CIRCULAR MOTION IN A MAGNETIC FIELD

- NEWTON'S 2ND LAW, $F_{NET} = ma$
- $F_{MAG} = |q| vB \sin\theta$
- CIRCULAR MOTION, $a = \frac{v^2}{r}$

$$|q| vB \sin\theta = m\frac{v^2}{r}$$

LET'S ASSUME THAT $\vec{V}$ IS $\perp$ TO $\vec{B}$ (SO THAT WE GET A CIRCLE INSTEAD OF A SPIRAL). THEN $\theta = 90°$

$$|q| vB = m\frac{v^2}{r}$$

(GG Ch 20 P14)

$$5.0\ \text{MeV} \times \frac{10^6\ \text{eV}}{1\ \text{MeV}} \times \frac{1.602\times10^{-19}\ \text{J}}{1\ \text{eV}} = \frac{1}{2}mv^2$$

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

SOLVE FOR v

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

$$|q|vB = m\frac{v^2}{r}$$

$$(1.602\times10^{-19}\ \text{C})(3.09\times10^{7}\ \text{m/s})(0.2\ \text{T}) = (1.67\times10^{-27}\ \text{kg})\frac{(3.09\times10^{7}\ \text{m/s})^2}{r}$$

$$r = 1.61\ \text{m}$$

WHAT FEELS A FORCE FROM A MAGNETIC FIELD?

(1) A MAGNET

(2) A MOVING CHARGED PARTICLE

$$F = |q| v B \sin\theta$$

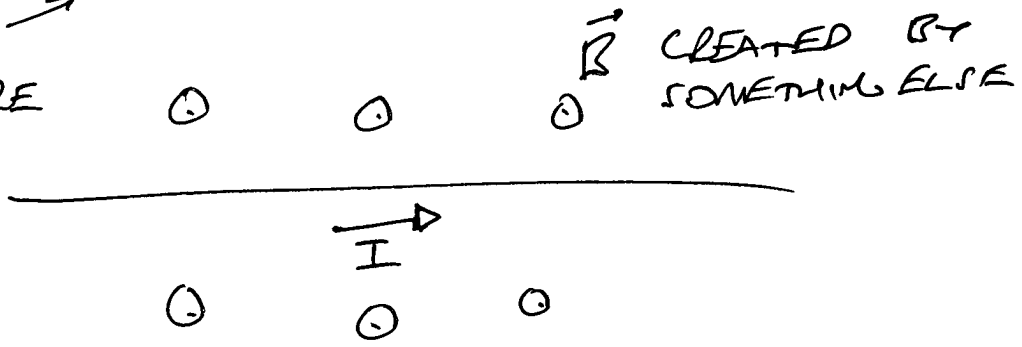
(3) A CURRENT

LENGTH OF WIRE (OR PORTION IN MAG. FIELD)

$$F = I \ell B \sin\theta$$

FORCE ON WIRE

$\vec{B}$ CREATED BY SOMETHING ELSE



θ = ANGLE BETWEEN WIRE AND $\vec{B}$

DIRECTION OF FORCE: RIGHT HAND RULE

(1) POINT FINGERS WITH CURRENT

(2) BEND FINGERS TOWARD $\vec{B}$

(3) THUMB POINTS IN DIRECTION OF $\vec{F}$.