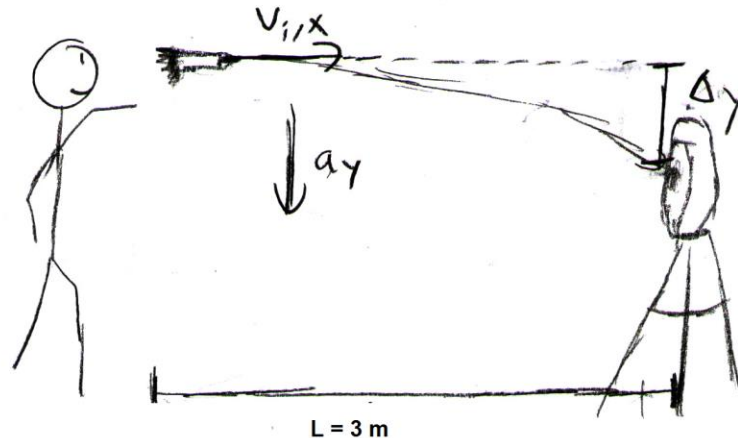


Answer on Question #63102, Physics / Mechanics | Relativity

A dart leaves the thrower's hand horizontally at a height of 1.9m above the ground. It strikes the board 3m away at a height of 1.5m above the ground. Calculate the horizontal velocity at which the dart left the thrower's hand

Solution:



Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only.

In projectile motion, the horizontal motion and the vertical motion are independent of each other; that is, neither motion affects the other.

The horizontal component of the velocity of the object remains unchanged throughout the motion. The vertical component of the velocity increases linearly, because the acceleration due to gravity is constant ($g=9.81 \text{ m/s}^2$).

Thus,

$$a_y = -g$$

Equations related to trajectory motion are given by

$$\text{Horizontal distance, } L = v_{ix} t$$

$$\text{Vertical distance, } y = y_0 + v_{iy} t - \frac{1}{2} g t^2$$

$$\Delta y = y_0 - y = 1.9 - 1.5 = 0.4 \text{ m}$$

$$v_{iy} = 0$$

Thus, time of flight is

$$t = \sqrt{\frac{2\Delta y}{g}} = \sqrt{\frac{2 \cdot 0.4}{9.81}} = 0.286 \text{ s}$$

From first equation,

$$v_{ix} = \frac{L}{t} = \frac{3}{0.286} = 10.5 \text{ m/s}$$

Answer: 10.5 m/s