Chapter ***19*** *(Bueche & Jerde)* ***Magnetism***

P**09**. $ILB = mg$, $B = mg/IL = (0.024)(9.80) / (0.30) = 0.784$ (T).

P**19**. (**a**) $evB = mg$, $B = mg/ev = (1.67\times10^{-27})(9.80)/[(1.60\times10^{-19})(4.00\times10^{6})] = 2.56\times10^{-14}$ (T); (**b**) The direction of $\vec{B}$ must be horizontal perpendicular to $\vec{v}$.

P**31**. $F_c = F_m$, $mv^2/r = qvB$, $v = qvB/m$; $E_K = (½)mv^2 = q^2r^2B^2/2m$.

P**34**. (**a**) $E = V/d = 120/0.06 = 2000$ V/m $= 2000$ N/C, $v = E/B = 2000/0.04 = 5.00\times10^4$ (m/s); (**b**) As $E = 0$, $r = mv/eB = (9.11\times10^{-31})(5.00\times10^4)/[(1.60\times10^{-19})(0.040)] = 7.12\times10^{-6}$ (m).

P**35**. $B = 0.04$ T and $r = 1$ m. For circular motion, $v_p = erB/m_p$. For a straight-line path in crossed electric and magnetic fields, $E = v_pB = erB^2/m_p = 1.53\times10^5$ N/C .

P**43**. $I_1 = I_2 = 20$ A, $r_1 = 10$ cm & $r_2 = 20$ cm. Using $B = \mu_0I/(2\pi r)$, $B_1 = 4.00\times10^{-5}$ T, $B_2 = 2.00\times10^{-5}$ T. (**a**) As the currents are in same direction, $B = B_1 - B_2 = 2.00\times10^{-5}$ T, in a direction perpendicular to the plane of the wires. (**b**) As the currents are in opposite direction, $B = B_1 + B_2 = 6.00\times10^{-5}$ T .

P**49**. (**a**) The magnetic force on the straight wire is zero because the current is parallel to the field due to the solenoid. (**b**) The field due to the current in the solenoid is uniform inside it, $B_s = 4.00\times 10^{-3}$ T, parallel to the axis. The field due to the current in the straight wire at the axis, $B_w = \mu_0I/(2\pi r) = 2.00\times 10^{-3}$ T, where $I = 50$ A and $r = 0.5$ cm, perpendicular to the solenoid field. The total field, $B = (B_s^2 + B_w^2)^{1/2} = 4.47\times10^{-3}$ T .

P**54**. $\tau_{max} = NIAB$, $I = \tau_{max}/NAB = (0.24) / [600(30\times10^{-4})(0.8)] = 0.167$ (A) .

P**58**. $\vec{F} = \int Id\vec{\ell}\times\vec{B}$. For closed loops in uniform field, $\vec{F} = I(\oint d\vec{\ell}\,)\times\vec{B} = 0$.