

Physics 4A: Assignment 1

Winter 2020

1. A car starts moving along a straight track from rest, initially with acceleration $a = 5.0 \text{ m/s}^2$, then the car moves with constant velocity, and finally, it decelerates at the same rate a until it comes to a stop. The car is in motion for a total time of $t = 25 \text{ s}$. The average velocity during that time is $v_{\text{avg}} = 72 \text{ km/h}$. For how long does the car move with constant velocity?
2. A lithium atom starts from rest at a position $x = x_0$ and falls toward zinc atom with an acceleration that depends on their separation as

$$a(x) = \frac{4\epsilon}{m} \left(12 \frac{\sigma^{12}}{x^{13}} - 6 \frac{\sigma^6}{x^7} \right) ,$$

where ϵ , m , and σ are positive constants, and the zinc atom stays fixed at position $x = 0$. Assume that $x_0 > 2^{1/6}\sigma$.

- (a) Find an expression for how the ~~velocity~~ speed of the moving lithium atom depends on x . (It will also depend on ϵ , m , x_0 , and σ .)¹
- (b) What is the distance of closest approach of the the two atoms (in terms of σ and x_0)?

¹The direction of the velocity could be toward or away from the atom at any valid position depending on the time.