

57. Since the velocity is constant, the net force on the proton vanishes. Using Eq. 29-2 and Eq. 23-28, we obtain the requirement (Eq. 29-7) for the proton's speed in terms of the crossed fields:

$$v = \frac{E}{B} \implies E = (50 \text{ m/s})(0.0020 \text{ T}) = 0.10 \text{ V/m} .$$

By the right-hand rule, the magnetic force points in the \hat{k} direction. To cancel this, the electric force must be in the $-\hat{k}$ direction. Since $q > 0$ for the proton, we conclude $\vec{E} = -0.10 \text{ V/m } \hat{k}$.