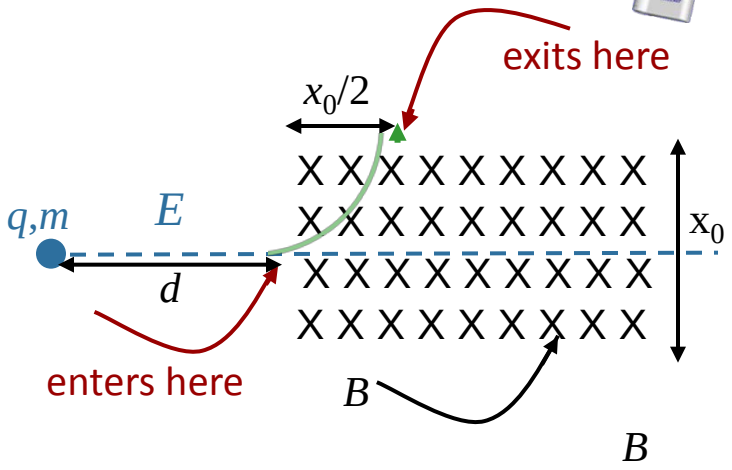
Calculation

A particle of charge q and mass m is accelerated from rest by an electric field E through a distance d and enters and exits a region containing a constant magnetic field B at the points shown. Assume q,m,E,d, and x_0 are known.



What is B?

$$v_o = \sqrt{\frac{2qEd}{m}} \qquad R = \tfrac{1}{2}x_0$$

$$B = \frac{2}{x_o}\sqrt{\frac{2mEd}{q}}$$ A

$$B = \frac{E}{v}$$ B

$$B = E\sqrt{\frac{m}{2qEd}}$$ C

$$B = \frac{1}{x_o}\sqrt{\frac{2mEd}{q}}$$ D

$$B = \frac{mv_o}{qx_o}$$ E

Why?

$$\vec{F} = m\vec{a} \rightarrow qv_oB = m\frac{v_o^2}{R} \rightarrow B = \frac{m}{q}\frac{v_o}{R} \rightarrow B = \frac{m}{q}\frac{2}{x_o}\sqrt{\frac{2qEd}{m}}$$

$$B = \frac{2}{x_o}\sqrt{\frac{2mEd}{q}}$$