

While passing a slower car on the highway, you accelerate uniformly from 17.4 m/s to 27.3 m/s in a time of 10.0 s. How far do you travel during this time? What is your acceleration magnitude?

Solution.

The conditions are

$$v_0 = 17.4 \text{ m/s}$$

$$v_f(t_f) = 27.3 \text{ m/s}$$

$$t_f = 10.0 \text{ s}$$

Laws of motion are

$$s(t) = v_0 t + \frac{at^2}{2}$$

$$v(t) = v_0 + at$$

Where $v(t)$ is velocity of car, a is acceleration of car, $s(t)$ is path which travel car during time t ,

v_0 is initial velocity.

From hence

$$a = \frac{v_f(t_f) - v_0}{t_f} = \frac{(27.3 - 17.4) \text{ m/s}}{10 \text{ s}} = 0.99 \frac{\text{m}}{\text{s}^2}$$

$$s(t_f) = v_0 t_f + \frac{at_f^2}{2} = 17.4 \frac{\text{m}}{\text{s}} \cdot 10 \text{ s} + 0.99 \frac{\text{m}}{\text{s}^2} \cdot \frac{(10 \text{ s})^2}{2} = 223.5 \text{ m}$$

Answer

$$a = 0.99 \frac{\text{m}}{\text{s}^2}$$

$$s(t_f) = 223.5 \text{ m}$$