Answer on Question #45702 – Physics, Other

A uniform electric field of 200 N/C is in the x-direction. A point charge of 3μC is released from rest at the origin. What is the kinetic energy of the charge when it is at x = 4 m?

Force on charge:

$$F = Eq$$

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

By the Second Newton's law:

$$F = ma \rightarrow a = \frac{F}{m} = \frac{Eq}{m}$$

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:

$$K = \frac{mv^2}{2} = \frac{m}{2}\frac{2xEq}{m} = Eqx$$

$$K = 200\frac{N}{C} \cdot 3 \cdot 10^{-6}C \cdot 4m = 2.4 \cdot 10^{-3}J$$

Answer: kinetic energy of the charge:

$$\boldsymbol{K = 2.4 \cdot 10^{-3}J}$$