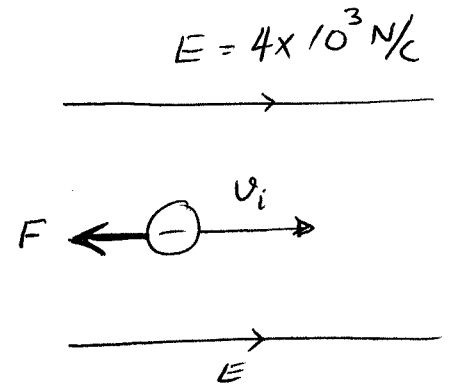
Physics 102
Quiz # 5
Chapters 22&23

Name : Solution Id : Sec. # :

An electron, traveling with initial velocity 10^5 m/s towards east, enters a region of a uniform electric field. The magnitude of the electric field is E = 4.0×10^3 N/C and its direction is towards east. Determine the time it takes the electron to come to rest momentarily.

The electric force on the electron is

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



But

$$\vec{F} = m\vec{a}$$

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

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

"electron will decelerate"

The time can be found from

$$v_f = v_i + at$$

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

$$\Rightarrow \quad 0 = v_i - \frac{eE}{m}t$$

$$\Rightarrow \quad t = \frac{m v_i}{eE} = \frac{9.11\times10^{-31}\times10^5}{1.6\times10^{-19}\times4\times10^3}$$

$$\Rightarrow \boxed{t = 1.4\times10^{-10}\text{ s}}$$