Answer on Question #41410, Physics, Mechanics | Kinematics | Dynamics

A cannon is placed on the edge of a cliff that is 300 m tall. The barrel of the cannon is parallel to the ground below. If a cannonball leaves the barrel in a horizontal direction with a velocity of 115 m/sec how far out from the base of the cliff will the cannonball land?

Solution:

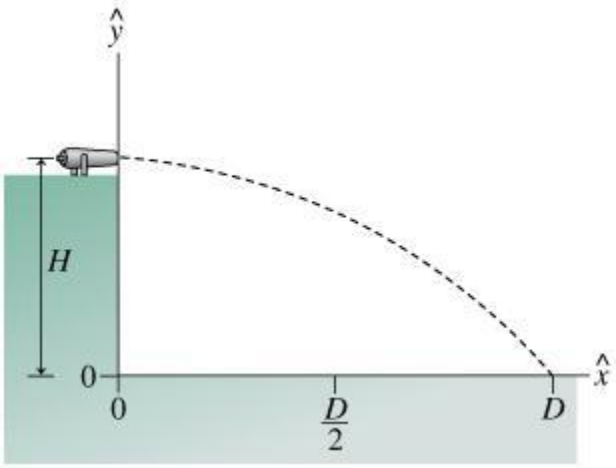
Given:

$y_0 = h = 300\ \text{m},$

$v_{0x} = 115\ \text{m/s},$

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

$d = ?$



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 m/s^2).

Equations related to trajectory motion are given by

$$\text{Horizontal distance,}\quad d = v_{0x}t$$

$$\text{Vertical distance,}\quad y = y_0 + v_{0y}t - \frac{1}{2}gt^2$$

At end of trajectory $y = 0$.

Thus,

$$0 = h + 0 \cdot t - \frac{1}{2}gt^2$$

$$h = \frac{1}{2}gt^2$$

$$t = \sqrt{\frac{2h}{g}}$$

So,

$$d = v_{0x}t = v_{0x}\sqrt{\frac{2h}{g}}$$

$$d = 115 \cdot \sqrt{\frac{2 \cdot 300}{9.81}} = 899.4 \approx 900 \text{ m}$$

Answer. $d = 899.4 \text{ m} \approx 900 \text{ m}$.