

Physics 102
Quiz # 5
Chapters 22&23

Name: Solution

Id: _____

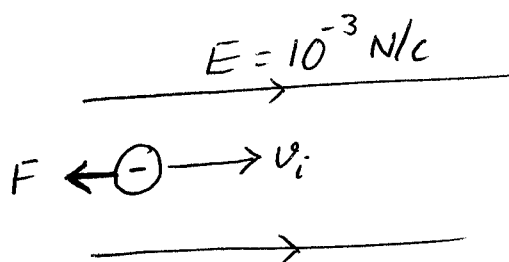
Sec. #: _____

An electron, traveling with initial velocity of 5×10^8 cm/s towards east, enters a region of a uniform electric field. The magnitude of the electric field is $E = 1.0 \times 10^3$ N/C and its direction is towards east. Determine the distance that the electron travels before stopping momentarily.

The electric force on the electron is

$$\vec{F} = q\vec{E} = -e\vec{E}$$

$$\Rightarrow m\vec{a} = -e\vec{E}$$



Thus

$$\vec{a} = -\frac{e}{m}\vec{E}$$

electron will decelerate since the direction of force is opposite to its motion

The distance x can be found from

$$v_f^2 = v_i^2 + 2ax$$

$$v_f = 0 \quad ; \quad v_i = 5 \times 10^6 \text{ m/s} \quad ; \quad a = -\frac{eE}{m}$$

$$\Rightarrow x = \frac{v_i^2}{2a} = \frac{mv_i^2}{2eE} = \frac{9.11 \times 10^{-31} \times (5 \times 10^6)^2}{2 \times 1.6 \times 10^{-19} \times 1 \times 10^3}$$

$$\Rightarrow x = 7.12 \times 10^{-2} \text{ m} \approx 7.1 \text{ cm}$$