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: $\vec{F} = BIL \sin 90^\circ \Theta$
- b: $\vec{F} = BIL \sin 0^\circ$ no force!
- c: $\vec{F} = BIL \sin 90^\circ \Omega$
- d: $\vec{F} = BIL \sin 0^\circ$ no force!

So: 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**

\[
\vec{F} \text{ on positive particle causes it to have centripetal acceleration.}\\
\vec{F}_B = \vec{F}_{centripetal}\\
qvB = \frac{mv^2}{r}\\
r = \frac{mv^2}{qvB}\\
r = \frac{mv}{qB}
\]