

Question #46581 – Physics – Mechanics | Kinematics | Dynamics

High-speed test vehicle is brought to rest by throwing out a drag chute behind it, causing a constant acceleration of -13 m/s^2 . The vehicle has a velocity of 56 m/s when the chute is deployed. What is the minimum length of track needed for this process?

Solution:

The vehicle moves with constant acceleration in a straight line.

Equations of motion:

Displacement and Acceleration:

$$d = v_0 t + \frac{at^2}{2}$$

Velocity and Acceleration:

$$v = v_0 + at$$

Where:

$$v_0 = 56 \text{ m/s}$$

$$a = -13 \text{ m/s}^2$$

To find the distance, we find the time which the vehicle was moving

When the vehicle stops speed becomes equal to 0, so $v = 0$

$$0 = 56 - 13t$$

$$t = \frac{56}{13} \text{ s} = 4.31 \text{ s}$$

$$d = 56 \cdot 4.31 - \frac{13 \cdot 4.31^2}{2} = 120.6 \text{ m}$$

Answer: the minimum track length should be 121 m.