

Quiz 4 Solutions

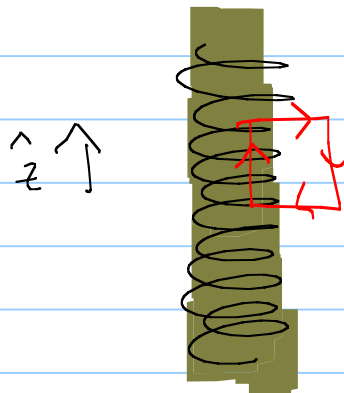
Note Title

4/21/2011

① $\vec{A} = \kappa s \hat{z}$ $\vec{B} = \nabla \times \vec{A} = \frac{1}{s} \frac{\partial}{\partial s} (s(\kappa s)) \hat{z}$

$$\vec{B} = \frac{1}{s} \kappa (2s) \hat{z} = 2\kappa \hat{z}$$

②



$\chi_m = 2.4$ $i = .056 \text{ A}$
 $n = 120 \text{ turns/m}$

$\oint \vec{H} \cdot d\vec{l} = i_{\text{free}}$

$H L = i_{\text{free}} = N i$

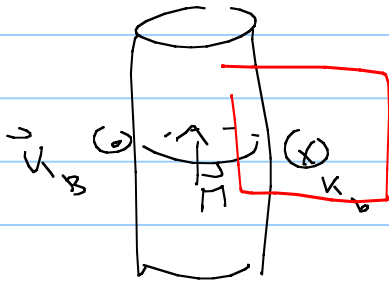
$H = \frac{N}{L} i = n i$

$$\vec{H} = 6.72 \frac{\text{A}}{\text{m}} \hat{z}$$

$\vec{B} = \mu_0 (1 + \chi_m) \vec{H}$ $\vec{M} = \chi_m \vec{H} = 16.1 \frac{\text{A}}{\text{m}} \hat{z}$

$\vec{B} = (4\pi \times 10^{-7}) (1 + 2.4) (6.72) \hat{z} = 2.87 \times 10^{-5} \text{ T} \hat{z}$

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$$\vec{M} = \text{constant} = M_0 \hat{z}$$

$$\vec{J}_b = \nabla \times \vec{M} = 0 \dots$$

$$\vec{K}_b = \vec{M} \times \hat{n} = M_0 \hat{z} \times \hat{s}$$

$$\vec{K}_b = M_0 \hat{\phi}$$

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 i_{enc} \Rightarrow BL = \mu_0 (K_b)(L)$$

$$i_{enc} = (K_b)(L) !$$

$$B = \mu_0 K_b = \mu_0 M_0$$

$$\vec{B} = \mu_0 \vec{M} \quad \text{inside}$$

$$\vec{B} = 0 \quad \text{outside} \dots$$

note $\vec{H} = 0$, no free current,

$$\vec{B} = \mu_0 (\vec{H} + \vec{M}) = \mu_0 \vec{M} \dots$$