

### Answer on Question #55896, Physics / Electromagnetism

**Task:** A uniform electric field of 200 N/C is in the x-direction. A point charge of  $3\mu\text{C}$  is released from rest at the origin. What is the kinetic energy of the charge when it is at  $x = 4\text{ m}$ ?

2.4×10<sup>-2</sup>J

1.6×10<sup>-2</sup>J

3.6×10<sup>-2</sup>J

4.8×10<sup>-2</sup>J

**Solution:**

Force on charge:  $F = Eq$

This force is constant and will increase charge's velocity with constant acceleration.

By the Second Newton's law:  $F = ma \rightarrow a = F/m = Eq/m$

Thus, time needed to reach  $x$ :  $x = \frac{at^2}{2} \Rightarrow t = \sqrt{\frac{2x}{a}} = \sqrt{\frac{2xm}{Eq}}$

Charge velocity at  $x$ :  $v = at = \frac{Eq}{m} \sqrt{\frac{2xm}{Eq}} = \sqrt{\frac{2xEq}{m}}$

And kinetic energy:  $K = \frac{mv^2}{2} = \frac{m}{2} \frac{2xEq}{m} = Exq = 200\text{ N/C} \cdot 3 \cdot 10^{-6}\text{ C} \cdot 4\text{ m} = 2.4 \cdot 10^{-3}\text{ J}$

**Answer:** kinetic energy of the charge  $K = 2.4 \cdot 10^{-3}\text{ J}$