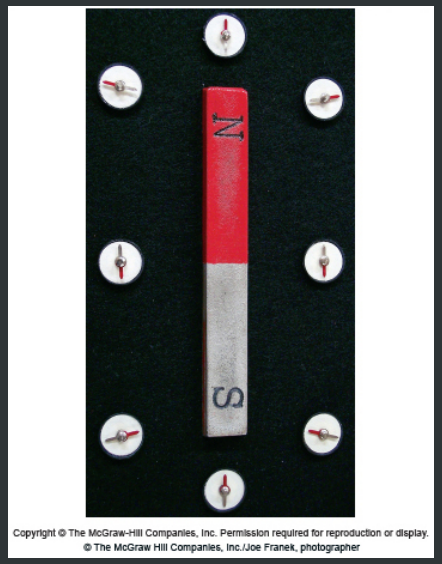
After this you can
- discuss the origin of of the magnetic field
- apply this to everyday magnetic phenomena

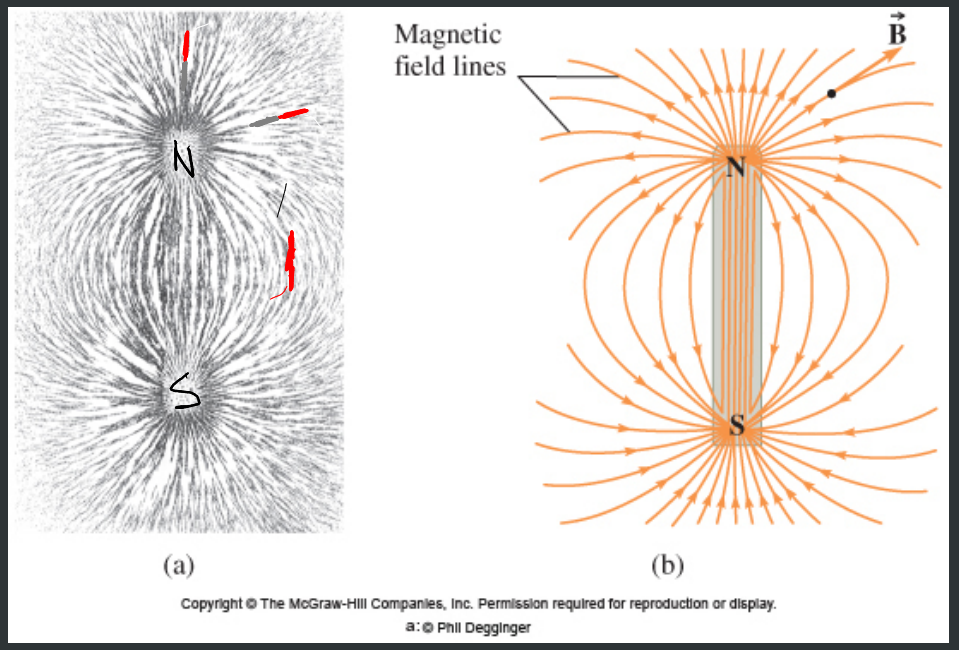
force field	property that produces the field	exerts a force on	force equation	field units
gravitational field, $\vec{g}$	mass	another mass	$\vec{F}_G = m \cdot \vec{g}$	$\frac{N}{kg}$
electric field $\vec{E}$	charge (active)	another charge (passive)	$\vec{F}_E = q \cdot \vec{E}$	$\frac{N}{C}$
magnetic field $\vec{B}$	current, moving charge	another current or moving charge	$\vec{F}_B = I\vec{l} \times \vec{B}$ or $\vec{F}_B = q\vec{v} \times \vec{B}$	$\frac{N}{A \cdot m}$, $\frac{N}{C \cdot m/s}$

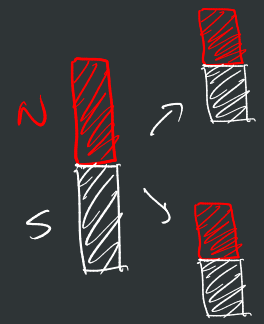
SI. → [Tesla] ⇒ [T]

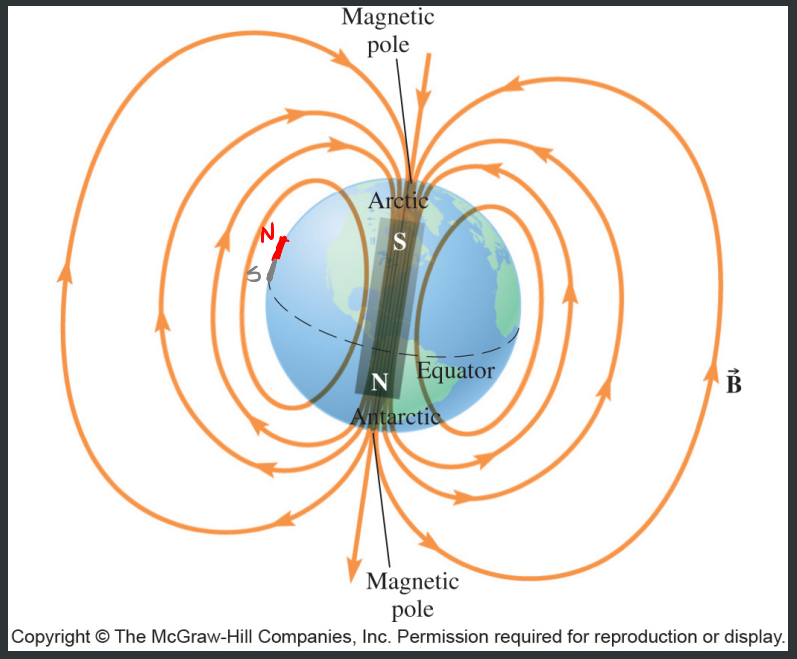
—or—

[Gauss]

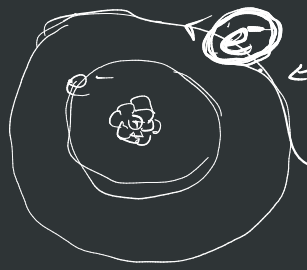








↳ where is the current?



electron orbit

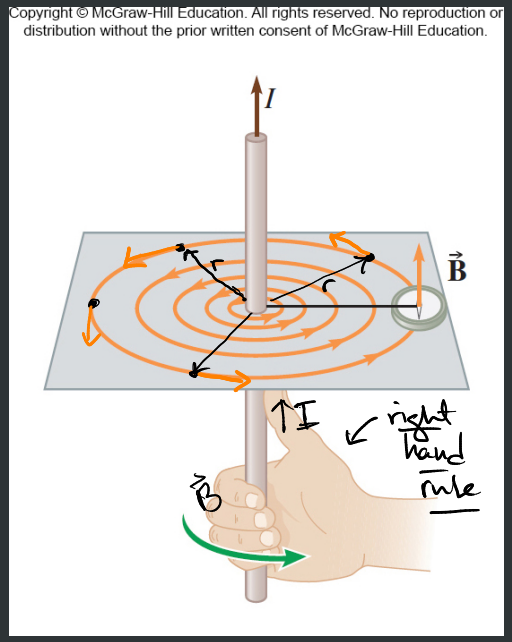
quantum property

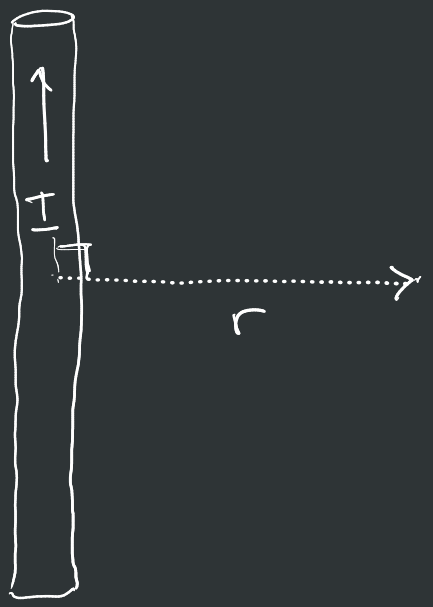
→ spin

acts like a magnetic dipole

After this you can:

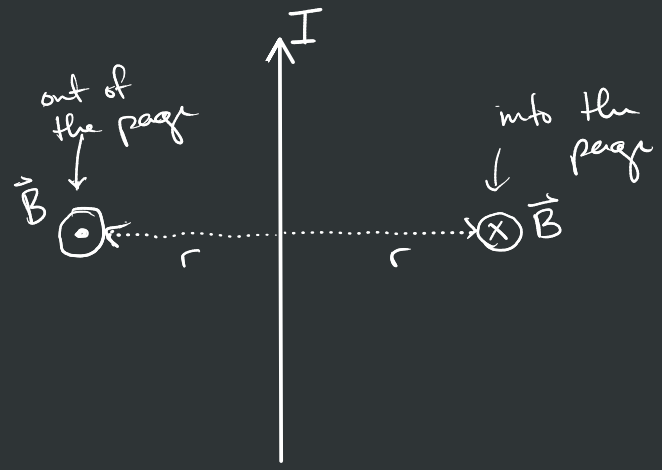
- discuss the shape of the magnetic field around a line of current
- calculate the magnetic field magnitude as a funtion of distance from the current

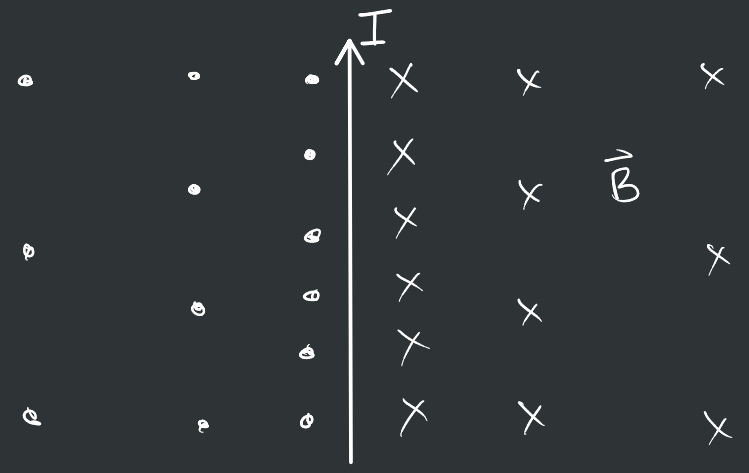




$$\mu_0 = 4\pi \cdot 10^{-7} \frac{T\,m}{A}$$

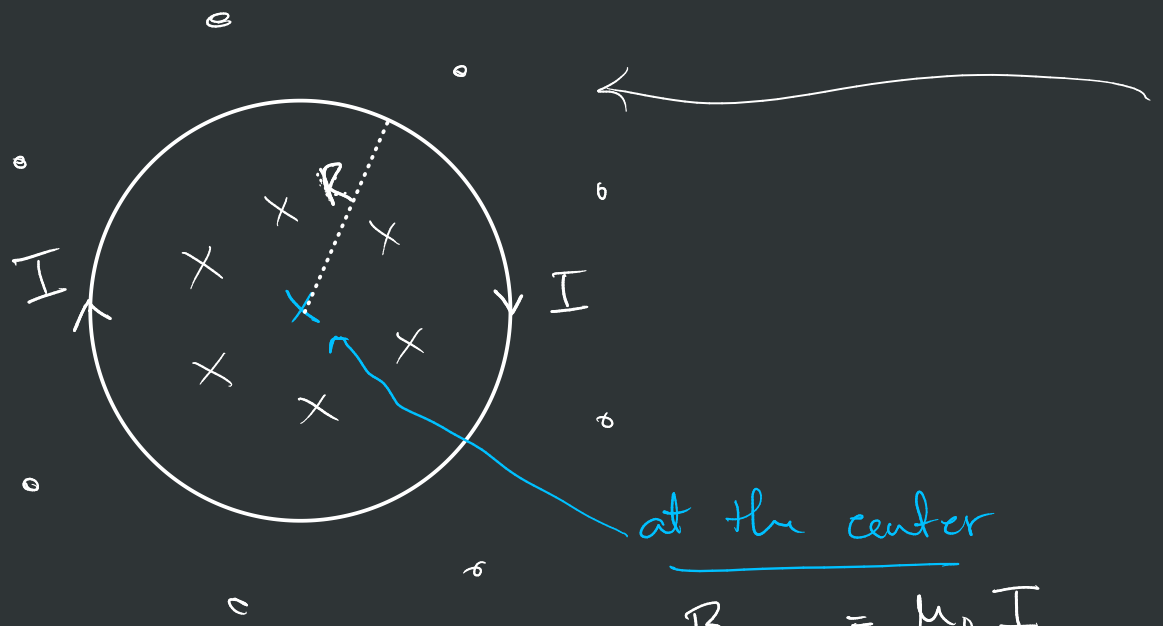
$$B(r) = \frac{\mu_0 I}{2\pi r}$$





After this you can

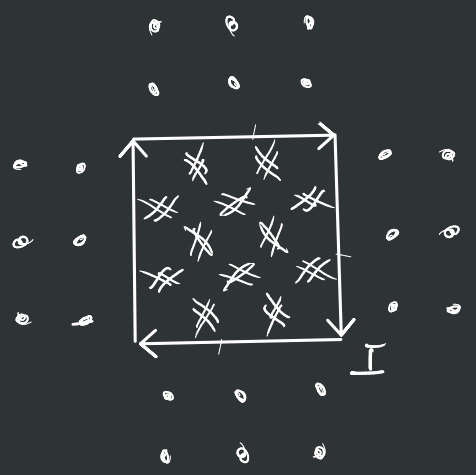
- discuss the magnetic field resulting from a coil
- discuss the magnetic field resulting from a solenoid

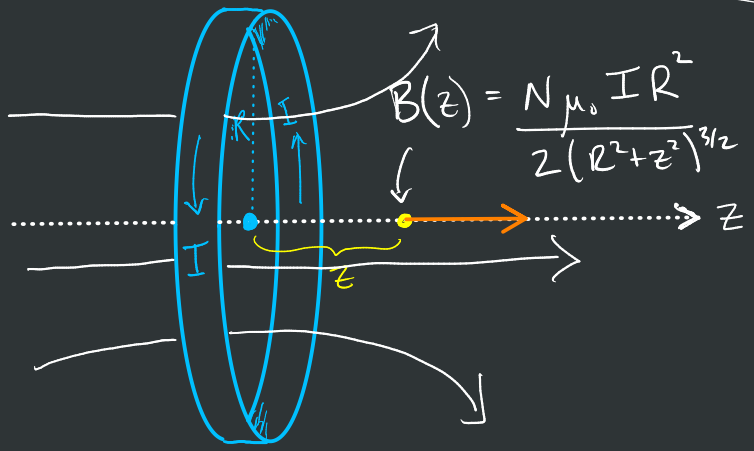


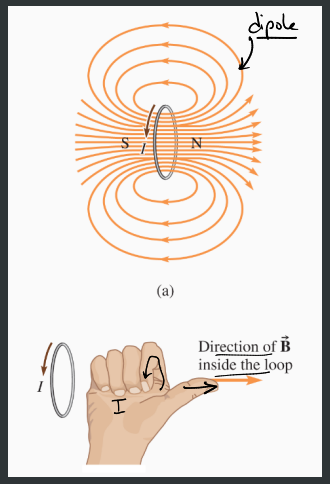
at the center

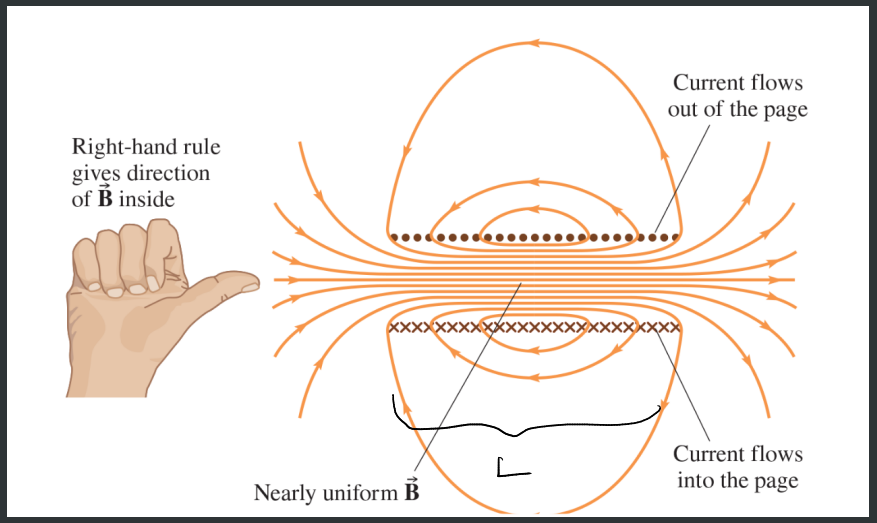
$$B_{center} = \frac{\mu_0 I}{2R}$$

↑ single loop









center of solenoid

$$B = \frac{\mu_0 N I}{L}$$

N → number of turns

$$\frac{N}{L} = n$$

n ← number of turns per unit of length

turn density

$$\boxed{B = \mu_0 n \cdot I}$$