PH213 - Chapter 27 Homework Solutions

2) $F = ILB|\sin\theta| = (150)(240)(5.00\times10^{-5})(\sin 60.0^\circ) = 1.56\,N$

9) $\Sigma\vec{F} = \vec{F}_g + \vec{F}_M = 0 \qquad (-mg) + (ILB|\sin\theta|) = 0$

$$I = \frac{mg}{LB|\sin\theta|} = \frac{\rho Vg}{LB|\sin 90^\circ|} = \frac{\rho(\pi R^2 L)g}{LB} = \frac{\rho\pi R^2 g}{B}$$

$$I = \frac{(8900)(\pi)(0.00100)^2(9.80)}{(5.00\times10^{-5})} = 5480\,A$$

13) $F = |Q|vB|\sin\theta| = |-1.60\times10^{-19}|(7.75\times10^5)(0.850)|\sin 90^\circ|$

$F = 10.5\times10^{-14}\,N = 1.05\times10^{-13}\,N$

$\hat{F}$ = south by RHR (for positive charge)

$Q<0$ for electron, so $\hat{F}$ = - south = <u>north</u>.

14) (a) $\hat{F}$ = to the right by RHR (for + charge), so $\hat{F}$ = <u>to the left</u>

(b) $\hat{F}$ = "

(c) $\hat{F}$ = down (for + charge), so $\hat{F}$ = <u>up</u>

(d) $\hat{F}$ = toward (for + charge), so $\hat{F}$ = <u>away</u>.

(e) $\vec{F} = 0$ so no direction.

(f) $\hat{F}$ = up (for + charge), so $\hat{F}$ = <u>down</u>.

19) (a) $K = \frac{1}{2}mv^2 = \frac{1}{2}\frac{m^2v^2}{m} = \frac{1}{2}\frac{(p)^2}{m} = \frac{p^2}{2m} = \frac{(QBr)^2}{2m}$

(b) $\vec{L} = \vec{R}\times\vec{p} = (R)(p)|\sin\theta| = (R)(p)|\sin 90^\circ| = Rp$

$\vec{L} = R(QBR) = QBR^2$

22) $F = |Q|vB|\sin\theta|$ $\quad F(max) = |Q|vB$

$$B = \frac{F(max)}{|Q|v} = \frac{(7.20\times10^{-13}\,N)}{|-1.60\times10^{-19}|(2.90\times10^{6})} = \underline{1.55\,T}$$

$\hat{B}$ = [redacted] by RHR (for + charges), so $\hat{B}$ = [redacted]
west $\qquad$ east

24) $m = 3.40\times10^{-3}\,kg \quad v = 160\,m/s \quad \theta = 90.0^\circ \quad B = 5.00\times10^{-5}\,T$

$Q = 13.5\times10^{-9}\,C \quad \Delta y = ? \quad \Delta x = 1.00\,km = 1000\,m$

$$F = QvB|\sin\theta| = QvB = ma \qquad a = \frac{QvB}{m}$$

$$\vec{y} = \vec{y}_0 + \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2 \qquad \Delta y = \frac{1}{2}at^2$$

$$\vec{x} = \vec{x}_0 + \vec{v}_{ox}t + \frac{1}{2}\vec{a}_x t^2 \qquad \Delta x = vt \qquad t = \frac{\Delta x}{v}$$

$$\Delta y = \frac{1}{2}at^2 = \frac{1}{2}\left(\frac{QvB}{m}\right)\left(\frac{\Delta x}{v}\right)^2 = \frac{QB(\Delta x)^2}{2mv}$$

$$\Delta y = \frac{(13.5\times10^{-9})(5.00\times10^{-5})(1000)^2}{2(3.40\times10^{-3})(160)} = 6.20\times10^{-7}\,m$$

49) $v_0 = 0 \quad v = ? \qquad \frac{1}{2}mv^2 = QV \qquad v = \sqrt{\frac{2QV}{m}}$

$$R = \frac{mv}{QB} = \frac{m\sqrt{2QV/m}}{QB} \qquad QBR = \sqrt{2QVm}$$

$$(QBR)^2 = 2QVm \qquad m = \frac{(QBR)^2}{2QV} = \frac{QB^2R^2}{2V}$$

52) $K_e = K_p \qquad \frac{1}{2}m_e v_e^2 = \frac{1}{2}m_p v_p^2 \qquad \frac{Pe^2}{2m_e} = \frac{Pp^2}{2m_p}$

$$\frac{(|Q_e|BR_e)^2}{2m_e} = \frac{(Q_p B R_p)^2}{2m_p} \qquad \frac{R_e^2}{m_e} = \frac{R_p^2}{m_p} \qquad \frac{R_p}{R_e} = \sqrt{\frac{m_p}{m_e}}$$