An electron travels with velocity < 2e5, 0, 0 > m/s. It enters a region in which there is a uniform magnetic field of < 0, 0.9, 0 > T.

What is the magnetic force on the electron?

$\vec{F}_B =$ [ ] N

Despite the magnetic force, the electron continues to travel in a straight line at constant speed. You conclude that there must be another force acting on the electron. Since you know there is also an electric field in this region, you decide that the other force must be an electric force. What is this electric force?

$\vec{F}_E =$ [ ] N

What is the electric field in this region that is responsible for the electric force?

$\vec{E} =$ [ ] N/C

Part One

$$\vec{F}_B = q\vec{v} \times \vec{B}$$

$$\begin{vmatrix} 2e5 & C & 0 \\ 0 & 0.9 & 0 \end{vmatrix}$$

$$= q\langle 0, 0, 180e3 \rangle$$

$$= -1.67e{-}19\langle 0, 0, 180e3 \rangle$$

$$= \langle 0, 0, -28.8e{-}15 \rangle \text{ N}$$

Part Two

$$\vec{F}_E = -\vec{F}_B$$

$$= \langle 0, 0, 28.8e{-}5 \rangle \text{ N}$$

Part Three

$$|\vec{E}| = \frac{\vec{F}}{q}$$

$$= 180e3 \text{ N/C}$$

$$\vec{E} = \langle 0, 0, -180e3 \rangle \text{ V/c}$$

A proton traveling with speed 2×10^5 m/s in the -z direction passes through a region in which there is a uniform magnetic field of magnitude 0.7 T in the -x direction.

You want to keep the proton traveling in a straight line at constant speed. To do this, you can turn on an apparatus that can create a uniform electric field throughout the region.

What electric field should you apply?
magnitude: $|\vec{E}|$ = [ ] V/m
direction: [---Select---]

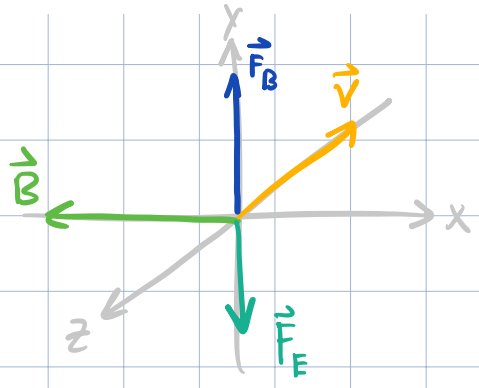
$$F_E = F_B$$

$$|\vec{E}|q = q\vec{v} \times \vec{B}$$

$$|\vec{E}| = |\vec{v}||\vec{B}|\sin(90)$$

$$= 140e3 \text{ V/m}$$

$$\vec{E} = \langle 0, -140e3, 0 \rangle \text{ V/m}$$



A proton moves at constant velocity in the +y direction, through a region in which there is an electric field and a magnetic field. The electric field is in the +x direction, and has magnitude 600 V/m. The magnetic field is in the -z direction, and has magnitude 0.35 T.

What is the magnitude of the net force on the proton?
F_{net} = [ ] N
What is the speed of the proton?
v = [ ] m/s

$$\vec{F}_{net\,x} = \vec{F}_{E\,x} - \vec{F}_{B\,x}$$

$$0 = |\vec{E}|q - q|\vec{v}||\vec{B}|\sin(90)$$

$$|\vec{E}| = |\vec{v}||\vec{B}|$$

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

$$= 1.714e3 \text{ m/s}$$