

## Answer on Question #42942, Physics, Mechanics | Kinematics | Dynamics

A car traveling at 30 m/s on level ground runs off a cliff. It strikes the water below in 4.0 s. Determine the point where the car hits the water (include both horizontal and vertical displacements).

### Solution:

Given:

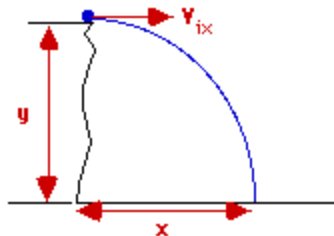
$$v_{0x} = 30 \text{ m/s,}$$

$$v_{0y} = 0 \text{ m/s,}$$

$$t = 4.0 \text{ s,}$$

$$x = ?,$$

$$y = ?$$



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 ( $g=9.81 \text{ m/s}^2$ ).

Equations related to trajectory motion are given by

$$\text{Horizontal distance, } x = v_{0x}t = 30 \cdot 4.0 = 120 \text{ m}$$

$$\text{Vertical distance, } y = -v_{0y}t + \frac{1}{2}gt^2$$

Thus,

$$y = -0 + \frac{1}{2} \cdot 9.81 \cdot 4^2 = 78.5 \text{ m}$$

**Answer:**  $x = 120 \text{ m, } y = 78.5 \text{ m.}$