Answer on Question # 71584, Physics / Mechanics | Relativity

Question

1. Ahmad is driving North on Highway 69 at 90 km/h and sees a large moose on the road. He quickly slams on his brakes, but his reaction time is 0.85 s (as he sees the moose, thinks about his response, and then presses the brake pedal). He presses the brake for 3.5 s and comes to a stop just in time.

a) Find the distance travelled after seeing the moose and before pressing the brake.

b) Find the total distance he travelled before coming to a stop.

c) Find the average acceleration once he presses the brake.

Solution.

a) Find the distance travelled after seeing the moose and before pressing the brake, x_1. Use the formula for distance at constant velocity

$$x_1 = v_0 t$$

Plug $v_0 = 90\text{km/h}$ and $t = 0.85\text{s}$

$$x_1 = v_0 t = 90\text{km/h} \times 0.85\text{s}$$

Since the units are mixed, we need to convert everything into SI units of meters and seconds.

$$x_1 = 90 \frac{\text{km}}{\text{h}} \times \frac{1000\text{ m}}{1\text{ km}} \times \frac{1\text{ h}}{3600\text{ s}} \times 0.85\text{s} = 25\text{ m/s} \times 0.85\text{s} = 21.25\text{ m}$$

b) Find the distance from the beginning of the braking to the stop, x_2. Use the formula for distance at constant acceleration

$$x_2 = \bar{v} t$$

where

$$\bar{v} = \frac{v_0 + v}{2}$$

is the average velocity, that is average of the initial and final velocities. Since $v_0 = 90\text{ km/h} = 25\text{ m/s}$ and $v = 0\text{ m/s}$ we get

$$\bar{v} = \frac{25 + 0}{2} = 12.5\text{ m/s}$$

Now we find x_2 plugging $\bar{v} = 12.5\text{ m/s}$ and $t = 3.5\text{s}$

$$x_2 = \bar{v} t = 12.5\text{ m/s} \times 3.5\text{s} = 43.75\text{ m}$$

Find the total distance he travelled before coming to a stop

$$x = x_1 + x_2 = 21.25\text{ m} + 43.75\text{ m} = 65\text{ m}$$

c) Find the average acceleration once he presses the brake. Use the formula for average acceleration

$$\bar{a} = \frac{v_f - v_0}{\Delta t}$$

where v_f is the final velocity, $v_f = 0$, v_0 is the initial velocity, Δt is a time from the beginning of the braking to the stop, $\Delta t = 3.5\text{s}$. Plugging these numbers, we obtain

$$\bar{a} = \frac{0 - 25}{3.5} = -\frac{50}{7} = -7.14 \ \text{m/s}^2$$

Answer.

a) The distance travelled after seeing the moose and before pressing the brake is 21.25 m.

b) The total distance he travelled before coming to a stop is 65 m.

c) The average acceleration once he presses the brake is $\bar{a} = -7.14 \ \text{m/s}^2$.