Answer on Question 79357, Physics, Other

Question:

A ball rolls off a horizontal table top with a speed of 1.7 m/s and strike the floor in 0.45 s. Compute the following:

a) The height of the table above the floor.

b) The speed of the ball when it strikes the floor.

Solution:

a) We can find the height of the table above the floor from the kinematic equation:

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

here, y is the height of the table above the floor, $v_{0y} = 0$ is the vertical component of the initial speed of the ball, $g = 9.8\ m/s^2$ is the acceleration due to gravity and t is the time.

Then, we get:

$$y = \frac{1}{2}gt^2 = \frac{1}{2} \cdot 9.8\ \frac{m}{s^2} \cdot (0.45\ s)^2 = 0.99\ m.$$

b) Let's first find the vertical component of the final speed of the ball:

$$v_{fy} = v_{0y} + gt = 9.8\ \frac{m}{s^2} \cdot 0.45\ s = 4.41\ \frac{m}{s}.$$

Finally, we can find the final speed of the ball when it strikes the floor from the Pythagorean theorem: $v_f = \sqrt{v_{fx}^2 + v_{fy}^2}$, here, $v_{fx} = 1.7\ m/s$ is the horizontal component of the final speed of the ball, $v_{fy} = 4.41\ m/s$ is the vertical component of the final speed of the ball.

Then, we get:

$$v_f = \sqrt{v_{fx}^2 + v_{fy}^2} = \sqrt{\left(1.7\ \frac{m}{s}\right)^2 + \left(4.41\ \frac{m}{s}\right)^2} = 4.72\ \frac{m}{s}.$$

Solution:

a) $y = 0.99\ m.$

b) $v_f = 4.72\ \frac{m}{s}.$