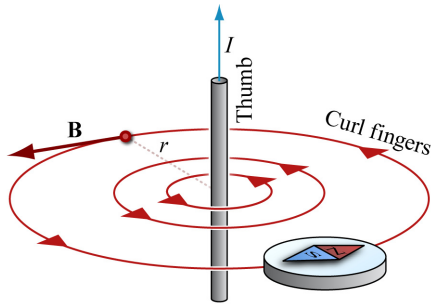


# Magnetism

Moving charges create magnetic fields, and magnetic fields exert magnetic forces on moving charges.

Moving charges create magnetic fields

**Steady infinite line current**





$$|\vec{B}| = \frac{\mu_0 I}{2\pi r}$$

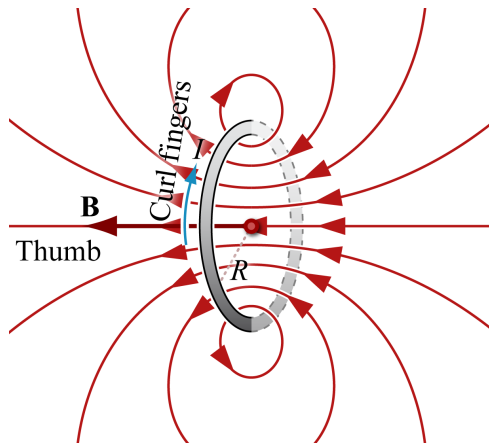
$$[B] = T$$

$$\mu_0 = 4\pi \times 10^{-7} \frac{T \cdot m}{A}$$

(All panels illustrate **right hand rules**)

Legend:  out (arrowhead)  
 in (fletching)

**Steady circular loop current**



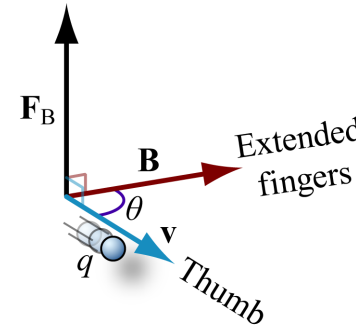
$$|\vec{B}_{\text{CENTER}}| = \frac{\mu_0 I}{2R}$$

**Superposition:**  $\vec{B}_{@P} = \vec{B}_{@P \text{ from src 1}} + \vec{B}_{@P \text{ from src 2}} + \dots$

Magnetic fields exert magnetic forces on moving charges

**Force on a moving charge**

Out from open palm



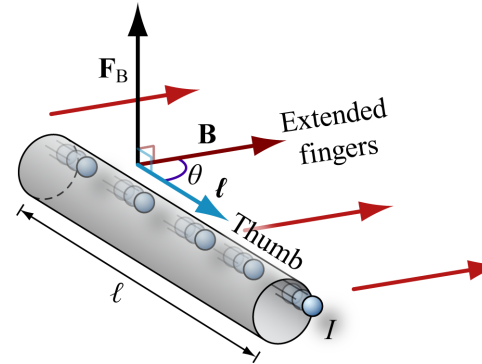
$$\vec{F}_B = q\vec{v} \times \vec{B}$$

(**RHR** for positive moving charge illustrated; for negative moving charge, reverse direction of thumb)

$$|\vec{F}_B| = |q||\vec{v}| \sin \theta |\vec{B}|$$

**Force on a line segment of current**

Out from open palm



$$\vec{F}_B = I\vec{\ell} \times \vec{B}$$

$$|\vec{F}_B| = I|\vec{\ell}| \sin \theta |\vec{B}|$$