Final Velocity

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1 Problem

Here's one more example. Say you're in your rocket ship, happily speeding along at some 3.25 kilometers per second (about 7,280 miles per hour) when you see a sign: Speed Zone 215 km Ahead — New Speed Limit: 3.0 km/s. You jam on the brakes (which are a retro rocket in the front of the rocket ship). The retro rocket is capable of accelerating your ship at –10.0 meters/second2. It's a tense moment. Will you get your speed down to below 3.0 kilometers per second in 215 kilometers of acceleration?

Holzner, Steven. Physics I For Dummies (For Dummies (Math & Science)) (pp. 49-50). Wiley. Kindle Edition.

2 Solution

$$v_i = 3.25km/s$$

$$v_f = 3.0km/s$$

$$a = -10m/s^2$$

$$s = 215km$$

$$\bar{v} = \frac{v_i + v_f}{2}$$

$$a = \frac{\triangle v}{\triangle t}$$

$$a = \frac{\frac{3km}{1s} - \frac{3.25km}{1s}}{t}$$

$$-\frac{10m}{1s^2} = \frac{\frac{-.25km}{1s}}{t}$$

$$-\frac{10m}{1s^2} = \frac{-.25km}{t * 1s}$$
$$-\frac{10m}{1s} = \frac{-.25km}{t}$$
$$t = 25s$$
$$\bar{v} = \frac{3125m/s + 3000m/s}{2}$$
$$\bar{v} = 3125m/s$$
$$total\ distance\ required = 3125m/s * 2.5s = 7812.5m$$

7812.5 m is drastically less than 250km so there should be no problem in reaching the speed limit.