

## Answer of question #83099, Physics / Mechanics / Relativity

1. How long will it take to reach the ground of a stone of mass 5kg thrown from the top of a building of 64m height?
2. An object moving at speed of 20ms<sup>-1</sup> loses its speed by 3ms<sup>-2</sup>. How far does it travel before it stops?
3. A bullet after penetrating 3cm of a wall loses half of its speed. How far will the bullet penetrate the wall afterwards?
4. A bullet was fired horizontally from a tower with a velocity 980ms<sup>-1</sup> and it touched the ground after 2s. Find the height of the tower and the distance from the bottom of the tower to the point where the bullet touched the ground?
5. A football kicked making an angle 30° with ground at the velocity 40ms<sup>-1</sup>. Find the magnitude of velocity of the football after 2s

1.

### Input Data:

Mass:

$$m = 5\text{kg}$$

Height:

$$h = 64\text{m}$$

Gravity:

$$g = 9.8 \frac{\text{m}}{\text{s}^2}$$

### Solution:

Equation of motion:

$$h = \frac{gt^2}{2}$$

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 * 64}{9.8}} = 3.6\text{s}$$

### Answer:

3.6s

2.

**Input Data:**

Velocity:

$$V = 20\text{m/s}$$

Acceleration:

$$a = -3\frac{m}{s^2}$$

**Solution:**

Equation of motion:

$$s = \frac{at^2}{2}$$

Time:

$$t = \frac{V}{a}$$

Distance:

$$s = \frac{V^2}{2a} = \frac{400}{6} = 66.7\text{m}$$

**Answer:**

66.7m

3.

Kinetic energy at the time of speed reduction by 2 times:

$$E_k = \frac{mV^2}{2} - \frac{m\left(\frac{V}{2}\right)^2}{2} = \frac{3}{8}mV^2$$

Since all the kinetic energy turned into work, then:

$$E_k = A$$

$$A = F * s = m * a * s$$

$$\frac{3mV^2}{8} = m * a * s$$

Acceleration:

$$a = \frac{3V^2}{8s}$$

Residual way bullet:

$$s_1 = \frac{\left(\frac{V}{2}\right)^2}{2a} = \frac{s}{3} = 1cm$$

**Answer:**

Residual way bullet:

1cm

Full way bullet:

4cm

4.

**Input Data:**

Velocity:

$$V = 980m/s$$

Time:

$$t = 2s$$

Gravity:

$$g = 9.8 \frac{m}{s^2}$$

**Solution:**

Height:

$$h = \frac{gt^2}{2} = 9.8 * \frac{4}{2} = 19.6m$$

Distance:

$$S = Vt = 980 * 2 = 1960m$$

**Answer:**

Height: 19.6m

Distance: 1960m

5.

**Input Data:**

Velocity:

$$V = 40\text{m/s}$$

Angle:

$$\alpha = 30^\circ$$

Gravity:

$$g = 9.8 \frac{\text{m}}{\text{s}^2}$$

**Solution:**

x- component velocity:

$$V_x = V * \cos\alpha = 40 * 0.866 = 34.64$$

y- component velocity:

$$V_y = V * \sin\alpha - gt = 40 * 0.5 - 9.8 * 2 = 20 - 19.6 = 0.4\text{m/s}$$

magnitude of velocity:

$$V = \sqrt{V_x^2 + V_y^2} = 34.6\text{m/s}$$

**Answer:**

magnitude of velocity:  $34.6\text{m/s}$

and the ball will be at maximum height

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