 = \frac{G M^2}{(4)^2} = 4.17 \times 10^{-12} N$$

$$F_{net} = \sqrt{F_1^2 + F_2^2} = 5.9 \times 10^{-12} N$$

Q.3 $$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

$$M = \frac{4 \times 3.14^2}{6.67 \times 10^{-11}} \frac{(10^7)^3}{(10^4)^2} = 5.91 \times 10^{24} kg$$

Q.4 (Same figure for Q.2)

$$U_{system} = -G\left(\frac{M^2}{4} + \frac{M^2}{4} + \frac{M^2}{\sqrt{32}}\right)$$

$$U = -4.5 \times 10^{-11} J$$

Q.5 $E_i = E_f$ ("Max" "h" means $K_f = 0$)

$U_i + K_i = U_f$ $\quad (r_f = h + Re = 4Re + Re)$

$$-\frac{GmM}{Re} + \frac{1}{2} m V_i^2 = -\frac{GmM}{(4Re + Re)}$$

$(\div m) \times 2 \Rightarrow$ $$V_i^2 = 2G\left(\frac{M}{Re} - \frac{M}{5Re}\right)$$

$$V_i = 10 \times 10^3 \text{ m/s} = 10 \text{ km/s}$$

Cont. CH14

Q.6

surface $a_g = \frac{G M}{R_e^2}$

at altitude: $a_g' = \frac{1}{8} a_g = \frac{G M}{r^2}$ $(r = h + R_e)$

$$\Rightarrow \frac{1}{8}\frac{G M}{R_e^2} = \frac{G M}{r^2}$$

$$r^2 = 8 R_e^2$$

$$r = \sqrt{8}\ R_e$$

$$h + R_e = \sqrt{8}\ R_e \Rightarrow h = \sqrt{8}\ R_e - R_e$$

$$\boxed{h = 1.83\ R_e}$$ above Earth's surface.

Q.7 $T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$ $M = \rho V = \rho\left(\frac{4}{3}\pi r^3\right)$

since $(r = R)$ of the planet

$$\Rightarrow T^2 = \frac{4\pi^2 r^3}{G\rho\left(\frac{4}{3}\pi r^3\right)} = \frac{3\pi}{G\rho}$$

$$\therefore \rho = \frac{3\pi}{GT^2} = \frac{3 \times 3.14}{6.67 \times 10^{-11} \times (6 \times 3600)^2}$$

$$\rho = 305\ kg/m^3$$

Q.8 $\Delta E = E_f - E_i = \frac{U_f}{2} - \frac{U_i}{2}$, where $E = \frac{U}{2}$

$$= -\frac{1}{2} G m M \left(\frac{1}{r_f} - \frac{1}{r_i}\right) = [illegible]$$

$$= -\frac{1}{2} \times 6.67 \times 10^{-11} \times 100 \times 5.98 \times 10^{24} \left(\frac{1}{1.92 \times 10^7} - \frac{1}{1.38 \times 10^7}\right)$$

$$\Delta E = 4.08 \times 10^8\ J$$

÷A CH # 14

Q.9

$$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

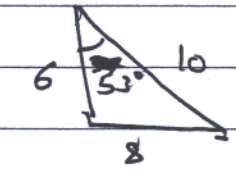
$$M = \left(\frac{4\pi^2}{GT^2}\right) r^3$$

$$= \frac{4\times(3.14)^2}{6.67\times10^{-11}\times(2.754\times10^4)^2} \times (9.4\times10^6)^3$$

$$M = 6.48\times10^{23}\ kg$$

Q.10 since $F_{net}(x) = 0$ (will cancel each other)

$$F_{net}(y) = 2\left(\frac{GMm}{(0.1)^2}\right)\cos 53\ (-\hat{j})$$



$$= 5.139\times10^{-10}\ N$$

$$F = ma \Rightarrow a = \frac{F}{m} = \frac{5.139\times10^{-10}}{0.01}$$

$$a = 5.13\times10^{-8}\ m/s^2\ (-\hat{j})$$

C-A.

End.

Ch14 (3)