Answer on Question 80884, Physics, Other

Question:

A book is pushed off a desk with a horizontal velocity of 45 in/s. How far from the desk will the book land if the desk is 4.4 feet tall?

Solution:

Let's first find the time that the book takes to reach the floor from the kinematic equation:

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

here, $y = 4.4\ ft$ is the height of the desk, $v_{0y} = 0$ is the initial vertical velocity of the book, $g = 32\ ft/s^2$ is the acceleration due to gravity(we choose the downwards as the positive direction, therefore, the acceleration due to gravity will be positive) and t is the time that the book takes to reach the floor.

Then, we get:

$$y = \frac{1}{2}gt^2,$$

$$t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2 \cdot 4.4\ ft}{32\ \frac{ft}{s^2}}} = 0.52\ s.$$

Finally, we can find how far from the desk will the book land from the formula:

$$x = v_{0x}t,$$

here, x is the distance from the base of the desk, v_{0x} is the initial horizontal velocity of the book, t is time that the book takes to reach the floor.

Then, we get:

$$x = v_{0x}t = 45\ \frac{in}{s} \cdot 0.52\ s = 23.4\ in \cdot \frac{1\ ft}{12\ in} = 1.95\ ft.$$

Answer:

$x = 1.95\ ft.$