Answer on Question #65229-Physics-Other

An electron (mass 9.1x10^-31kg) is projected between the plates of an oscilloscope (length of 3.8x10^-2m) with an initial velocity of 1.8 x 10^7 m/s parallel to the plates. Then uniform electric field between the plates is 2.0x10^4 N/C upward.

a. What is the acceleration (magnitude and direction) of the electron between the plates?

b. How long does it take to go through the plates?

c. How far has it dropped or risen (specify which) when it leaves the plates.

Solution

a.

$$ma = eU$$

$$a = \frac{eU}{m} = \frac{(1.6 \cdot 10^{-19})(2.0 \cdot 10^{4})}{(9.1 \cdot 10^{-31})} = 3.5 \cdot 10^{15} \frac{m}{s^2}.$$

b.

$$t = \frac{d}{v_x} = \frac{3.8 \cdot 10^{-2}}{1.8 \cdot 10^{7}} = 2.1 \cdot 10^{-9} s$$

c. . Then uniform electric field between the plates is upward. Thus, the electron has dropped.

$$h = \frac{at^2}{2} = \frac{(3.5 \cdot 10^{15})(2.1 \cdot 10^{-9})^2}{2} = 7.7 \cdot 10^{-3} m.$$