Question#20663

the motors of an electric train can give it an acceleration of 1 m/s2 and the brakes can give a negative acceleration of 3m/s2. find the shortest time interval in which the train can make a journey between two stations 1210m apart .

Solution:

Let:

$S = 1210\ m$

$a_1 = 1\ m/s^2$

$a_2 = 3\ m/s^2$

$t-?$

$S = S_1 + S_2$

Were:

S_1 is the distance of moving with the positive acceleration

S_2 is the distance of moving with the negative acceleration

Such as:

$$\frac{S_1}{S_2} = \frac{a_1}{a_2} = \frac{1}{3}$$

$$S_1 = \frac{3}{4}S,\ S_2 = \frac{1}{4}S$$

$$S_1 = \frac{1}{2}a_1{t_1}^2$$

$$S_2 = -\frac{1}{2}a_2{t_2}^2$$

Were:

t_1, t_2

Are the times of moving with the positive and negative accelerations respectively.

$t = t_1, +t_2$

$$\boldsymbol{t = \sqrt{\frac{2\,S_1}{a_1}} + \sqrt{\frac{2S_2}{a_2}}}$$

$$t = \sqrt{\frac{3S}{2a_1}} + \sqrt{\frac{S}{2a_2}}$$

$$t = \sqrt{\frac{3*1210}{2*1}} + \sqrt{\frac{1*1210}{2*3}} = 56.8\,s$$

Answer: 56,8 s.