# Physics 210 Multiple Choice Solutions Week 8

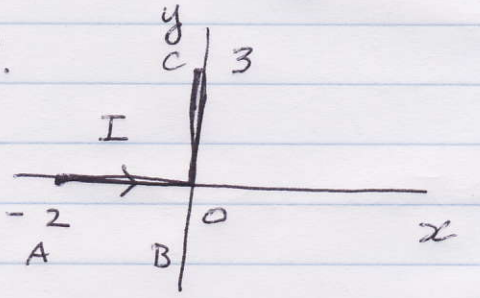
1. $\vec{F} = m\vec{a} = q\vec{v} \times \vec{B}$

$$\vec{a} = \frac{q}{m}(\vec{v} \times \vec{B}) = \frac{q}{m}\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3\,km/s & 0 & 0 \\ 2 & 3 & 4 \end{vmatrix}$$

$$= -\frac{6\mu C}{2mg}\left[-\hat{j}(3\,km/s \times 4mT) + \hat{k}(3\,km/s \times 3mT)\right]$$

$$\vec{a} = 36\,\hat{j} - 27\,\hat{k}$$

2.



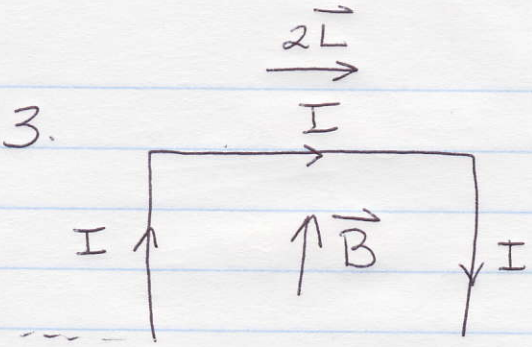

$\vec{B} = 40mT\ \hat{k}$

Segment AB $I = 25A$ $\vec{L} = 2\hat{i}$ $\vec{F} = I\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 0 & 0 \\ 0 & 0 & 40 \end{vmatrix}$

$$\vec{F}_{AB} = I\left(-\hat{j}(2\times 40)\right) = (25A)(-\hat{j})\,80(mT)(m)$$
$$= -2N\,\hat{j}$$

$$\vec{F}_{BC} = I\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 3 & 0 \\ 0 & 0 & 40 \end{vmatrix} = (25A)\,\hat{i}\,(3)(40) = 3N\,\hat{i}$$

$$|\vec{F}| = \sqrt{2^2+3^2} = 3.61\,N$$

3. 

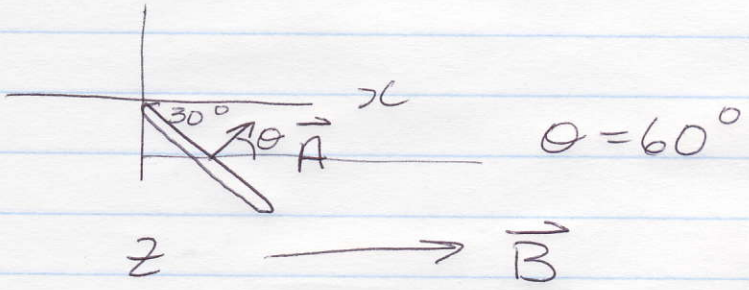

-no force on vertical parts

$\vec{F} = I\, 2\vec{L} \times \vec{B} = 2IBL$ +z-dir

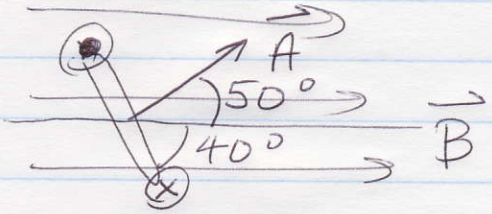
4. $|\vec{\tau}| = NAIB\sin\theta$.

$= 80(.3m)(.4m)8A * (40mT)(\sin 60°)$

$= 2.7\ N\cdot m$




$\theta = 60°$

5. 


$\tau = ABI\sin 50$

$I = \dfrac{1\ N\cdot m}{(.5m)^2(70mT)(\sin 50°)}$

$= 75A$

6. $B_x = 0.5\,T \quad v = 60\,km/s$

pitch = 5mm $= v_{\parallel} \cdot T = v\cos\theta \cdot \frac{2\pi m}{qB}$

$$\cos\theta = \frac{5mm\ q\cdot B}{v\ 2\pi m} = \frac{(5mm)(1.6\times10^{-19}C)(0.5T)}{60km/s\ \ 2\pi\ \ 1.67\times10^{-27}kg}$$

$\theta = 51^\circ$

7. $v_\perp = 40\ m/s \qquad R = \frac{mv_\perp}{qB} = \frac{(3\times10^{-9}kg)\ 40\ m/s}{(5\times10^{-6}C)(60\,mT)} = 0.4m$

8. $v = \frac{RqB}{m} = 48\ km/s \qquad d = vt = 48km$

9. $T = \frac{2\pi m}{qB} = 1.2\times10^{-7}s$

10. $K.E = \frac{1}{2}mv^2 \qquad mv = \sqrt{2mK.E}, \qquad K.E = q\Delta V$

$$R = \frac{mv}{qB} = \frac{\sqrt{2mK.E}}{qB} = \frac{\sqrt{2mq\Delta V}}{qB}$$

$$= \sqrt{\frac{2m\Delta V}{q}} \cdot \frac{1}{B} = \sqrt{\frac{2(1.67\times10^{-27}kg)(2.5kV)}{1.6\times10^{-19}C}} \cdot \frac{1}{.6T}$$

$= 12\,mm$

11. $v = \frac{E}{B} \qquad B = \frac{E}{v} = \frac{80\,kV/m}{\sqrt{\frac{2K.E}{m}}} = \frac{80kV/m}{\sqrt{\frac{2\times2keV\times1.6\times10^{-19}J/eV}{1.67\times10^{-27}kg}}} = 0.13T$