

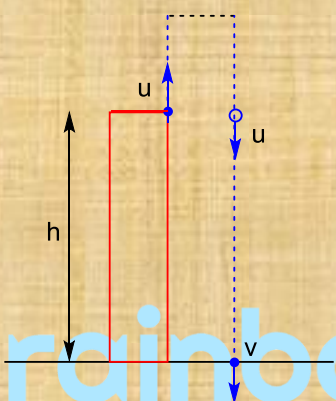
Chapter 03

MOTION IN A STRAIGHT LINE

Projection from the top of a tower:

- If a body is projected vertically up from the top of a tower of height h with a velocity u and takes ' t ' seconds to reach the ground then height of tower

$$h = -ut + \frac{1}{2}gt^2.$$



- If an object is dropped from a balloon rising up with a velocity u at a height h .

a) Equation of motion relative to earth is

$$h = -ut + \frac{1}{2}gt^2.$$

b) Equation of motion relative to balloon is $h = \frac{1}{2}gt^2$.

c) Relative to earth body goes up and then falls.

d) Relative to the balloon it falls vertically downward.

- If a particle starts from rest and moves with uniform acceleration ' a ' such that it travels distances S_m and

$$S_n \text{ in the } m^{\text{th}} \text{ and } n^{\text{th}} \text{ sec then } a = \frac{S_m - S_n}{m - n}.$$

- A particle starts from rest and moves along a straight line with uniform acceleration. If ' S ' is the distance travelled in n seconds and S_n is the

distance travelled in the n^{th} second then

$$\frac{S_n}{S} = \frac{[2n-1]}{n^2}.$$

- If a bullet loses $(1/n)^{\text{th}}$ of its velocity while passing through a plank, then the number of such planks required to just stop the bullet is,

$$\frac{n^2}{2n-1} \approx \frac{n}{2} + 1$$

- The velocity of a body becomes $[1/n]^{\text{th}}$ of its initial velocity after a displacement of 'X', then it will come to rest after a further displacement of $\frac{X}{n^2-1}$.
- Starting from rest a body travels with an acceleration 'a' for some time and then with deceleration 'b' and finally comes to rest. If the total time of journey is 't', then the maximum velocity and displacement and average velocity are respectively.

$$(i) V_{\max} = \frac{\alpha \beta t}{\alpha + \beta}$$

$$(ii) S = \frac{\alpha \beta t^2}{2[\alpha + \beta]}$$

$$(iii) \text{Average velocity} = \left[\frac{V_{\max}}{2} \right]$$

