Physics 1C Chapter 27 Problems

27.3) $\vec{B} = 1.29\text{T}\,\hat{y}$

$|q| = 8.20\mu\text{C}$

$\vec{v} = 4.60\text{km/s}\,\hat{z}$

a) $\vec{F_B} = q\vec{v} \times \vec{B}$

positive

b) $F_B = qvB\sin 90 = qvB$

$= (8.2\times10^{-6}\text{C})(4.6\times10^{3}\frac{\text{m}}{\text{s}})(1.29\text{T})$

$= \boxed{0.049\text{N}}$

27.18) $B = 1.9\text{T}$

$F = mA = qv \times B$

a) $KE = \frac{1}{2}mv^2$

$KE = 5.0\text{ MeV}$

$m = m_{proton} = 1.67\times10^{-27}\text{kg}$

$v = \sqrt{\frac{2KE}{m}}$

$5.0\text{MeV} = 8\times10^{-13}\text{ J}$

$\boxed{v = 3.09\times10^{7}\frac{\text{m}}{\text{s}}}$

b) UCM: $A = \frac{v^2}{R}$

$m\frac{v^2}{R} = qvB$

$R = \frac{mv^2}{qvB}$

$R = \frac{mv^2}{e^- vB} = \frac{mv}{e^- B}$

$\boxed{R = 0.168\text{m}}$

27.31) $L = 53\text{cm} = 0.53\text{m}$

$m = 800\text{g} = 0.8\text{kg}$

$\vec{B} = -0.500\text{T}\,\hat{z}$

$R = 23\Omega$

a) $F_B = F_g$

$ILB = mg$

$V = IR$

$I = \frac{V}{R}$

$\frac{V}{R}LB = mg$

$V = \frac{Rmg}{LB}$

$\boxed{V = 680\text{V}}$

b) $F = mA = F_B - F_g$

$mA = ILB - mg$

$I = \frac{V}{R}$

$mA = \frac{V}{R}LB - mg$

$A = \frac{VLB}{Rm} - g$

$\boxed{A = 102.9\frac{\text{m}}{\text{s}^2}}$

27.34) $\vec{B} \perp \vec{v}$

a) $F = mA = m\frac{v^2}{R} = qvB$

$m = \frac{RqvB}{v^2} = \frac{RqB}{v}$

$U_E = qV = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2qV}{m}}$

$m^2 = \frac{R^2q^2B^2}{\frac{2qV}{m}}$

$m^2 = \frac{R^2q^2B^2m}{2qV}$

$\boxed{m = \frac{R^2qB^2}{2V}}$

b) $m_c = 1.99\times10^{-26}\text{kg}$

$R = 50\text{cm} = 0.5\text{m}$

$B = 0.150\text{T}$

$V = \frac{R^2qB^2}{2m}$

$\boxed{V = 22.61\text{kV}}$

c) $m_1 = 2.32\times10^{-26}\text{kg}, m_2 = 1.99\times10^{-26}\text{kg}$

$R^2 = \frac{2mV}{qB^2}$

$R = \sqrt{\frac{2mV}{2B^2}}$

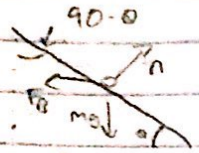
$\Delta R = \sqrt{\frac{2m_1V}{qB^2}} - \sqrt{\frac{2m_2V}{2B^2}}$

$\Delta R = 0.54\text{m} - 0.5\text{m} = 0.04\text{m}$

$\Delta D = \Delta R \times 2 = \boxed{0.08\text{m}}$

d) **easily**

27.55)



a) $F_{Bx} = mg_x$

$F_{By} = mg_y$

$n - mg\cos\theta - F_B\sin\theta = 0$

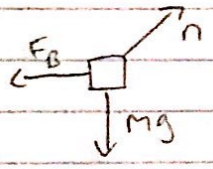
$mg\sin\theta - F_B\cos\theta = 0$

$ILB\cos\theta = mg\sin\theta$

$$I = \frac{mg}{LB}\tan\theta$$

b) right to left

c)



27.57) $v = 8.5\,km/s = 8500\,m/s$

$d = 25cm \rightarrow r = 0.125m$

$m_{12} = 1.99\times10^{-26}kg$

$m_{13} = 2.16\times10^{-26}kg$

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

a) $m\frac{v^2}{R} = 2vB$

$B = \frac{mv^2}{2vR} = \frac{mv}{qR}$

$B = 0.0084T$

b) $R = \frac{mv}{qB}$

$R = 0.137m$

$D = 0.273m = 27.3cm$

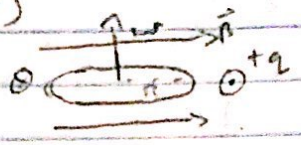
c) $s = \Delta D$

$s = 27.3 - 25m$

$s = 2.3cm$

d) Y_{C2}

27.58)



$T = H\times B = NIA\times B$

$T = NIAB = IAB$

$T = I(\pi R^2)B$

$I = \frac{q}{T} = \frac{2\omega}{2\pi}$

$T = \frac{q\omega}{2\pi}(\pi R^2)B$

$$T = \frac{1}{2}q\omega R^2 B$$

27.59) $F_B = I\ell\times B$

a) $F_B = I\ell\times B = ILB\sin90$

$F_B = ILB$

b) right

c) $F = mA$

$ILB = mA$

$v^2 = 2A(\Delta d)$

$A = \frac{v^2}{2d}$

$ILB = m(\frac{v^2}{2d})$

$$d = \frac{mv^2}{2ILB}$$

d) $m = 30kg$

$v = 11.2km/s = 11200\frac{m}{s}$

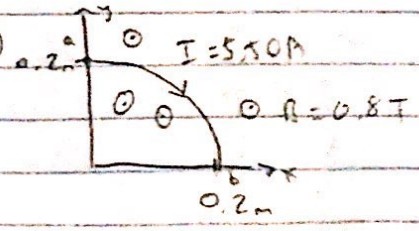
$B = 0.72T$

$L = 51cm = 0.51m$

$I = 2500A$

$d = 2.05\times10^6 m$

27.61)



a) $F_B = I\ell\times B = ILB$

$F_{Bx} = ILB\cos\theta$

$F_{By} = ILB\sin\theta$

$L = r\theta \rightarrow dL = r\,d\theta$

$dF_{Bx} = I\,dL\,B\cos\theta$

$dF_{Bx} = rIB\cos\theta\,d\theta$

$F_{Bx} = rIB(\sin\theta)_0^{\pi/2}$

$F_{Bx} = rIB$

$F_{By} = rIB$

$F^2 = F_{Bx}^2 + F_{By}^2$

$F = \sqrt{2(IB)^2}$

$\boxed{F = 1.24N}$

b) towards the origin

c) $\vec{B} = B_x\hat{x} \rightarrow F_{Bx} = 0$

$F = F_{By} = rIB$

$\boxed{F = 0.88N}$

d) z-axis

27.63) $B = 0.50G = 5\times10^{-5}T$

$d = 5mm = 0.005m \rightarrow r = 0.0025m$

$\rho = 8900 kg/m^3$

a) $F_B = ILB = mA = mg$

$ILB = mg$

$\rho = \frac{m}{V} \rightarrow m = \rho V$

$ILB = \rho V g$

$V = \pi r^2 L$

$ILB = \rho(\pi r^2 L)g$

$I = \frac{\rho\pi r^2 g}{B\cos45}$

$\boxed{I = 4.8\times10^4 A}$

b) not feasible

c) $I = 900A$

$ILB = \rho(\pi r^2 L)g$

$B = \frac{\rho\pi r^2 g}{I}$

$\boxed{B = 0.0019T}$

d) $W_{mg} = ILB$

$W_{mg} = 1N$

$W_{mg} = \rho(\pi r^2 L)g$

$W_{mg} = 0.17N$

$\boxed{W = 0.83N}$

27.65) $\frac{m}{L} = 0.13 g/cm = 0.013 kg/m$

$I = 8.9A$

a) $\vec{F}_B = I\vec{L}\times\vec{B}$

$\tau_B = I\vec{A}\times\vec{B} = IAB\sin60$

$\tau_B - \tau_g = 0$

$\tau_B = \tau_g$

$\tau_g = r\times F = rF\sin30$

$IAB\sin60 = rmg\sin30$

$B = \frac{rmg\sin30}{IA\sin60}$

$m = 0.28m \times (0.013 kg/m)$

$m = 0.00364kg$

$\boxed{B = 0.019T}$

b) +y-direction

27.69) $N = 51$ turns

$d = 1.40cm \rightarrow r = 0.007m$

$I = 0.920A$

$B = 0.210T \quad \theta = 60°$

a) $\vec{F}_B = rI\vec{L}\times\vec{B}$

$F_B = ILB\sin30$

$L = 2\pi r(51) = 102\pi r$

$F_B = I(102\pi r)B\sin60$

$\boxed{F_B = 0.375N}$

b) -y-direction

27.82) b) $W_E = qEy$

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

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

$v = \sqrt{\frac{2qEy}{m}}$

c) $qvB - qE = m\frac{v^2}{r}$

$qvB - qE = m\left(\frac{2qEy}{m}\right)\left(\frac{1}{2y}\right)$

$qvB = 2qE$

$\boxed{v = \frac{2E}{B}}$