P577 1, 3, 4, 9, 14, 15, 19, 26, 29, 38, 67, 73, 79, 83, 85

(1)(a) $F = BIL \sin\theta$

$\frac{F}{L} = BI = (0.90\,T)(8.40\,A)$

$\frac{F}{L} = \underline{7.6\ N\,m^{-1}}$

(b) $\frac{F}{L} = BI\sin\theta$

$= (0.9\,T)(8.40\,A)\sin 45$

$\frac{F}{L} = \underline{5.3\ N\,m^{-1}}$

(3) $F = BIL \sin\theta$

$I = \frac{F}{BL} = \frac{0.750\,N}{(0.08\,T)(4.80\,m)} = \underline{1.95\,A}$

(4) $F = BIL\sin\theta$

$= (5.5\times10^{-5}\,T)(4.5\,A)(1.5\,m)\sin 38$

$= \underline{2.3\times10^{-4}\,N}$

(9) $F_B = F_c$

$qvB\sin\theta = \frac{mv^2}{r}$

$B = \frac{mv}{qr} = \frac{(6.6\times10^{-27}\,kg)(1.6\times10^{7}\,ms^{-1})}{2(1.6\times10^{-19}\,C)(0.25\,m)} = \underline{1.32\,T}$

(14) $F_B = F_c$

$qvB\sin\theta = \frac{mv^2}{r}$

$r = \frac{mv}{qB}$

$E_k = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(5.0\times10^{6}\,eV)(1.6\times10^{-19}\,J\,eV^{-1})}{1.67\times10^{-27}\,kg}}$

$v = 3.095\times10^{7}\,ms^{-1}$

$r = \frac{(1.67\times10^{-27}\,kg)(3.095\times10^{7}\,ms^{-1})}{(1.6\times10^{-19}\,C)(0.20\,T)}$

$r = \underline{1.6\,m}$

(15) $F = qvB \sin\theta$

$$B = \frac{F}{qv} = \frac{7.2 \times 10^{-13}\ N}{(1.6 \times 10^{-19}\ C)(2.9 \times 10^{6}\ ms^{-1})} = 1.6\ T \quad \text{east}$$

(19) $F_B = F_C$

$$qvB \sin\theta = \frac{mv^2}{r} \qquad v = \frac{2\pi r}{T}$$

$$qB = \frac{m 2\pi \cancel{r}}{\cancel{r} T}$$

$$T = \frac{2\pi m}{qB}$$

(26) $$B = \frac{\mu_0}{2\pi}\frac{I}{r} = \frac{(\frac{2}{4\pi} \times 10^{-7}\ T m A^{-1})(65A)}{(.06m)} = 2.2 \times 10^{-4}\ T$$

Earth's magnetic field $\simeq 5.5 \times 10^{-5}\ T$

(29) $$\frac{F}{L} = \frac{\mu_0}{2\pi}\frac{I_1 I_2}{r}$$

$$I_2 = \frac{F}{L}\frac{r}{I_1}\frac{2\pi}{\mu_0} = \frac{(8.8 \times 10^{-4}\ N m^{-1})(.07m)\ 2\pi}{(24A)(\frac{4\pi}{2} \times 10^{-7}\ T m A^{-1})} = 13A \text{ up}$$

(38) left wire

$$B = \frac{\mu_0}{2\pi}\frac{I}{r} = \frac{(\frac{2}{4\pi} \times 10^{-7}\ T m A^{-1})(25A)}{2\pi\ (.1014m)} = 4.93 \times 10^{-5}\ N \quad \text{out of page}$$

right wire

$$B = \frac{\mu_0 I}{2\pi r} = \frac{(\frac{2}{4\pi} \times 10^{-7}\ T m A^{-1})(25A)}{2\pi\ (0.0986m)} = 5.07 \times 10^{-5}\ N \quad \text{into the page}$$

$$B_{net} = 5.07 \times 10^{-5} - 4.93 \times 10^{-5} = 1.4 \times 10^{-6}\ N \text{ into the page}$$

(67) $F_c = F_B$

$\frac{mv^2}{r} = qvB\sin\theta$ $\quad p = mv$

$B = \frac{p}{qr} = \frac{4.8\times10^{-16}\ kg\,ms^{-1}}{(1.6\times10^{-19}C)(1.0\times10^{3}m)} = \underline{3.0\ T\ up}$

(73) $F = ma$

$F = BIL\sin\theta$

$v^2 = u^2 + 2as$

$a = \frac{v^2}{2s}$

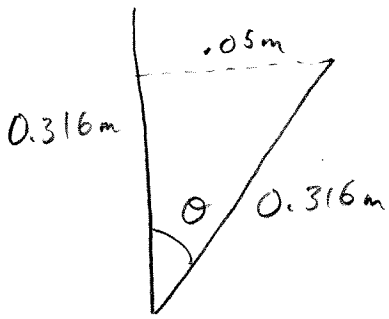
$\frac{mv^2}{2s} = BIL$

$I = \frac{mv^2}{2sBL} = \frac{(1.5\times10^{-3}kg)(28\ ms^{-1})^2}{2(1.0m)(1.7\ T)(0.22m)} = \underline{1.6\ A}$

the magnetic field must point down

(79) $\frac{mv^2}{r} = qvB\sin\theta$

$r = \frac{mv}{qB} = \frac{(1.67\times10^{-27}kg)(1.0\times10^{7}ms^{-1})}{(1.6\times10^{-19}c)(0.33T)} = 0.316\ m$



$\sin\theta = \frac{0.05}{0.316m}$

$\theta = 9.1^\circ$

(83) (a) $F_E = F_B$

$$qE = qvB$$

$$B = \frac{E}{v} = \frac{10\,000\ V m^{-1}}{4.8 \times 10^6\ m s^{-1}} = \underline{0.002\ T}$$

(b) towards you; out of the plane of the electric field and velocity.

(c) $\frac{mv^2}{r} = qvB \qquad f = \frac{1}{t} \qquad v = \frac{s}{t} = \frac{2\pi r}{t}$

$$\frac{m 2\pi \cancel{r}}{\cancel{r} t} = qB$$

$$f = \frac{qB}{2\pi m}$$

(85) $B = \frac{\mu_0 N I}{L}$

$$N = \frac{BL}{\mu_0 I} = \frac{(0.3\,T)(0.32\,m)}{(4\pi \times 10^{-7}\ T m A^{-1})(5.7\,A)} = \underline{13\,000\ \text{turns}}$$