

Answer on Question # 69847, Physics / Mechanics | Relativity

Question. Standing at the base of one of the cliffs of Mt. Arapiles in Victoria, Australia, a hiker hears a rock break loose from a height of 105 m. He can't see the rock right away but then does, 1.50 s later.

- (a) How far above the hiker is the rock when he can see it?
(b) How much time does he have to move before the rock hits his head?

Given.

$$H = 105 \text{ m};$$

$$t_1 = 1.50 \text{ s};$$

$$g = 9.81 \text{ m/s}^2.$$

Find.

$$h;$$

$$t_m.$$

Solution.

Kinematic equation for the rock in free-fall is

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

Therefore, we have

$$y = \frac{gt_1^2}{2};$$

$$h = H - y = H - \frac{gt_1^2}{2} = 105 - \frac{9.81 \cdot 1.5^2}{2} = 94 \text{ m}.$$

The time that he has to move before the rock hits his head

$$t_m = t - t_1,$$

where

$$H = \frac{gt^2}{2} \rightarrow t = \sqrt{\frac{2H}{g}}.$$

Finally

$$t_m = \sqrt{\frac{2H}{g}} - t_1 = \sqrt{\frac{2 \cdot 105}{9.81}} - 1.50 = 3.13 \text{ s}.$$

Answer. $h = 94 \text{ m}; t_m = 3.13 \text{ s}.$

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