

Constant acceleration warm-up problems

Physics 271, Recitation #1, Fall 2017

1. The brakes on your car can slow you at a rate of 5.2 m/s^2 . If you are going 137 km/h and suddenly see a state trooper, what is the minimum time in which you can get your car under the $90. \text{ km/h}$ speed limit?
2. A certain elevator cab has a maximum speed of 5.08 m/s , and it accelerates from rest and then back to rest at 1.22 m/s^2 . How far does the cab move while accelerating to full speed from rest?
3. An electron with initial velocity $v_0 = 1.50 \times 10^5 \text{ m/s}$ enters a region of length $L = 1.00 \times 10^{-2} \text{ m}$. where it is electrically accelerated. It emerges with $v = 5.70 \times 10^6 \text{ m/s}$. What is the acceleration, assumed constant?
4. A car traveling 15.6 m/s is 24.0 m from a barrier when the driver slams on the brakes. The car hits the barrier 2.00 s later. (a) What is the magnitude of the car's constant acceleration before impact? (b) How fast is the car traveling just before impact?
5. Go back to the elevator cab in problem 2. How long does it take to make its nonstop 190 m run, starting and ending at rest?
6. You are driving along a straight road at $30. \text{ m/s}$. At the moment you pass a police car pulled over at the side of the road, it starts to accelerate at 5.2 m/s^2 . How far do you travel before it catches up with you?
7. A hot-air balloon is ascending at the rate of 12 m/s and is 80 m above the ground when a package is dropped over the side.
(a) How long does the package take to reach the ground?
(b) With what speed does it hit the ground?
8. A stone is dropped into a river from a bridge 43.9 m above the water. Another stone is thrown vertically down 1.00 s after the first is dropped. The stones strike the water at the same time. What is the initial speed of the second stone?

*most of these are adapted from Halliday Resnick and Walker 10th ed Chapter 2.