

Answer on Question #48668, Physics, Mechanics | Kinematics | Dynamics

A ball is rolls the top of stairs way with a horizontal velocity of magnitude 2m/s. The steps are 10cm high and 20 cm wide. If $g=10\text{m/s}^2$, then the ball hits first the edge of

A) 1st. B) 2nd. C) 3rd. E) 4th

Solution:

If the ball hits n th step, the horizontal and vertical distances traversed are nw and nh respectively.

$$w = 20 \text{ cm},$$

$$h = 10 \text{ cm}.$$

Let t be the time taken by the ball for this horizontal and vertical displacement.

$$x = nw = vt$$

$$y = nh = \frac{gt^2}{2}$$

From first equation

$$t = \frac{nw}{v}$$

From second equation

$$nh = \frac{g}{2} \left(\frac{nw}{v} \right)^2$$

The number of step is

$$n = \frac{2hv^2}{gw^2} = \frac{2 * 0.1 * 2^2}{10 * 0.2^2} = 2$$

Answer: B) 2nd.