Answer on Question #72469-Physics-Other

A ball is thrown upward from the ground. You observe the ball through a window on its way up, and notice that it was visible for 1.9 seconds while it travels from the bottom of the window to the top, which is a length of 51.71705 metres.

How much time does it take for the ball to be seen again, in seconds?

Solution

$$h = vt - \frac{gt^2}{2}.$$

$$h_1 = vt_1 - \frac{gt_1^2}{2}$$

$$h_2 = vt_2 - \frac{gt_2^2}{2}$$

$$h_2 - h_1 = v(t_2 - t_1) - \frac{g}{2}(t_2^2 - t_1^2)$$

$$v = \frac{h_2 - h_1}{t_2 - t_1} + \frac{g}{2}(t_1 + t_2)$$

At maximum height:

$$v - gT = 0, T = \frac{v}{g}.$$

$$T = \frac{1}{g}\frac{h_2 - h_1}{t_2 - t_1} + \frac{1}{2}(t_1 + t_2)$$

We need to find:

$$t' = 2(T - t_2) = 2\left(\frac{1}{g}\frac{h_2 - h_1}{t_2 - t_1} + \frac{1}{2}(t_1 + t_2) - t_2\right) = \frac{2}{g}\frac{h_2 - h_1}{t_2 - t_1} - (t_2 - t_1)$$

$$t' = \frac{2}{9.81}\frac{51.71705}{1.9} - 1.9 = 3.65 \text{ s}.$$

Answer: 3.65 s.