Answer on Question 62462, Physics – Mechanics | Relativity

Question:

Billy, a mountain goat, is rock climbing on his favorite slope one sunny spring morning when a rock comes hurtling toward him from a ledge $40.0\,m$ above. Fortunately, Billy ducks and avoids injury.

a) How fast is the rock traveling when it passes Billy?

Solution:

We can find the final velocity of the rock from the kinematic equation:

$$v_f^2 = v_i^2 + 2ah,$$

here, $v_i = 0\ \frac{m}{s}$ is the initial velocity of the rock, $a = g = 9.8\ \frac{m}{s^2}$ is the acceleration due to gravity (we take the downwards to be the positive direction, thus the acceleration due to gravity will be positive) and h is the height.

Then, we can calculate the final velocity of the rock (when it passes Billy):

$$v_f = \sqrt{2gh} = \sqrt{2 \cdot 9.8\ \frac{m}{s^2} \cdot 40.0\ m} = 28\ \frac{m}{s}.$$

Answer:

a) $v_f = 28\ \frac{m}{s}$.