

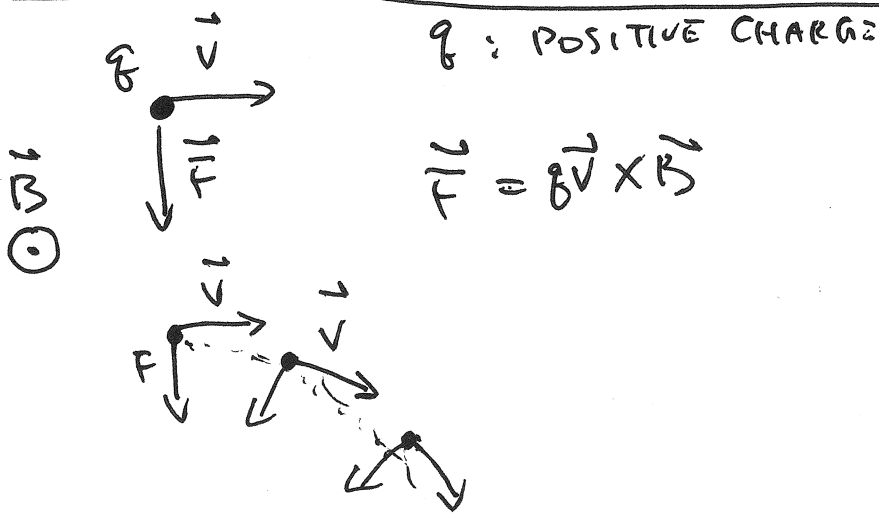
$$\vec{F} = q \vec{v} \times \vec{B}$$

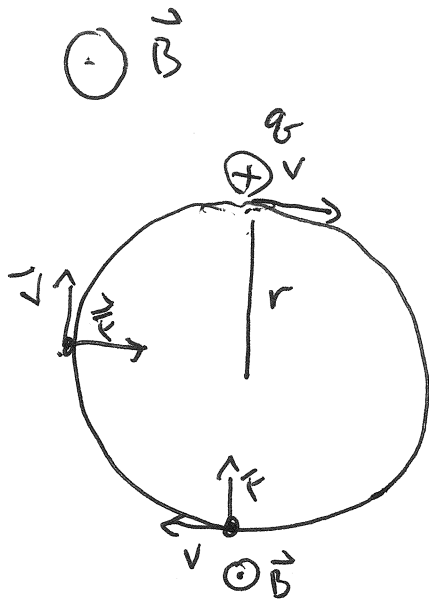
UNITS: TESLA

SURFACE OF EARTH: $0.5 \times 10^{-4} \text{ T}$

STRONG MAGNET: 30 T

MEDICAL MRI: 1.5 T





$$F = ma \quad a = \frac{v^2}{r}$$

$$F = \frac{mv^2}{r} = qvB$$


$$r = \frac{mv^2}{qvB} = \frac{mv}{qB}$$

How long does it take to go around once

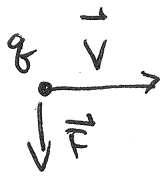
$$T = \frac{2\pi r}{v} \quad v = \frac{qBr}{m}$$

$$\frac{2\pi r}{\cancel{v}} \cdot \frac{m}{qB\cancel{r}} = 2\pi \frac{m}{qB}$$

$$f = \frac{1}{T} = \frac{1}{2\pi} \frac{qB}{m} \quad \text{! CYCLOTRON FREQUENCY}$$

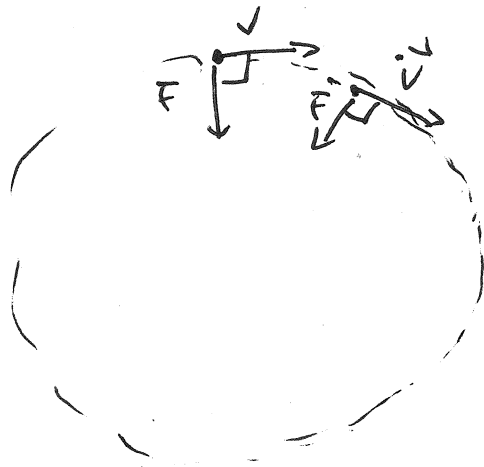

↑
Pointing out


↑
Pointing in



q : POSITIVE CHARGE

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



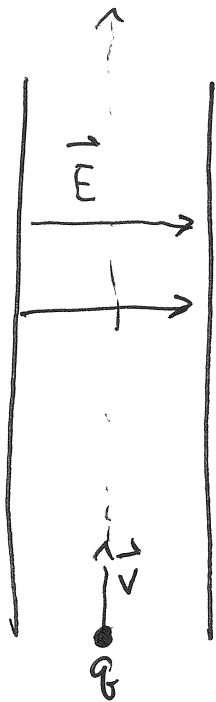
$$W = \vec{F} \cdot d$$

$$B = 0.01 \text{ T}$$

$$q = 1.6 \times 10^{-19} \text{ C (POSITIVE)}$$

$$\vec{v} = 10^7 \text{ m/s}$$

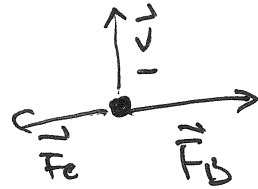
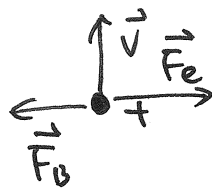
$$\begin{aligned} |\vec{F}| &= (0.01) \cdot (1.6 \times 10^{-19}) \cdot 10^7 \\ &= 1.6 \times 10^{-14} \text{ N} \end{aligned}$$



$\otimes \vec{B}$

$$\vec{F} = q\vec{E} + q\vec{v} \times \vec{B}$$

WHAT VELOCITY DO YOU NEED TO GET THRU THIS REGION?



$$qE = qvB$$

$$|\vec{v}| = \frac{|\vec{E}|}{|\vec{B}|} \quad \text{! VELOCITY SELECTOR}$$