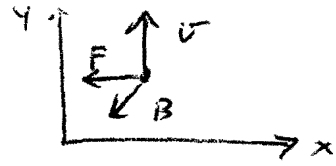
20. RQ. 27

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



$\vec{v} \times \vec{B}$ is in the $+x$ direction, but $q = -e$ so the force is in the $-x$ direction

$|\vec{F}| = evB = (1.6 \times 10^{-19} C)(2 \times 10^{7} m/s)(3.5 T) = 1.1 \times 10^{-11} N$

20. RQ. 28

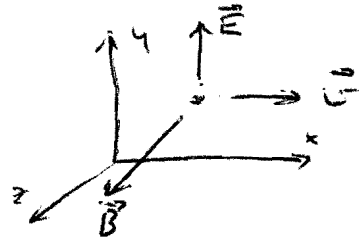
$\vec{F}_{elec} = q\vec{E}$ in $+y$ direction

for $\vec{F}_{net}$ to be zero, $\vec{F}_{mag}$ must be opposite to $\vec{F}_{elec}$ ($-y$ direction)

$\Rightarrow \vec{B}$ must be in $+z$ direction ($\vec{v} \times \vec{B}$ in $-y$ direction)

$|\vec{F}_{elec}| = |\vec{F}_{mag}| \Rightarrow qE = qvB$

$B = E/v$



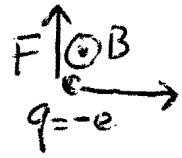
20 P. 43

(a) The magnetic field at C due to the straight sections is zero.

For a circular arc, $B = \frac{\mu_0 I}{2r}$

$B_{net} = \frac{1}{4}\left(\frac{\mu_0 I}{2a}\right) - \frac{1}{4}\left(\frac{\mu_0 I}{2b}\right) = \frac{\mu_0 I}{8}\left(\frac{1}{a} - \frac{1}{b}\right)$

(out of page)

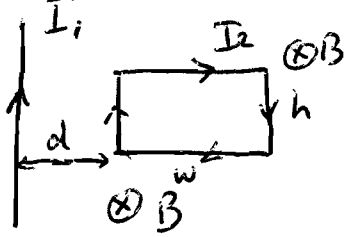
(b) 

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

$\vec{v} \times \vec{B}$ points down, but q is negative so F points up.

$|\vec{F}| = evB = ev\frac{\mu_0 I}{8}\left(\frac{1}{a} - \frac{1}{b}\right)$

20.P.49



B due to long wire:

$$B = \frac{\mu_0 I_1}{2\pi r} \quad \text{(into the page)}$$

$$\vec{F} = I \vec{L} \times \vec{B}$$

left side of loop $|\vec{F}| = I_2 h \frac{\mu_0 I_1}{2\pi d}$ points to left

right side of loop $|\vec{F}| = I_2 h \frac{\mu_0 I_1}{2\pi (d+w)}$ to the right

Forces on top and bottom of rectangle are opposite and cancel each other

$$F_{net} = I_2 h \left(\frac{\mu_0 I_1}{2\pi d} - \frac{\mu_0 I_1}{2\pi (d+w)} \right) \text{ to the left}$$