

36. (a) The initial direction of motion is taken to be the $+x$ direction (this is also the direction of \vec{E}). We use $v_f^2 - v_i^2 = 2a\Delta x$ with $v_f = 0$ and $\vec{a} = \vec{F}/m = -e\vec{E}/m_e$ to solve for distance Δx :

$$\Delta x = \frac{-v_i^2}{2a} = \frac{-m_e v_i^2}{-2eE} = \frac{-(9.11 \times 10^{-31} \text{ kg})(5.00 \times 10^6 \text{ m/s})^2}{-2(1.60 \times 10^{-19} \text{ C})(1.00 \times 10^3 \text{ N/C})} = 7.12 \times 10^{-2} \text{ m} .$$

- (b) Eq. 2-17 leads to

$$t = \frac{\Delta x}{v_{\text{avg}}} = \frac{2\Delta x}{v_i} = \frac{2(7.12 \times 10^{-2} \text{ m})}{5.00 \times 10^6 \text{ m/s}} = 2.85 \times 10^{-8} \text{ s} .$$

- (c) Using $\Delta v^2 = 2a\Delta x$ with the new value of Δx , we find

$$\begin{aligned} \frac{\Delta K}{K_i} &= \frac{\Delta(\frac{1}{2}m_e v^2)}{\frac{1}{2}m_e v_i^2} = \frac{\Delta v^2}{v_i^2} = \frac{2a\Delta x}{v_i^2} = \frac{-2eE\Delta x}{m_e v_i^2} \\ &= \frac{-2(1.60 \times 10^{-19} \text{ C})(1.00 \times 10^3 \text{ N/C})(8.00 \times 10^{-3} \text{ m})}{(9.11 \times 10^{-31} \text{ kg})(5.00 \times 10^6 \text{ m/s})^2} = -11.2\% . \end{aligned}$$