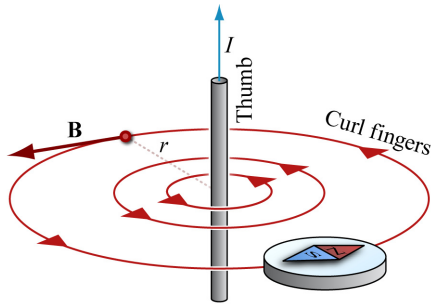


Magnetism

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

Moving charges create magnetic fields

Infinite line current





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

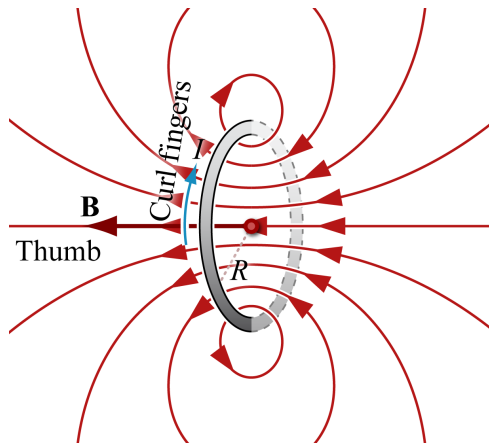
$$[B] = \text{T}$$

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

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

Legend:  out (arrowhead)
  in (fletching)

Circular loop current



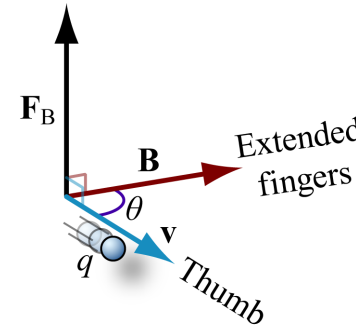
$$|\vec{B}_{\text{CENTER}}| = \frac{\mu_0 I}{2R}$$

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



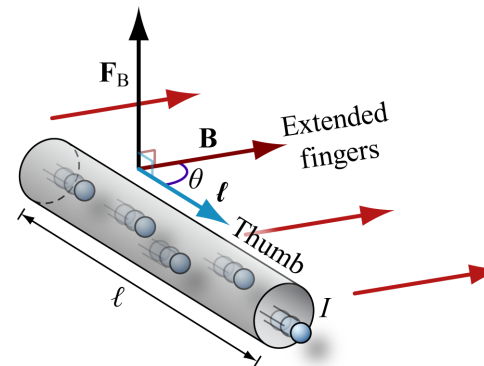
$$\vec{F}_B = q\vec{v} \times \vec{B}$$

(**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



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

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