Answer on Question #54684, Physics / Mechanics | Kinematics | Dynamics

A golf ball is hit with an initial angle of 31.5° with respect to the horizontal and an initial velocity of 80.7 mph. It lands a distance of 86.8 m away from where it was hit. By how much did the effects of wind resistance, spin, and so forth reduce the range of the golf ball from the ideal value?

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 m/s^2).

$$\text{Horizontal range,} \quad R = x_{max} = \frac{v_0^2 \sin 2\theta}{g}$$

where v_0 is the initial velocity.

1 Miles per Hour = 0.44704 Meters per Second.

Thus,

$$v_0 = 80.7 \text{ mph} = 80.7 * 0.44704 = 36.08 \text{ m/s}$$

The theoretical (ideal) horizontal range is

$$R = \frac{36.08^2 * \sin(2 * 31.5°)}{9.81} = 118.2 \text{ m}$$

The reducing of range of the golf ball is

$$\Delta R = 118.2 - 86.8 = 31.4 \text{ m}$$

Answer: 31.4 m