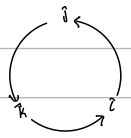
Q4 $\vec{B}=(20\hat{i}-50\hat{j}-30\hat{k})\,mT$, At $t=0 \Rightarrow \vec{v}=(20\hat{i}-30\hat{j}+50\hat{k})\,m/s$



a) $\vec{v}\times\vec{B}=(20\hat{i}-30\hat{j}+50\hat{k})\times(20\hat{i}-50\hat{j}-30\hat{k})*10^{-3}$

$=(20\hat{i}-30\hat{j}+50\hat{k})\times(0.02\hat{i}-0.05\hat{j}-0.03\hat{k})$

$=-1\hat{k}+0.6\hat{j}+0.6\hat{k}+0.9\hat{i}+1\hat{j}+2.5\hat{i}$

$=3.4\hat{i}+1.6\hat{j}-0.4\hat{k}$

$|\vec{v}\times\vec{B}|=\sqrt{3.4^2+1.6^2+0.4^2}=3.78\ \frac{m}{s}.T$

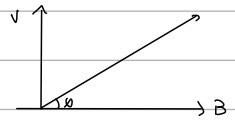
$|\vec{v}|=\sqrt{20^2+30^2+50^2}=62\ m/s$

$|\vec{B}|=(\sqrt{20^2+50^2+30^2})\times10^{-3}=61.6\times10^{-3}\,T$

$\vec{v}\times\vec{B}=|\vec{v}||\vec{B}|\sin\theta \Rightarrow \sin\theta=\frac{|\vec{v}\times\vec{B}|}{|\vec{v}||\vec{B}|} \Rightarrow \theta=\sin^{-1}\left(\frac{|\vec{v}\times\vec{B}|}{|\vec{v}||\vec{B}|}\right)=84^o$

b) No, the magnetic field can only change the direction of motion

c)



d) $m\frac{v^2}{r}=q\,v\,B \Rightarrow mv=qBr \Rightarrow r=\frac{mv}{qB} \Rightarrow \frac{mv\sin\theta}{qB}$

Q21 $m_{wire}=6.75\,g=6.75\times10^{-3}\,kg$ $L=15\,cm=15\times10^{-2}\,m$ $B=0.44\,T$

$F_B=F_g \Rightarrow IBL=mg \Rightarrow I=\frac{mg}{BL}=\frac{6.75\times10}{0.44(15\times10^{-2})}$

Q42 $m=12g=12\times10^{-3}\,kg$ $q=80\,\mu C=80\times10^{-6}\,C$ $g=-9.8\hat{j}\,m/s^2$, $v=20\hat{i}\,km/s=20\times10^3\,m/s$, $B=??$, $\theta=90$

$F=ma=12\times10^{-3}\times-9.8=-0.1176$ الجاذبية $-y$ ∴ القوة المغناطيسية لازم تكون $+y$ وبما أن السرعة $+x$ فالمجال حسب هاي القاعدة

$F=qvB\sin\theta \Rightarrow B=\frac{F}{qv}=\frac{0.1176}{80\times10^{-6}\times20\times10^3}=0.0735$ المجال لازم يكون $-z$

Q43 $v=(12\hat{j}-15\hat{k})\,Km/s=(12\times10^3\hat{j}-15\times10^3\hat{k})$ $a=12\times10^{12}\hat{i}$ $\vec{B}=(30\,mT)\hat{i}=(30\times10^{-3}\,T)\hat{i}$

$F=F_E+F_B$,, $F=ma$

$m_e a=q_e E+q_e v\times B \Rightarrow m_e a=q_e[E+v\times B]$

$E=\frac{m_e a}{q_e}-|\vec{v}\times\vec{B}|$

$\vec{v}\times\vec{B}=$

	$\hat{i}$ (+)	$\hat{j}$ (−)	$\hat{k}$ (+)
v →	0	12×10^3	15×10^3
B →	30×10^{-6}	0	0

$=(0-0)\hat{i}-(0-(15\times10^3\times30\times10^{-6}))\hat{j}+(0-(12\times10^3\times30\times10^{-6}))\hat{k}$

$=-4.5\hat{j}+3.6\hat{k}$

Q47 $L=75\,\mu m=75\times10^{-6}\,m$ $d=45mm=4.5\times10^{-3}\,m$ $B=0.65\,T$ $I=57\,A$ $n=8.47\times10^{28}\,e/m^3$

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Q44 $I = 4.6\ A$ $N = 3$ $A = 4 \times 10^{-3}\ m$ $B = (3\hat{i} - 3\hat{j} - 4\hat{k})\ mT = (3\times10^{-3}\hat{i} - 3\times10^{-3}\hat{j} - 4\times10^{-4}\hat{k})T$

$\mu = NIA = 3 \times 4.6 \times 4\times10^{-3} = 0.0552\ (-\hat{j})$ قاعدة اليد اليمنى $\Rightarrow \mu = -0.0552\ \hat{j}$

$U = -\mu \cdot \vec{B} = -0.0552\ \hat{j} \cdot (3\times10^{-3}\hat{i} - 3\times10^{-3}\hat{j} - 4\times10^{-4}\hat{k}) = 1.656 \times 10^{-4}\ J$

b) $\tau = \vec{\mu} \times \vec{B}$