

## Answer on Question #40959, Physics, Mechanics

(a) At  $t = 0$  seconds, a ball is thrown straight upwards from the edge of 50m-high building, with a velocity of 10 m/s. If there is no air resistance, the ball hits the ground after:

(b) In the expression  $E = \frac{1}{2} C (L/T)^2$ ,  $L$  is measured in meters,  $t$  is measured in seconds and  $E$  is measured in (Newton . meter), what is the unit of the symbol  $C$ , and what does it physically represent?

- a) Newton.meter; it represents force
- b) Kg; it represents mass
- c) m/s; it represents speed
- d) m/s; it represents velocity
- e) None of the above

### Solution:

(a)

An object in free fall experiences an acceleration  $g$  of  $-9.81 \text{ m/s}^2$ . (The - sign indicates a downward acceleration.) Whether explicitly stated or not, the value of the acceleration in the kinematic equations is  $-9.8 \text{ m/s}^2$  for any freely falling object.

The kinetic equation is

$$y = y_0 + v_0 t + \frac{1}{2} a t^2$$

where

$y_0 = 50 \text{ m}$  is initial position

$v_0 = 10 \text{ m/s}$  is initial speed

$a = g = -9.81 \text{ m/s}^2$  is acceleration

At time  $t = ?$ , the position of a ball is  $y = 0$

Thus,

$$-\frac{1}{2} \cdot 9.81 \cdot t^2 + 10t + 50 = 0$$

The solutions of quadratic equation are:

$$t = -2.33217$$

$$t = 4.3709$$

We choose positive solution.

So, the ball hits the ground after  $t = 4.37 \text{ s}$ .

(b)

$$E = \frac{1}{2} C \left( \frac{L}{T} \right)^2$$

From this

$$C = \frac{2ET^2}{L^2} = \left[ \frac{N \cdot m \cdot s^2}{m^2} \right] = \left[ \frac{N \cdot s^2}{m} \right]$$

newton (N) = kg·m/s<sup>2</sup>

Thus,

$$C = \left[ \frac{kg \cdot m \cdot s^2}{m \cdot s^2} \right] = [kg]$$

**Answer.** (a) t = 4.37 s,

(b) b) Kg; it represents mass.