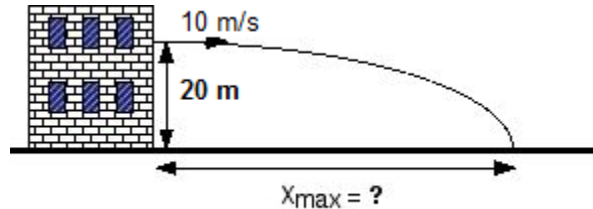


Answer on Question #45646, Physics, Mechanics | Kinematics | Dynamics

An object is thrown horizontally with a velocity of 10 m/s from the top of a 20-m high building. Where does the object strike the ground?

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

Equations related to trajectory motion are given by

$$\text{horizontal distance, } x_{max} = v_{0x}t$$

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

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, the range is

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

$$x_{max} = 10 \cdot \sqrt{\frac{2 \cdot 20}{9.81}} \approx 20.2 \text{ m}$$

Answer: $x_{max} = 20.2 \text{ m}$