

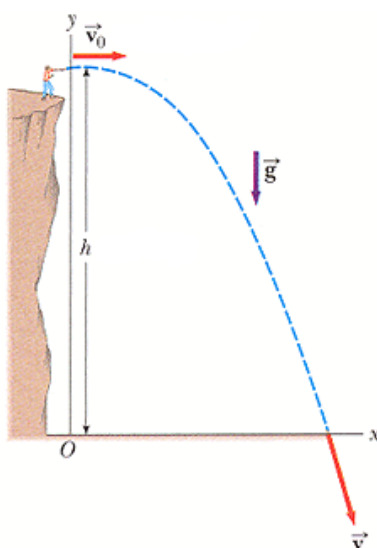
Answer on Question #63308, Physics / Mechanics | Relativity

A hiker throws a stone directly downward from a cliff with a speed of 10.0 m/sec. The stone travels 35.4 meters downward before hitting a rotten log. What is the speed of the stone just as it reaches the log? Assume there is negligible friction or drag force.

Select one:

- a. 28.2 m/sec
- b. 29.9 m/sec
- c. 24.4 m/sec
- d. 26.3 m/sec
- e. 33.3 m/sec

Solution:



Given:

$$y_0 = h = 35.4 \text{ m,}$$

$$v_{0x} = 10.0 \text{ m/s,}$$

$$v_{0y} = 0 \text{ m/s,}$$

$$v = ?$$

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 ($g=9.80 \text{ m/s}^2$).

The kinematic equation that describes an object's motion in vertical direction is:

$$v_y^2 = v_{0y}^2 + 2gh$$

Thus,

$$v_y = \sqrt{2gh} = \sqrt{2 \cdot 9.80 \cdot 35.4} = 26.34 \text{ m/s}$$

The horizontal component of velocity is 10.0 m/s and the vertical component of velocity is 26.34 m/s.

The final speed is

$$v = \sqrt{v_x^2 + v_y^2}$$

Thus,

$$v = \sqrt{10^2 + 26.34^2} = 28.2 \text{ m/s}$$

Answer: a. 28.2 m/sec

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