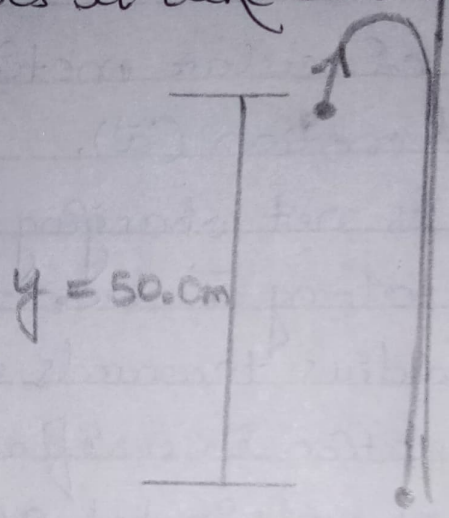
Tue
3.7.21

1Q) A ball is thrown upward with an initial velocity of 10.0 m/s from top of a 50.0m tall building.

a) With what velocity will the ball strike the ground?

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



Ans: a) $y = -50.0\,m$ (displacement), $V_0 = +10.0\,m/s$

$$V^2 = V_0^2 - 2gy = (+10.0\,m/s)^2 - 2(9.80\,m/s^2)(+50.0\,m)$$

$$= 1.08 \times 10^3\,m^2/s^2$$

So, $V = \sqrt{1.08 \times 10^3\,m^2} = \pm 32.9\,m/s$

The positive answer is discarded since the ball is falling when it lands (moving downwards)

Therefore $V = -32.9\,m/s$

b) $V = V_0 - gt$, we have

$$t = \frac{V_0 - V}{g} = \frac{(+10.0\,m/s - (-32.9\,m/s)}{9.80\,m/s^2}$$

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

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

i) the height of the bridge from water level.

ii) the distance covered by stone in the last second ($g = 9.8 ms^{-2}$)

Ans. i) Given,

Initial spee = $u = 0 m/s$ time = $t = 5 sec$

[Case-1] distance travelled = Height of bridge = h m

From second equation of motion:

$$s = ut + \frac{1}{2} at^2 h$$

$$= 0 \times t + \frac{1}{2} 9.8 \times 5 \times 5h$$

$$= 122.5 m$$ (height of bridge from water level)

ii) (I) Distance travelled in 4 sec

$$= \frac{1}{2} \times 9.8 \times 4 \times 4$$

$$= 16 \times 4.9$$

$$= 78.4 m$$

(II) Distance travelled in 5 sec − distance travelled in 4 sec
$= 122.5 - 78.4 = 44.1 m$ (distance covered by stone)

Hw
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3. A tennis ball is struck with a racket, giving it straight upward at 22 metres per second. After how much time will it be falling at 15 meters per second.

Ans: Case 1:-

Given $u = 22 m/s$, $v = 0$

To find:- t_1

$\Rightarrow v = u + gt_1$

$\Rightarrow 0 = 22 + (-9.8) \times t_1$

$\Rightarrow 0 = 22 - 9.8 t_2$

$\Rightarrow 9.8 t_1 = 22$

$\Rightarrow t_1 = \frac{22}{9.8} = 2.24$ secs

Case 2:-

Given = $u = 0$, $v = 15 m/s$, $g = 9.8$;

to find = t_2

$\Rightarrow v = u + gt_2$

$\Rightarrow 15 = 0 + 9.8 t_2$

$\Rightarrow 15 = 9.8 + 2$

$\Rightarrow \frac{15}{9.8} = t_2$

$\Rightarrow 1.53 = t_2$

$\Rightarrow t_2 = 1.53$ secs

So, $t = t_1 + t_2 = (2.24 + 1.53)$ secs

$= 3.77$ secs $= 3.8$ secs

∴ After 3.8 secs it will be falling at 15 m/s.