What is the path of a charge moving in an electric field perpendicular to it?

Solution

The particle has an initial velocity V_0 perpendicular to an electric field E.

$$\overrightarrow{V_0} = \begin{pmatrix} V_0 \\ 0 \end{pmatrix}, \vec{E} = \begin{pmatrix} 0 \\ E \end{pmatrix}.$$

In x – direction it moves uniformly:

$$x = V_0 t.$$

In y – direction it accelerated by electric force:

$$F_{el} = qE = ma,$$

where q is charge, m is mass of charged particle, a is an acceleration.

So

$$a = \frac{qE}{m} = const.$$

$$y = \frac{at^2}{2} = \frac{qE}{2m} t^2.$$

Now we have the equation f moving:

$$y * \frac{2m}{qE} = \left(\frac{x}{V_0}\right)^2 \rightarrow y = \frac{qE}{2mV_0^2} * x^2,$$

which is the parabolic equation. Now we know that the path of a charge moving in an electric field perpendicular to it is parabola.

Answer: parabola.