CHAPTER EIGHT

GRAVITATION

Problem 4:

If the K.E of the satellite is 10^4 J. Find its P.E.

Sol.

Given K.E = $\frac{1}{2}mv_0^2 = \frac{1}{2}G\frac{Mm}{R}$

$\therefore v = \sqrt{\frac{GM}{R}}$

Then, P.E = $-G\frac{Mm}{R}$

From the data, $\frac{1}{2}\frac{GMm}{R} = 10^4$

$\therefore \frac{GMm}{R} = -2\times10^4\ J$

Problem 5:

If the value of 'g' on earth is 9.8 m/s^2 then find its value at a height of 6400 km.

Sol.

g = 9.8 m/s^2

g_h = ?

R = 6400 km

Here 'h' value is comparable to 'R' therefore we will use the formula.

$$g_h = G\frac{M}{(R+h)^2}$$

$$= \frac{GM}{R^2} \times \frac{1}{(1+h/R)^2}$$

$$= \frac{g}{\left(1+\frac{h}{R}\right)^2}$$

$$= \frac{9.8}{(1+1)^2} = \frac{9.8}{4}$$

$$= 2.45 \text{ m/s}^2$$

Problem 6:

If the escae velocity on earth is 11.2 km/sec. Find its value for a planet having double the radius and 8 times the mass of earth.

Sol.

Given, $V_e = \sqrt{2\frac{GM}{r}}$

$$\frac{11.2}{v_e'} = \frac{\sqrt{2\frac{GM}{R}}}{\sqrt{2 \times G \times \frac{8M}{2R}}}$$

$$\frac{11.2}{v_e'} = \frac{1}{2} \Rightarrow v_e' = 22.4 \text{ km/s}$$