



Problem 2: A ball is tossed with a velocity of 20m/sec directed vertically from a window located at 50m above the ground. Determine

1. Elevation y of the ball above the ground
2. Time and velocity when the ball hits the ground

Solution:

- a) Elevation of the ball above the ground

Initial velocity, $u=20\text{m/sec}$

Acceleration due to gravity, $g=-9.81\text{ m/sec}^2$

Final velocity, $v=0$

We know $v^2 = u^2 - 2gs$

$$0 = 20^2 - 2 \times 9.81 \times s$$

$$s = 20.387\text{m}$$

$$y = 50 + s$$

$$= 50 + 20.387$$

$$= 70.387\text{m}$$

- b) Time and velocity when of the ball to hit the ground

Initial velocity $u=0$

Final velocity $v = v_2$

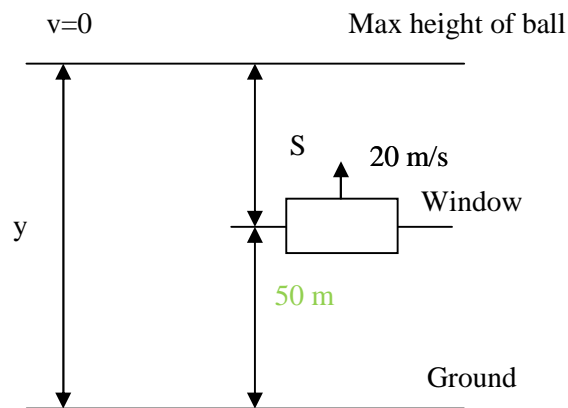
Distance $s=70.387\text{ m}$

Acceleration due to gravity $g = 9.81\text{ m/s}^2$

$$v^2 - u^2 = 2gs$$

$$v^2 - 0 = 2 \times 9.81 \times 70.387$$

$$\text{Final velocity } v^2 = 37.16\text{ m/sec}$$



Time taken to reach maximum height

$$\begin{aligned}v &= u + at \\0 &= 20 - 9.81t \\ \frac{20}{9.81} &= t_1 \\ t_1 &= 2.038 \text{ sec}\end{aligned}$$

Time required to reach the ground from maximum height

$$\begin{aligned}v &= u + at_2 \\37.16 &= 0 + 9.81 t_2 \\ t_2 &= 3.788 \text{ sec}\end{aligned}$$

Total time of travel= $t_1 + t_2$

$$\begin{aligned}&= 2.038 + 3.788 \\ &= 5.826 \text{ sec}\end{aligned}$$