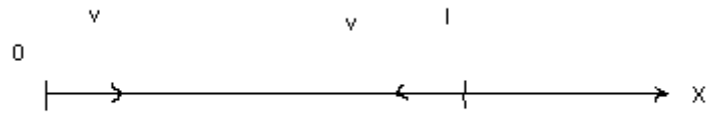
Question

You are arguing over a cell phone while trailing an unmarked police car by 26.0 m; both your car and the police car are traveling at 120 km/h. Your argument diverts your attention from the police car for 2.0 s (long enough for you to look at the phone and yell, "I won't do that!"). At the beginning of that 2.0 s, the police officer begins braking suddenly at 5.20 m/s^2. (a) What is the separation between the two cars when your attention finally returns? Suppose that you take another 0.500 s to realize your danger and begin braking. (b) If you too brake at 5.20 m/s^2, what is your speed when you hit the police car?

Solution

a) $l = 26$ m; $v_{01} = v_{02} = v = 120$ km/h ≈ 33.333 m/s; $t = 2$ s, $a_1 = 0$; $a_2 = a = 5.2$ m/s^2.



Our car: $x_1 = v_{01}t = vt$.

Police car: $x_2 = l - v_{02}t + a_2t^2/2 = l - vt + at^2/2$.

The separation between the two cars: $\Delta x = x_2 - x_1 = l - 2vt + at^2/2 = -96.932$ m.

It means that cars hit before end of 2 s. **Answer: Δx = 0.**

b) The speed of our car is **33.333 m/s**, because we can't return our attention (cars hit before end of 2 s). **Answer: $v = v_{01} = 120$ km/h ≈ 33.333 m/s.**

P.S. I guess condition of the problem contain mistake. I think initial separation between the two cars is bigger. Please check it and if you want write me back, I'll do it again.