

Question #32443

A body is thrown vertically upward such that it crosses the same height after 2sec

and after 8 sec. What is the value of the mentioned height?

Solution:

Let:

$$t_1 = 2 \text{ sec}$$

$$t_2 = 8 \text{ sec}$$

$$h_1 = ?$$

For the body thrown vertically upwards

$$H = v_0 t - \frac{1}{2} g t^2$$

$$v = v_0 - g t$$

$$h_1 = v_0 t_1 - \frac{1}{2} g t_1^2$$

Where v_0 is the initial velocity g is the acceleration due to gravity

Such as the uprise time of the body from mentioned height to maximal height is equal to the slope time from the maximal height to mentioned height

$$t_{\text{maximal height}} = \frac{t_2 - t_1}{2} + t_1$$

$$t_{\text{maximal height}} = \frac{t_2 + t_1}{2}$$

Such as the velocity in highest point is equal to zero

$$v_0 = g t_{\text{maximal height}}$$

$$v_0 = g \frac{t_2 + t_1}{2}$$

According to this

$$h_1 = g \frac{t_2 + t_1}{2} t_1 - \frac{1}{2} g t_1^2$$

$$h_1 = 9.8 \frac{8+2}{2} 2 - \frac{1}{2} 9.8 * 2^2 = 78.4 \text{ m}$$

Answer: 78.4 m.