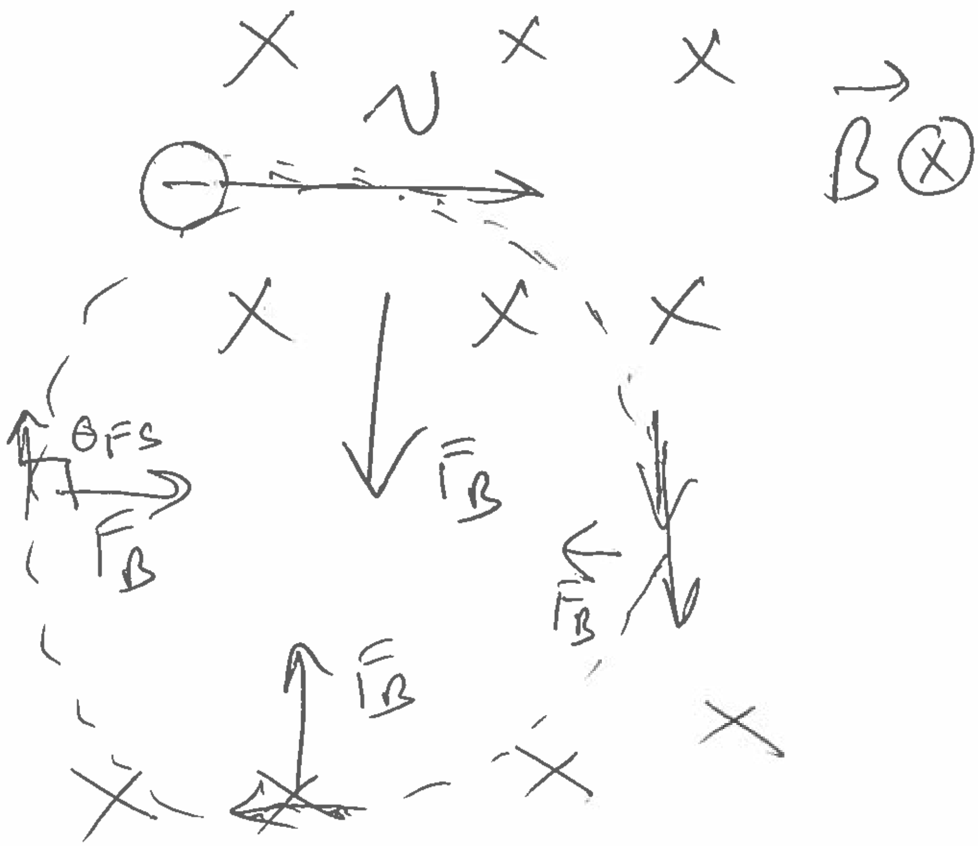
$$\vec{F}_B = Q\vec{v} \times \vec{B}$$

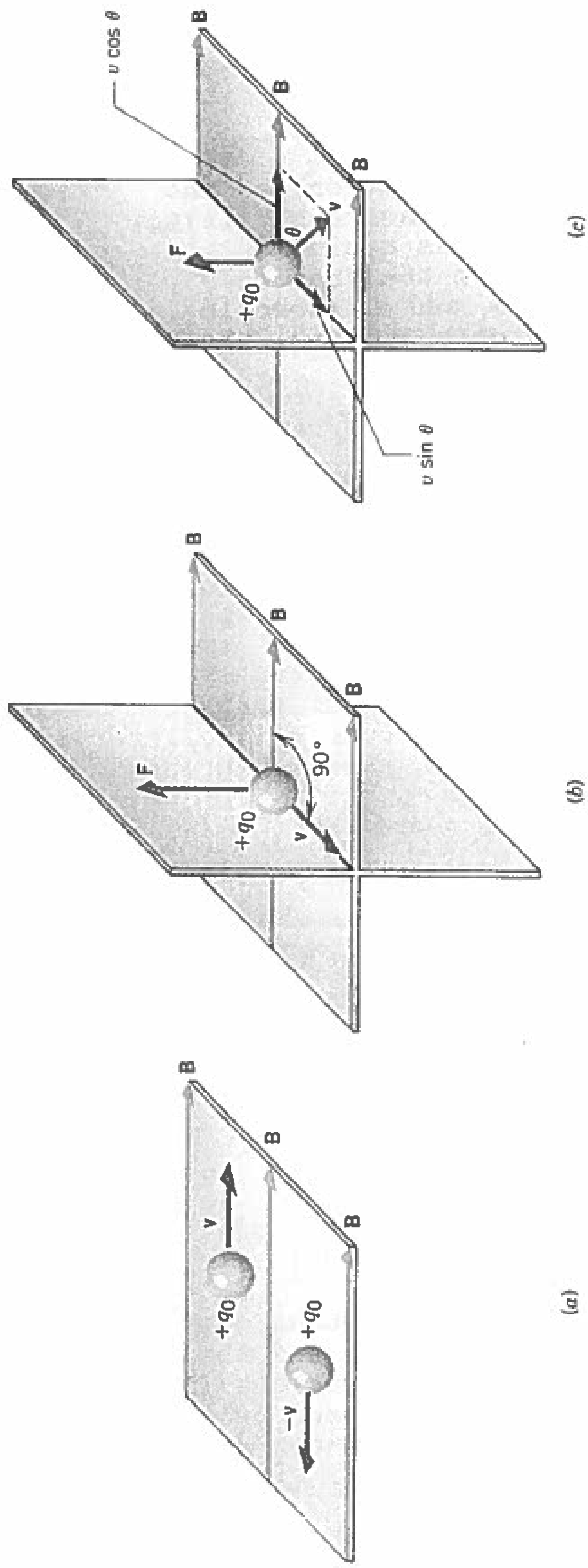
$$|\vec{F}_B| = Q|\vec{v}||\vec{B}| \sin\theta_{vB}$$



$$W_{F_B} = \vec{F}_B \cdot \vec{S} = |\vec{F}_B||\vec{S}| \cos\theta_{FS}$$

$$= |\vec{F}_B||\vec{S}| \cos 90^\circ \rightarrow 0$$

Static Magnetic forces do No Work!



B
B
B
+q0
+q0
v
−v
(a)
B
B
B
F
+q0
v
90°
(b)
B
B
B
v cos θ
v sin θ
F
+q0
v
θ
(c)

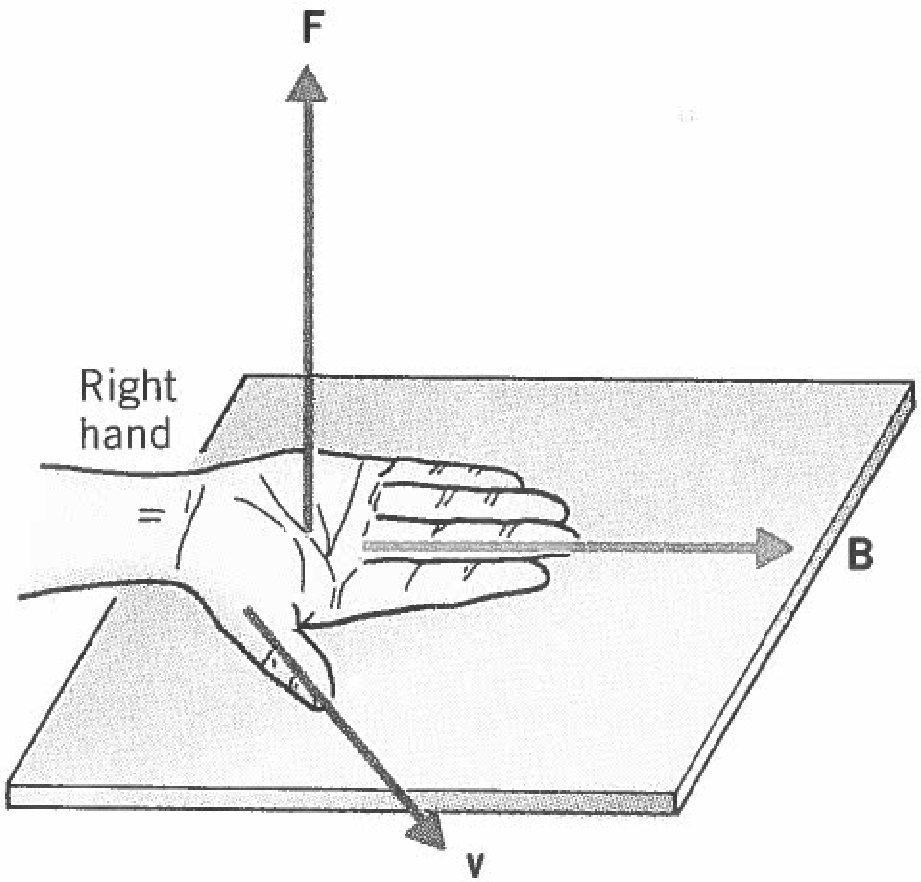


FIGURE 21.7

$$\omega = 0$$

$$\vec{a} = \frac{v^2}{R} (-\hat{r})$$

v remains constant

$$\sum W = 0 = \Delta K \Rightarrow v \text{ is constant.}$$

$$\vec{E} = \vec{F}_E / Q$$

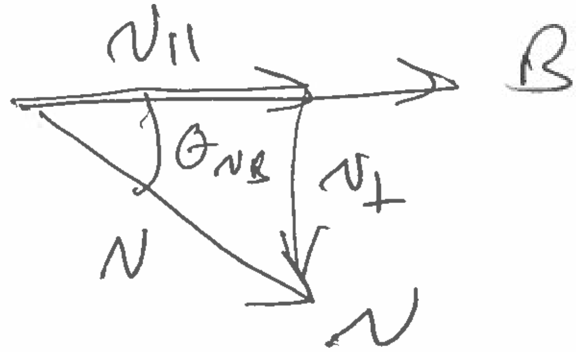
$$\vec{F}_B = Q \vec{v} \times \vec{B} = Q v \underline{B} \sin\theta \left(\hat{\text{Rt Hand Rule}} \right)$$

$$B = \frac{F_B}{Q v \sin\theta}$$

Gravitational field $\quad g = \dfrac{F}{m} = \dfrac{GmM/r^2}{m}$

$$g = \frac{GM}{r^2}$$

Source of $B \Rightarrow Q v \sin\theta_{vB}$



$\sin\theta_{vB} \Rightarrow \perp$ part of $\vec{v}$ relative $\vec{B}$

$$Q v \sin\theta = (\text{charge})(\perp \text{ velocity})$$

$$C \ \frac{m}{s} = \frac{C}{s} \ m$$

$$i \ L$$

$Q v \sin\theta$ as current loops

Source of magnetism is current loops.

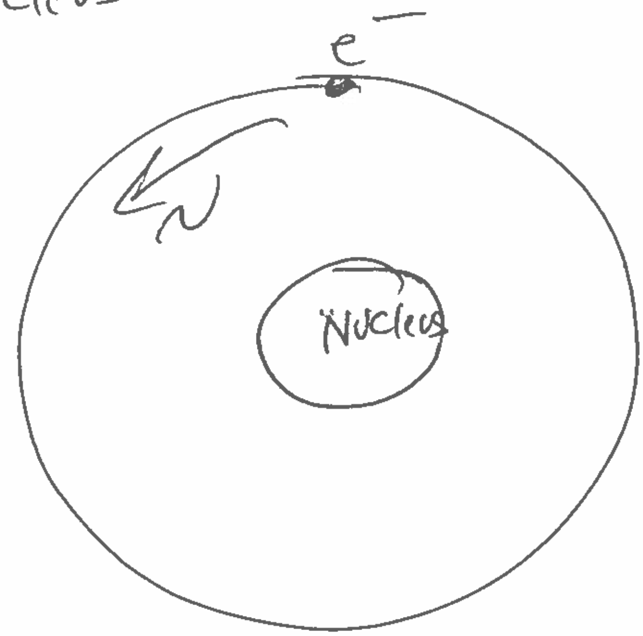
$$B_{Earth} \sim 10^{-4} - 10^{-5} \ T$$

Natural Magnet $\Rightarrow$ Iron

$$Fe \ 4s^2 \ 3d^6 \Rightarrow 4 \text{ unpaired } e^-$$

Consider a pt charge orbiting

nucleus



orbiting
CCW

Current
CW

Neutrons $\Rightarrow$ No charge

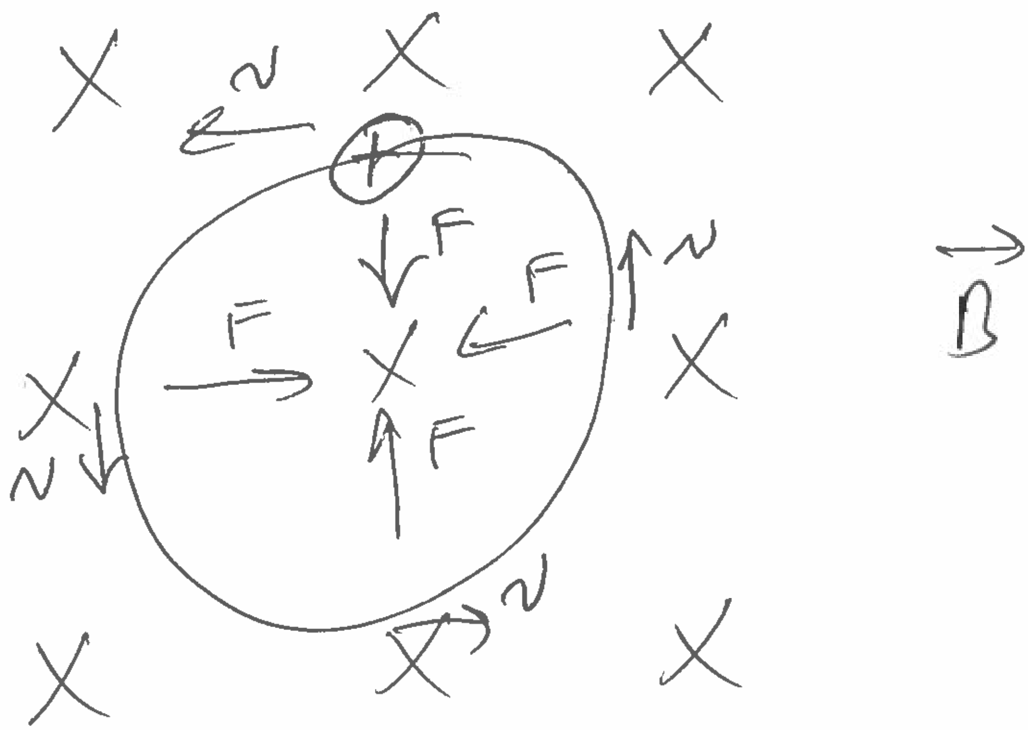
Neutrons $\Rightarrow$ detect by magnetic field.

Neutron made up of 3 Quarks
Quarks are charged $\Rightarrow$ current created
by Quarks $\Rightarrow$ create magnetic field
of Neutron.

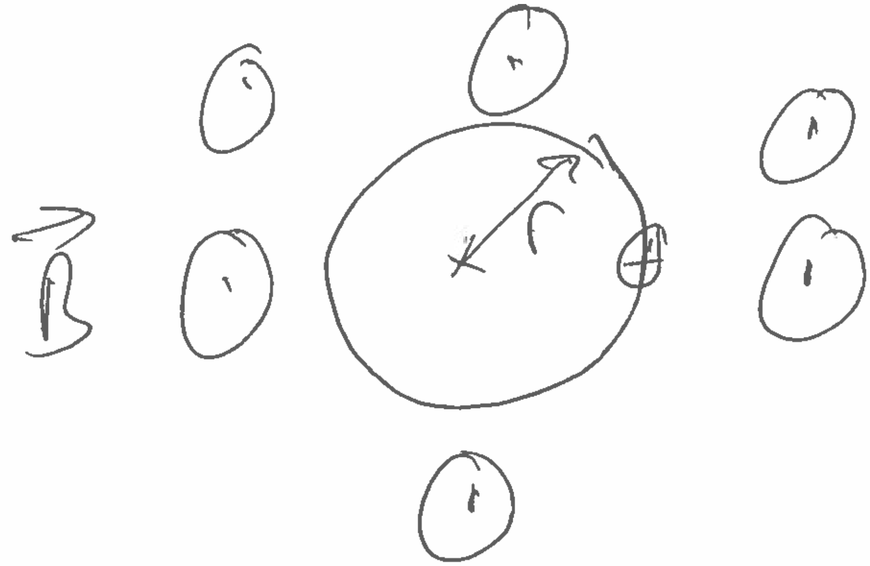
$$B = \frac{F}{qv\sin\theta} = \frac{N}{C\,\frac{m}{s}}$$

$$\text{Tesla} = \frac{1\,N\,S}{C\,M} = \frac{kg\,m/s^2\,S}{C\,M}$$

$$\boxed{1\,T = \frac{1\,kg}{C\,S} = \frac{1\,N}{A\,m} = \frac{1\,N\,S}{C\,M}}$$


v
F
F
F
F
v
v
v
B


v
v
F
F
F
F
v
v
B



$$\vec{F} = QvB(-\hat{r}) = \frac{mv^2}{r}(-\hat{r})$$

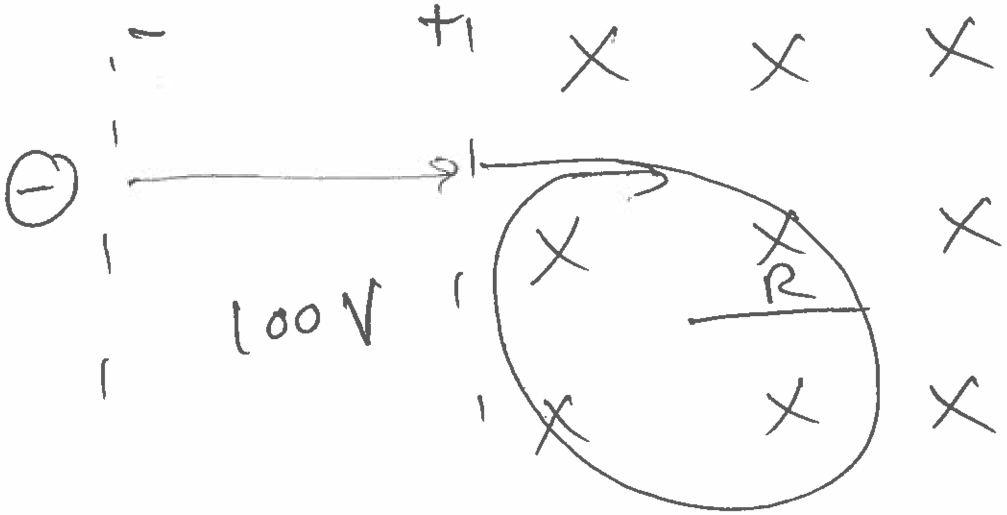
$$QvB = \frac{mv^2}{r}$$

$$\boxed{B = \frac{m}{Q}\frac{v}{r}}$$

$$\boxed{r = \frac{mv}{QB}}$$

radius of a circular path

eg/ e^- accelerated from rest by a 100 V potential difference enters a magnetic field of 0.01 T into page. What is radius of motion? Clockwise or counter cw?



$\hat{CW}$ ✓

$$R = \frac{mv}{QB} \qquad v = ?$$

$$Q\Delta V = \frac{1}{2}mv^2$$

$$v^2 = \frac{2Q\Delta V}{m}$$

$$v = \sqrt{\frac{2Q\Delta V}{m}}$$

$$R = \frac{m}{QB}\sqrt{\frac{2Q}{m}\Delta V}$$

$$R = \sqrt{\frac{2m\Delta V}{QB^2}}$$

$$R = \sqrt{\frac{2(9.11\times10^{-31}\,kg)(100\,V)}{(1.6\times10^{-19}\,c)(0.01\,T)^2}}$$

$$R = 3.37\times10^{-3}\,m \qquad c\hat{w}$$

$$v = \sqrt{\frac{2(1.6\times10^{-19}\,c)(100\,V)}{9.11\times10^{-31}\,kg}}$$

$$= \sqrt{\frac{3.2\times10^{-17}}{9.11\times10^{-31}}} = \sqrt{3.51\times10^{13}}$$

$$v = 5.99\times10^{6}\,m/s$$