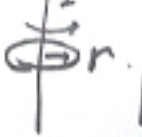
$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_C$ Ampere's Law

$\mu_0 = 4\pi \times 10^{-7}$



$\vec{B} \parallel \vec{s}$ $|\vec{B}|$ constant

$\oint \vec{B} \cdot d\vec{s} = \oint B\, ds = B \oint ds$

$= B(2\pi r) = \mu_0 I$

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

$I = J(\pi a^2)$

DC

$R = \rho \frac{L}{A}$

$\vec{B} \parallel \vec{S}$ $|\vec{B}|$ constant

$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_c$

$B(2\pi r) = \mu_0 \iint_{I_c} \vec{J} \cdot d\vec{A}$

$$\iint \vec{J} \cdot d\vec{A} = \iint J \, dA$$

$$= J \iint dA = J(\pi r^2)$$

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

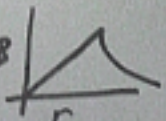
1.

$$\vec{B} = \mu_0 \frac{J r}{2} \hat{\theta} = \frac{\mu_0 I}{2\pi a^2} \hat{\theta} \left(\pi a^2\right)$$

Inside ($r < a$)

$r > a$ $\quad \vec{B} = \dfrac{\mu_0 I}{2\pi r} \hat{\theta}$

$\dfrac{\mu_0 \hat{\theta} I}{2\pi a}$

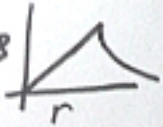


$\vec{B} = \mu_0 \frac{J r}{2} \hat{\theta} = \frac{\mu_0 I}{2} \hat{\theta} \left(\frac{r}{\pi a^2}\right)$

Inside ($r < a$)

$\frac{\mu_0 \hat{\theta} I}{2\pi a}$

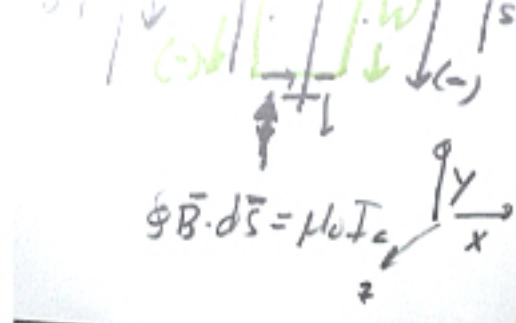
$r > a \quad \vec{B} = \frac{\mu_0 I \hat{\theta}}{2\pi r}$



$B = 0$

$J = \frac{I}{\pi(a^2 - b^2)}$

$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_c$



$$\oint \vec{B} \cdot d\vec{s} = -2BW$$

$$J_s = \frac{I}{\text{Length}}$$

$$I_c = J_s \cdot W$$

$$-2BW = \mu_0 J_s W$$

$$\vec{B} = -\frac{\mu_0 J_s}{2} \hat{i}$$

$+\hat{y}$ | $-\hat{y}$

$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_c$

$\oint \vec{B} \cdot d\vec{s} = -2BW$

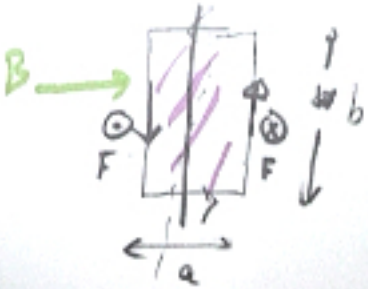
$J_s = \frac{I}{\text{length}}$

$I_c = J_s \cdot W$

$-2BW = \mu_0 J_s W$

$\vec{B} = -\frac{\mu_0 J_s}{2}\hat{y}$

$+\hat{y}$ | $-\hat{y}$



$$\vec{F} = I\vec{L} \times \vec{B}$$

$$\vec{\tau} = \vec{R} \times \vec{F}$$

$$\Rightarrow \tau = \left(\frac{a}{2}\right) I b B \times 2$$

$$= I(ab)B = IAB$$

a_{Area}

$\tau = r \times F$

$\Rightarrow \tau = \left(\frac{a}{2}\right) I b B \times 2$

$\vec{\mu} = I \vec{A}$

$\vec{\tau} = \vec{\mu} \times \vec{B}$

$\tau = \mu B \sin\theta$

$\mu = n I \vec{A}$ 25 loops

$a = .054\,m$ $1.5\,mA$

$b = .085\,m$

$\mu = 25(.054 \times .085) \times 1.5 \times 10^{-3}$

$1.7 \times 10^{-4}\ Am^2$