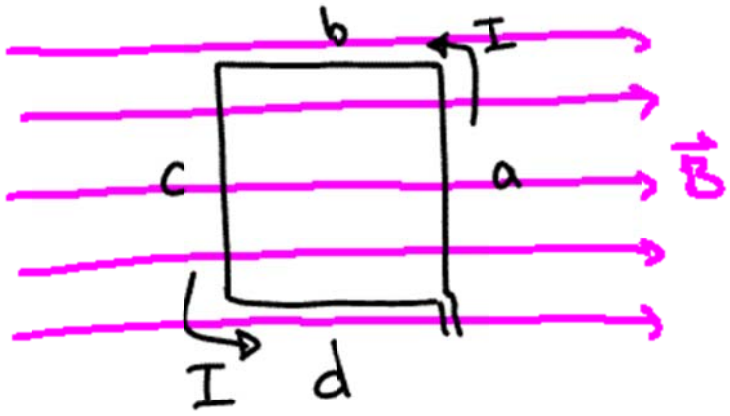
AP Physics - Magnetism - Force Examples

Note Title 4/4/2008

Torque in a Current Loop

If we take a square loop of wire in a uniform magnetic field, and run a current through it, we will have different forces on each section of wire:



Side a: $\vec{F} = BIl\sin 90^\circ$ ⊗

b: $\vec{F} = BIl\sin 0^\circ$
no force!

c: $\vec{F} = BIl\sin 90^\circ$ ⊙

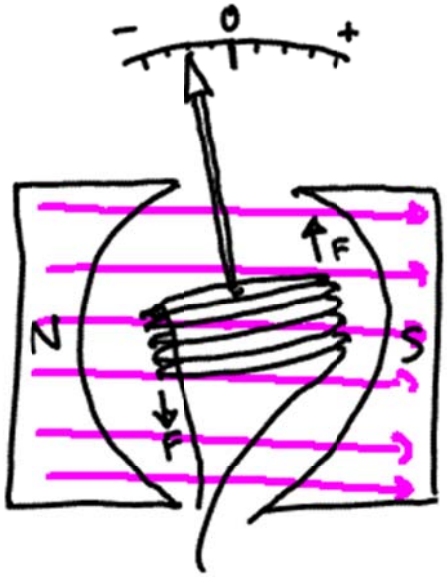
d: $\vec{F} = BIl\sin 0^\circ$
no force!

∴ The loop will feel force into the page at "a" and out of the page at "c". → There will be a net torque on the loop.

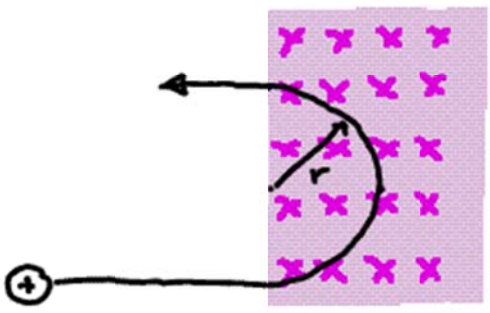
✳ This is the basis for all motors which transform electrical energy into rotational energy

Example - Galvanometer

A galvanometer is a device that measures current flow. It does this with multiple loops. Each loop adds its own component to the force. The resulting force deflects a needle. The needle deflection is proportional to the force, which is, in turn, proportional to the current running through the wire.



Force on a Charged Particle in a $\vec{B}$ Field



$\vec{F}$ on positive particle causes it to have centripetal acceleration.

$$\vec{F}_B = \vec{F}_{centripetal}$$

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

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

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