Neglecting air resistance, if a ball thrown 4.5 m/s horizontally from a 94 m cliff, how far has the ball fallen after 2.7 seconds?

Solution:

Equation of motion of the ball along the X-axis:

$$S = V_x t + \frac{g_x t^2}{2}, g_x - \textit{ the projection of the gravitational acceleration on the X axis}$$

$$g_x = 0, V_x = V, \quad S = Vt = 4.5\frac{m}{s} * 2.7\ s = 12.15\ m$$

Equations of motion along the Y-axis:

$$h = V_y t + \frac{g_y t^2}{2}, g_y - \textit{ the projection of the gravitational acceleration on the Y axis}$$

$$g_y = g, V_y = 0, \quad h = \frac{gt^2}{2} = \frac{9.8\ \frac{m}{s^2} * 2.7\ s * 2.7\ s}{2} = 35.721\ m$$

The distance from the point of throwing by the Pythagorean theorem:

$$L = \sqrt{h^2 + S^2} = 37.73\ m$$

Distance above the ground: $k = H - h = 94\ m - 35.721\ m = 58.279\ m$

Answer: distance above the ground: k = 58.279 m;

distance from the point of throwing: L = 37.73 m;

height of ball fall: h = 35.721 m;

length of the path of the ball along the X axis: S = 12.15 m.