

Answer on Question #68289-Physics-Mechanics | Relativity

A football is kicked vertically upward from the ground and a student gazing out of the window sees it moving upward past her at 5.00 m/s. The window is 10.0 m above the ground.

- how high does the ball go above the ground?
- how long does it take to go from a height of 10m to its highest point?
- find its velocity and acceleration 1/2s after it left the ground.

Solution

a. at the height of the window:

$$u^2 - v^2 = 2gh$$

$$u = \sqrt{v^2 + 2gh}.$$

At the maximum height:

$$u^2 - 0^2 = 2gH$$

$$H = \frac{u^2}{2g} = \frac{v^2 + 2gh}{2g} = h + \frac{v^2}{2g} = 10.0 + \frac{1(5.00)^2}{2(9.81)} = 11.3 \text{ m}.$$

b.

$$t = \sqrt{\frac{2H}{g}} = \sqrt{\frac{2(11.3)}{9.81}} = 1.52 \text{ s}.$$

c. The velocity:

$$v' = u - gt = \sqrt{v^2 + 2gh} - gt = \sqrt{5^2 + 2(9.81)(10)} - (9.81)0.5 = 9.97 \frac{\text{m}}{\text{s}}.$$

The acceleration is $g = -9.81 \frac{\text{m}}{\text{s}^2}$.

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