Question #65279, Physics / Mechanics | Relativity

A car driver travelling at 90km/h, notices that he is heading directly to a cliff when he is 20m away from the edge. He applies the brakes and experiences a backward acceleration of 8.0 m/s2, but it's not enough. The car goes off the cliff, if the cliff is 12m high, how far is the car traveling horizontally until it lands?

$v_0 = 90\frac{km}{h} = 25\frac{m}{s}$

$s = 20\ m$

$a = 8\ m/s^2$

$h = 12\ m$

$x = ?$

The answer to the question.

Equations of uniformly accelerated motion:

$$\begin{cases} v = v_0 - at \\ s = v_0 t - \frac{at^2}{2}; \end{cases}$$

We find the movement time:

$$\frac{at^2}{2} - v_0 t + s = 0$$

$$\frac{8t^2}{2} - 25t + 20 = 0$$

$$4t^2 - 25t + 20 = 0$$

$t = \frac{25-17.5}{8} = 0.9s;$

The second root of the equation does not satisfy the condition of the problem.

$v = 25 - 7.5 = 17.5\frac{m}{s};$

Consider the uniformly accelerated drop *h*.

$h = \frac{g{t_1}^2}{2};$ hence $t_1 = \sqrt{\frac{2h}{g}} = \sqrt{\frac{24\ m}{9.8\ m/s^2}} = 1.6\ s$

$x = v\ \ t = 17.5\frac{m}{s} \cdot 1.6\ s = 27.4\ m$

Answer: *the car traveling horizontally until it lands* $x = 27.4\ m$.