WS-20 for class 8th

Tarik

(1) $M_p = \frac{1}{10} M_e$

$v_{ep} = \frac{1}{\sqrt{2}} v_{eE}$

$v_e \propto \sqrt{\frac{M}{R}}$

$\Rightarrow \frac{v_{ep}}{v_{eE}} = \sqrt{\frac{M_p}{M_e} \times \frac{R_e}{R_p}}$

$\Rightarrow \frac{\frac{1}{\sqrt{2}} v_{eE}}{v_{eE}} = \sqrt{\frac{\frac{1}{10} M_e}{M_e} \times \frac{R}{R_p}}$

$\Rightarrow \frac{1}{\sqrt{2}} = \sqrt{\frac{1}{10}} \sqrt{\frac{R}{R_p}}$

$\Rightarrow \frac{1}{2} = \frac{1}{10} \frac{R}{R_p}$

$\Rightarrow R_p = \frac{1}{5} R$

(2) $\frac{v_1}{v_2} = \frac{1}{2}$; $\frac{d_1}{d_2} = \frac{2}{1}$

$\Rightarrow v_e \propto \sqrt{d}\, R$

$\Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{d_1}{d_2}} \frac{R_1}{R_2}$

$\Rightarrow \frac{1}{2} = \sqrt{\frac{2}{1}} \frac{R_1}{R_2}$

$\Rightarrow \frac{1}{2} = \sqrt{2} \frac{R_1}{R_2}$

$\Rightarrow \frac{R_1}{R_2} = \frac{1}{2\sqrt{2}}$

(3) Given

$M = 5 \times 10^{24}$ kg.

$R = 6.67 \times 10^4$ m.

$v_e = \sqrt{\frac{2GM}{R}}$

$v_e = \sqrt{\frac{2 \times 6.67 \times 10^{-11} \times 5 \times 10^{24}}{6670 \times 10^3}}$

$v_e = 10^4$ m/sec

$v_e = 10$ km/sec.

(4) $v_e = 12$ km/sec.

$R' = \frac{1}{4} R$.

$v_e \propto R$.

$\Rightarrow \frac{v_e}{v_e'} = \frac{R}{R'}$

$\Rightarrow \frac{12}{v_e'} = \frac{R}{\frac{1}{4}R} = \frac{1}{\frac{1}{4}} = 4$

$\Rightarrow \frac{12}{v_e'} = 4$

$\Rightarrow v_e' = 3$ km/sec

(5) $v_e = 11.2$ km/sec

$v_p = ?$; $R_p = 2R_e$

$v_e \propto \sqrt{d}\, R$.

$\Rightarrow \frac{v_{eE}}{v_p} = \frac{R_E}{R_p}$

$\Rightarrow \frac{11.2}{v_p} = \frac{R_E}{2R_E}$

$\Rightarrow \frac{11.2}{v_p} = \frac{1}{2} \Rightarrow v_p = 22.4$ km/sec

(6) $h = \frac{R}{2}$

$v_0 \propto \frac{1}{\sqrt{R+h}}$

$\Rightarrow \frac{v_0}{v_0'} = \sqrt{\frac{R+h}{R}}$

$\Rightarrow \frac{v}{v_0'} = \sqrt{\frac{R+\frac{R}{2}}{R}}$

$\Rightarrow \frac{v}{v_0'} = \sqrt{\frac{3R}{2R}}$

$\Rightarrow v_0' = \sqrt{\frac{2}{3}}\, v$

(7) $v_e' = 10 v_e$.

$v_e' \propto \frac{1}{\sqrt{R}}$.

$\frac{v_e}{v_e'} = \sqrt{\frac{R'}{R}}$.

$\Rightarrow \frac{v_e}{10 v_e} = \sqrt{\frac{R'}{6400}}$.

$\Rightarrow \left(\frac{1}{10}\right)^2 = \frac{R'}{6400}$.

$\Rightarrow R' = 64$ km

(8) $L = mvr$.

$L = mr^2\omega$

$\frac{dL}{dt} = \frac{1}{2} m \frac{dA}{dt}$.

$= \frac{d}{dt}(mr^2\omega)$

$\Rightarrow \frac{dA}{dt} \propto \omega r^2$.

(9) $v_e = \sqrt{2gR}$

$= \sqrt{2}\sqrt{gR}$

$v_e = \sqrt{2}\, v_0$

$\Rightarrow \frac{v_e}{v_0} = \sqrt{2}$.

(15) G.P.E $= -\frac{GMm}{R+h}$

$h = R$

$= -\frac{GMm}{R+R}$

G.P.E $= -\frac{gR^2 m}{2R}$

$= \frac{mgR}{}$

$g = \frac{GM}{R^2}$

$\Rightarrow GM = gR^2$.

(16) $v_e = 11$ km/s

$v_e \propto R$

$\frac{v_e}{v_p} = \frac{R_e}{R_p}$

$\Rightarrow \frac{11}{v_p} = \frac{R}{2R}$

$\Rightarrow v_p = 22$ km/s

(17) $v = \sqrt{2gR}$

$H_{max} = \frac{v^2}{2g}$

$H_{max} = \frac{(\sqrt{2gR})^2}{2g} = \frac{2gR}{2g}$

$H_{max} = R$

(10) $v_e = \sqrt{2gR}$

$= \sqrt{2}\sqrt{gR}$

$v_e = \sqrt{2}\, v_0$

$\Rightarrow \frac{v_e}{v_0} = \sqrt{2}$.

LTark

(1) $R_p = 4R$

$g_p = 9 g_e$

$v_e = \sqrt{2gR}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{\frac{g_p}{g_e}\frac{R_p}{R_e}}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{\frac{9g_e}{g_e} \times \frac{4R_e}{R_e}}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{36} = 6$

$\Rightarrow v_p = 6 v_e$

$\Rightarrow v_p = 67.2 \text{ km/sec}$

(2) $V_0 = 7 \text{ km/sec}$

$V_0 = \sqrt{\frac{GM}{R+h}}$

$\frac{V_0}{V_0'} = \sqrt{\frac{R+h_2}{R+h_1}}$

$\frac{V_0}{V_0'} = \sqrt{\frac{R+4R}{R}}$

$\frac{V_0}{V_0'} = \sqrt{5}$

$V_0' = \frac{V_0}{\sqrt{5}} = \frac{7}{\sqrt{5}}$

$= 1.4 \text{ km/sec}$

(3) $U \propto \sqrt{\frac{M}{R}}$

$\Rightarrow \frac{U}{U_p} = \sqrt{\frac{M_e}{M_p}\frac{R_p}{R_e}}$

$\Rightarrow \frac{U}{U_p} = \sqrt{\frac{M}{2M}\frac{2R}{R}}$

$\Rightarrow U_p = U$

[Given $M_p = 2M$, $R_p = 2R$]

(4) $v_e = 11.2 \text{ km/sec}$; $R_p = 2R$, $M_p = 8M$

$v_e \propto \sqrt{\frac{M}{R}}$

$\Rightarrow \frac{v_e}{v_p} = \sqrt{\frac{M_e}{M_p}\frac{R_p}{R_e}}$

$\Rightarrow \frac{11.2}{v_p} = \sqrt{\frac{M_e}{8M_e}\frac{2R_e}{R_e}}$ ($8M_e = 4$)

$\Rightarrow \frac{11.2}{v_p} = \frac{1}{\sqrt{4}} = \frac{1}{2}$

$\Rightarrow v_p = 2 \times 11.2$

$= 22.4 \text{ km/s}$

(5) $v_e = 11.2 \text{ km/sec}$

$M_p = \frac{M}{4}$; $R_p = \frac{R}{2}$

$\Rightarrow v_e \propto \sqrt{\frac{M}{R}}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{\frac{M_p}{M_e} \times \frac{R_e}{R_p}}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{\frac{M}{4M} \times \frac{R}{\frac{R}{2}}}$

$\Rightarrow \frac{v_p}{v_e} = \sqrt{\frac{1}{4} \times 2} = \frac{1}{\sqrt{2}}$

$\Rightarrow v_p = \frac{v_e}{\sqrt{2}} = 8 \text{ km}$

(6) For 1 month of FEB

29 days $\rightarrow$ A.

$\Rightarrow 1 \text{ day} = \frac{A}{29}$

$\Rightarrow 7 \text{ day} = \frac{7A}{29}$

(7) Given $T_A = 8 \text{ hrs}$; $T_B = 1 \text{ hr}$

$T^2 \propto R^3 \Rightarrow T \propto R^{\frac{3}{2}}$

$\Rightarrow T_A^{\frac{2}{3}} \propto R$.

$\Rightarrow \frac{R_A}{R_B} = \left(\frac{T_A}{T_B}\right)^{\frac{2}{3}} = \left(\frac{8}{1}\right)^{\frac{2}{3}}$

$\Rightarrow \frac{R_A}{R_B} = \left(2^3\right)^{\frac{2}{3}} = 2^2 = 4$

(8) $v_e \propto \sqrt{MR}$

$\Rightarrow \frac{V_m}{v_e} = \sqrt{\frac{M_m}{M_e}\frac{R_e}{R_m}}$

$\Rightarrow \frac{V_m}{v_e} = \sqrt{\frac{M_m}{9M_m}\frac{2R_m}{R_m}}$

$\Rightarrow \frac{V_m}{v_e} = \frac{\sqrt{2}}{3}$

$\Rightarrow V_m = \frac{v_e}{3}\sqrt{3} = 5.65 \text{ km/sec}$

(10) $R_p = R$; $T_p = 24 \text{ hrs}$

$R' = 4R$; $T' = ?$

$T \propto (R)^{\frac{3}{2}}$

$\Rightarrow \frac{T_p}{T'} = \left(\frac{R_p}{R'}\right)^{\frac{3}{2}}$

$\Rightarrow \frac{T_p}{T_e} = \left(\frac{R}{4R}\right)^{\frac{3}{2}} = \left(\frac{1}{4}\right)^{\frac{3}{2}}$

$\Rightarrow \frac{T_p}{T'} = \frac{1}{2^3} = \frac{1}{8}$

$\Rightarrow T' = 8 T_p$

$\Rightarrow T' = 8 \times 1 \text{ day}$

$\Rightarrow T' = 8 \text{ day}$

(15) $\frac{m_1}{m_2} = \frac{2}{3}$; $\frac{R_1}{R_2} = \frac{3}{2}$.

$\frac{V_1}{V_2} = \sqrt{\frac{M_1}{M_2}\frac{R_2}{R_1}} = \sqrt{\frac{2}{3} \times \frac{2}{3}}$

$\frac{V_1}{V_2} = \frac{2}{3}$

(16) $V_e \propto R$; $R_p = 3R_e$

$\frac{v_e}{v_p} = \frac{R_e}{R_p}$

$\Rightarrow \frac{v_e}{v_p} = \frac{R}{3R}$

$\Rightarrow \frac{v_e}{v_p} = \frac{1}{3}$

$\Rightarrow v_p = 3 v_e$

$\Rightarrow v_p = 33.6 \text{ km/sec}$

(17) Given $h = R$

$V = \sqrt{\frac{GM}{R+h}}$; $V \propto \frac{1}{\sqrt{R+h}}$

$\frac{V_1}{V_2} = \sqrt{\frac{R+h_2}{R+h_1}}$

$\frac{V_1}{V_2} = \sqrt{\frac{R+R}{R+0}}$

$\frac{V_1}{V_2} = \sqrt{\frac{2R}{R}}$

$\Rightarrow \frac{V}{V_2} = \sqrt{2}$

$\Rightarrow V_2 = \frac{V}{\sqrt{2}}$