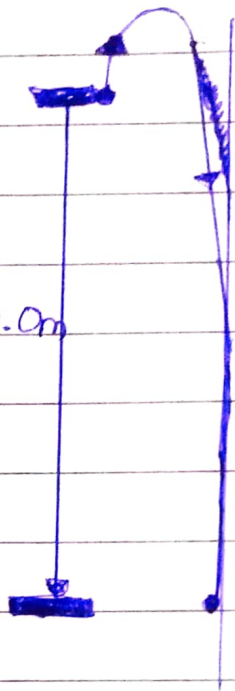


## Freefall :-

1. A ball is thrown upward with an initial body velocity of  $10.0 \text{ m/s}$  from top of a  $50.0 \text{ m}$  tall building  $y = 50.0 \text{ m}$

(a) with what velocity the ball will strike the ground.

(b) How long does it take the ball to strike the ground.



ans given  $y = -50.0 \text{ m}$  (disp.  $\cdot v_0 = +10.0 \text{ m/s}$ .  
 $a = -g$

$y$  in kinetic eq<sup>n</sup> stands for disp<sup>o</sup> from the launch point, not distance. When the ball strikes the ground, it will displace  $-50.0 \text{ m}$  or  $50 \text{ m}$  below launch point

$$(a) v^2 = v_0^2 - 2gy = (+10.0 \text{ m/s})^2 - 2(9.80 \text{ m/s}^2)(-50.0 \text{ m}) \\ = 1.08 \times 10^3 \text{ m}^2/\text{s}^2$$

$$\text{so } v = \sqrt{1.08 \times 10^3 \text{ m}^2/\text{s}^2} = \pm 32.9 \text{ m/s}$$

The +ve answer is discarded since the ball

is falling when it lands & downward  
Therefore  $v = -32.9 \text{ m/s}$

(b) from  $v = u_0 - gt$ , we have  

$$t = \frac{u_0 - v}{g} = \frac{10.0 \text{ m/s} - (-32.9 \text{ m/s})}{9.80 \text{ m/s}^2}$$

$$= \frac{42.9 \text{ m/s}}{9.80 \text{ m/s}^2} = 4.38 \text{ s}$$

2- A stone is dropped freely in the river from a bridge. It takes 5 s to touch the water surface in river.

calculate

- (i) the height of the bridge from the water level.  
 (ii) the dist. covered by stone in the last second.  
 ( $g = 9.8 \text{ m s}^{-2}$ )

ans-  $u = 0, g = 9.8 \text{ m s}^{-2}, t = 5 \text{ s}$

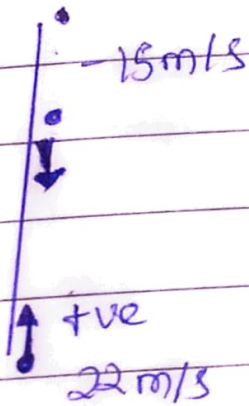
(i) From eq<sup>n</sup> of motion;  $h = ut + \frac{1}{2}gt^2$ ;  $h = 0 \times 5 + \frac{1}{2} \times 9.8 \times (5)^2$   

$$= \frac{9.8 \times 25}{2} = 122.5 \text{ m.}$$

(ii) Dist covered in last second,  $S_{(1)} = u + \frac{g(2t-1)}{2}$   

$$= 0 + \frac{1}{2} \times 9.8 \times (2 \times 5 - 1) = 44.1 \text{ m.}$$

3- A tennis ball is struck with a racket, firing it straight upward at  $22\text{ m/s}$ . After how much time will it be falling at  $15\text{ m/s}$



$$a = -g = -10\text{ m/s}^2$$

$$v = -15\text{ m/s}, u = 22\text{ m/s}$$

$$v = u + at$$

$$\Rightarrow -15 = 22 - 10t$$

$$\Rightarrow t = \frac{22 + 15}{10} = 3.7\text{ s}$$