Answer on Question #43269, Physics, Other

A car accelerates from rest at constant rate of 2 ms^{-2} for some time. Then it retards at a constant rate of 4 ms^{-2} and comes to rest. Calculate the maximum speed attained by the car if it remains in motion for 3 seconds.

Solution:

Given:

$a_1 = 2\ \text{m/s}^2,$

$a_2 = -4\ \text{m/s}^2,$

$t = 3\ \text{s},$

$v = ?,$

For the first period of motion the acceleration is

$$a_1 = \frac{v - v_0}{t_1} = \frac{v}{t_1}$$

$$t_1 = \frac{v}{a_1}$$

For the second period of motion the acceleration is

$$a_2 = \frac{0 - v}{t_2} = -\frac{v}{t_2}$$

$$t_2 = \frac{-v}{a_2}$$

From given

$$t = t_1 + t_2 = \frac{v}{a_1} - \frac{v}{a_2} = v\left(\frac{1}{a_1} - \frac{1}{a_2}\right)$$

Thus,

$$v = \frac{t}{\left(\dfrac{1}{a_1} - \dfrac{1}{a_2}\right)}$$

$$v = \frac{3}{\dfrac{1}{2} + \dfrac{1}{4}} = 4\ \text{m/s}$$

Answer: $v = 4\ \text{m/s}.$