

$$\vec{F}_{A \rightarrow B} = i_B L_B \times \vec{B}_A \quad \wedge \text{ Left}$$

$$\vec{F}_{B \rightarrow A} = i_A L_A \times \vec{B}_B \quad \wedge \text{ Right}$$

$$B_A = \frac{\mu_0 i_A}{2\pi d}$$

$$B_B = \frac{\mu_0 i_B}{2\pi d}$$

$$\vec{F}_{A \rightarrow B} = \frac{i_b L_b \mu_0 i_A}{2\pi d} \quad \uparrow \text{Left}$$

$$\vec{F}_{B \rightarrow A} = \frac{i_A L_A \mu_0 i_B}{2\pi d} \quad \uparrow \text{Right}$$

$i_A = 10 \text{ A}$ $d = 1.0 \text{ m}$
 $i_B = 20 \text{ A}$ $L_A = 1.0 \text{ m}$ $L_B = 2.0 \text{ m}$

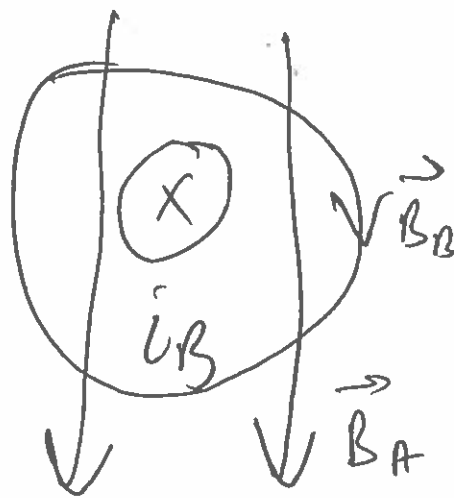
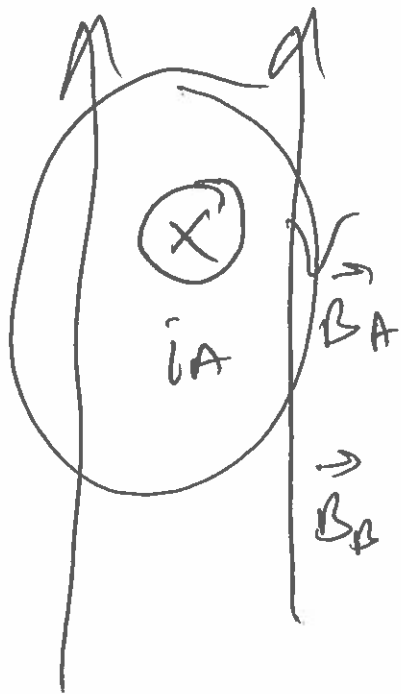
$$\vec{F}_{A \rightarrow B} = \frac{(20 \text{ A})(1 \text{ m})(4\pi \times 10^{-7} \text{ Tm/A})(10 \text{ A})}{2\pi (1 \text{ m})} \quad \uparrow \text{Left}$$

$$\vec{F}_{A \rightarrow B} = 4.0 \times 10^{-5} \text{ N} \quad \uparrow \text{Left}$$

$$\vec{F}_{B \rightarrow A} = \frac{(10 \text{ A})(1 \text{ m})(4\pi \times 10^{-7} \text{ Tm/A})(20 \text{ A})}{2\pi (1 \text{ m})} \quad \uparrow \text{Right}$$

$$\vec{F}_{B \rightarrow A} = 4.0 \times 10^{-5} \text{ N} \quad \uparrow \text{Right}$$

$$\vec{F}_{B \rightarrow A} = -\vec{F}_{A \rightarrow B}$$

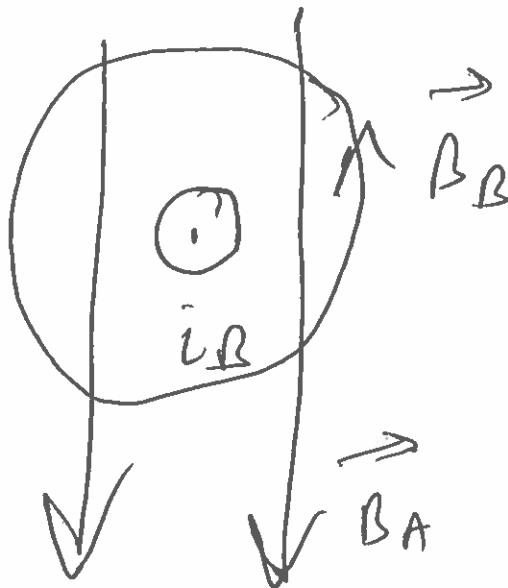
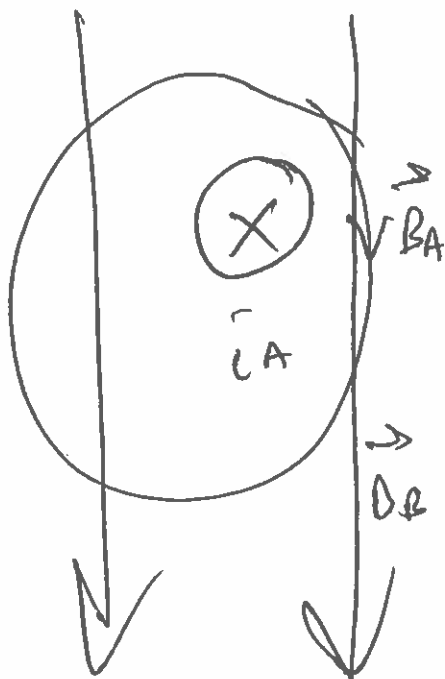


$$\overline{\overline{A}} \rightarrow B \Rightarrow$$

$$\overline{B} \rightarrow A \Rightarrow$$

^
Left

^
Right



$$\overline{\overline{A}} \rightarrow B \Rightarrow$$

$$\overline{B} \rightarrow A \Rightarrow$$

=>

=>

^
Right

^
Left

B-field of
a circular loop
of wire



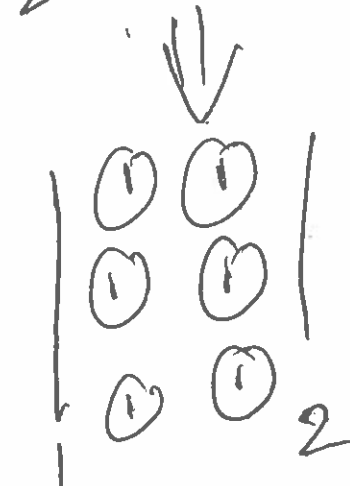
$$\vec{B}_{loop} = \frac{\mu_0 i}{2R} \hat{n}$$

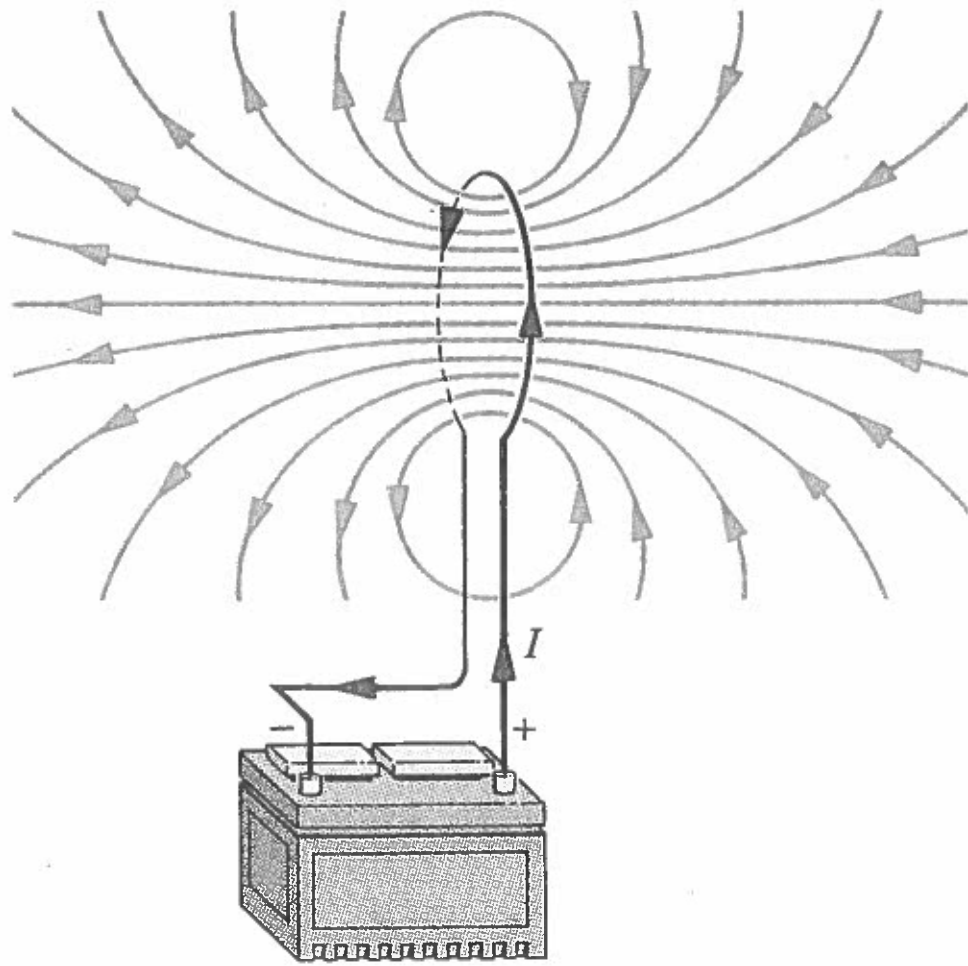
RT
Hand
Rule

Nothing

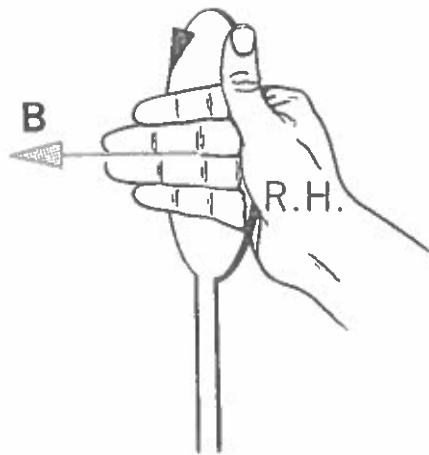


Nothing






(a)



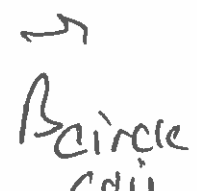
(b)

for a single circular wire


$$\vec{B}_{\text{circle}} = \frac{\mu_0 i}{2R}$$


^
RT
Hand
Rule

for a circular coil N turns


$$\vec{B}_{\text{circle coil}} = \frac{\mu_0 N i}{2R}$$

^
RT Hand
Rule

A 20 turn circular coil carrying 15 A counter clockwise. coil has a radius of 0.15 m \vec{B} at the center

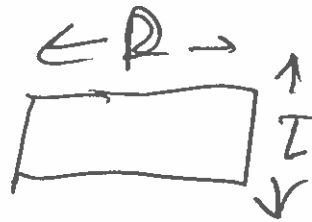

$$\vec{B}_{\text{coil}} = \frac{\mu_0 N i}{2R}$$
$$= \frac{(4\pi \times 10^{-7} \frac{\text{Tm}}{\text{A}})(20)(15\text{A})}{2(0.15\text{m})}$$

^
⊙

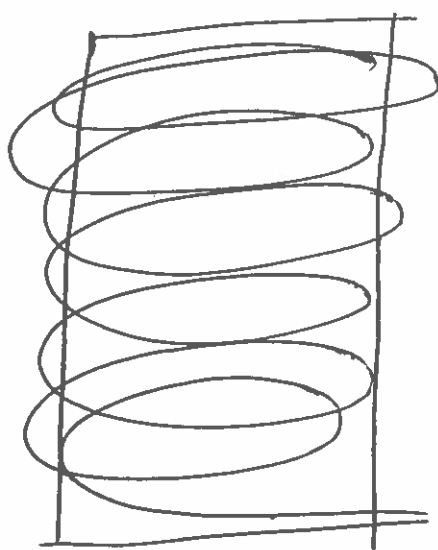
$$\vec{B}_{\text{coil}} = 1.26 \times 10^{-3} \text{ T}$$

^
⊙

Circular coil



$z \ll D$
 Thickness \ll Diameter



$z \sim > D$

Solenoid

$$\vec{B} = \mu_0 n \vec{i}$$

$$\frac{\mu_0 N}{L} L \quad n = \frac{N}{L}$$

$n = \frac{\text{Turns}}{\text{length}}$

