

4. (a) The force on the electron is

$$\begin{aligned}\vec{F}_B &= q\vec{v} \times \vec{B} = q(v_x\hat{i} + v_y\hat{j}) \times (B_x\hat{i} + B_y\hat{j}) \\ &= q(v_xB_y - v_yB_x)\hat{k} \\ &= (-1.6 \times 10^{-19} \text{ C})[(2.0 \times 10^6 \text{ m/s})(-0.15 \text{ T}) - (3.0 \times 10^6 \text{ m/s})(0.030 \text{ T})] \\ &= (6.2 \times 10^{-14} \text{ N}) \hat{k} \text{ .}\end{aligned}$$

Thus, the magnitude of \vec{F}_B is $6.2 \times 10^{-14} \text{ N}$, and \vec{F}_B points in the positive z direction.

- (b) This amounts to repeating the above computation with a change in the sign in the charge. Thus, \vec{F}_B has the same magnitude but points in the negative z direction.