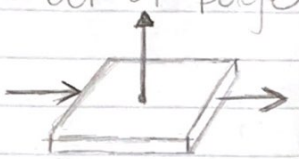
gaby gonzalez

Midterm 3

Chapter 11: Magnetic Forces and Fields

1. a: into the page b. left
   c. out of page

2. 

a. $\vec{F} = q\vec{v} \times \vec{B}$

$qE = q\vec{v}\vec{B}\sin\theta$ but since perpendicular, so $\theta = 90°$

$qE = qvB$

$E = vB$ which gives the relationship $v = \frac{E}{B}$

b. known: $E = \frac{\Delta V}{\Delta x}$

$\Delta V = E(\Delta x)$ from last problem $(E = vB)$

$\Delta V = (vB)(\Delta x)$ $(v_d = i/(nqA))$

$\Delta x = i/(nqA)(B\Delta x)$

$\Delta x = \frac{iB\Delta x}{nqeA}$ ✓

now plug in values

$B = 1.33\ T$, $\Delta x = 2cm$, $I = 10A$, $n = 2 \times 10^{28} m^{-3}$, $A = 1mm^2$,

$q_e = 1.6 \times 10^{-19}$ ↘ $2 \times 10^{-2} m$ ↳ $1 \times 10^{-3} m$

$$\Delta x = \frac{(1.33)\cdot(2\times10^{-2})\cdot 10}{(2\times10^{28})\cdot(1.6\times10^{-19})\cdot(1\times10^{-3})^2}$$

$\boxed{\Delta x = 8.31 \times 10^{-5} V}$

3. Torque can: $IABsin(\theta)$

$A = 4\pi(0.65\times10^{-15})^2$ $I = 1.05\times10^{4} A$ $B = 2.50\ T$

$= 8.17 \times 10^{-15} m$

$= 5.31 \times 10^{-30} m^2$

$Torque = (1.05\times10^{4})\cdot(5.31\times10^{-30})\cdot(2.50)\ Nm$

$\boxed{= 1.39 \times 10^{-25}\ Nm}$

Chapter 12: Sources of Magnetic Fields

1. a) $B = \mu_0 n I$
$= (4\pi \times 10^{-7}) \cdot (500) \cdot (.3)$
$= 1.88 \times 10^{-4}\ T$

b) $B = \mu_0 n I$
$= (5000\mu_0) n I$
$= 5000 \cdot (1.88 \times 10^{-4})$
$= .9425\ T$

2. a) In general, the net force of the particle is 0. Which means the force of electrical and force of magnetic will equal 0.

$q\vec{E} + q\vec{v} \times \vec{B} = 0$
$q(\vec{E} + \vec{v} \times \vec{B}) = 0$
$q(E - \vec{v}\vec{B}) = 0$ so in order to equal 0 then
$E = vb$ & $v = E/B$

2.

b) $E = 10\ V/m$ Proton charge $= 1.602 \times 10^{-19}\ C$
$B = 0.01T$ mass $= 16 \cdot (1.67 \times 10^{-27}) = 2.672 \times 10^{-26}\ kg$

$$r = \frac{mE}{qB^2}$$

$$r = \frac{(2.672 \times 10^{-26}) \cdot (10)}{(1.602 \times 10^{-19})(0.01)^2}$$

$r = 0.01667\ m$

Chapter 13: Electromagnetic Induction

1. a)

$$\frac{dB}{dt} = B_0 \left[\frac{2}{\pi} \cos(2\pi f t) \cdot 2\pi f + \frac{2}{3\pi} \cos(6\pi f t) \cdot 6\pi f + \frac{2}{5\pi} \cos(10\pi f t) \cdot 10\pi f \right]$$

$$= B_0 \left[4f \cos(2\pi f t) + 4f \cos(6\pi f t) + 4f \cos(10\pi f t) \right]$$

$$= 4f B_0 \left[\cos(2\pi f t) + \cos(6\pi f t) + \cos(10\pi f t) \right] \cdot \text{Area}$$

$$= \pi r^2 \left[4f B_0 (\cos(2\pi f t) + \cos(6\pi f t) + \cos(10\pi f t)) \right]$$

so

$$\mathcal{E} = -\pi r^2 4f B_0 \left[\cos(2\pi f t) + \cos(6\pi f t) + \cos(10\pi f t) \right]$$

b) $B_0 = 0.1\ T$, $r = 0.1\ m$, $f = 10^3\ Hz$

$$|\mathcal{E}| = \pi (0.1)^2 4 (10^3) (0.1) \left[\cos(0) + \cos(0) + \cos(0) \right]$$

$$|\mathcal{E}| = 12\ V$$

c) $1\ ms = 10^{-3}\ s$

$$|\mathcal{E}| = \pi (0.1)^2 4 (10^3) (0.1) \left[\cos(2\pi) + \cos(6\pi) + \cos(10\pi) \right]$$

$$\approx 11.18\ V$$

Chapter 14: Inductance

1. $\mathcal{E} = -L \frac{dI}{dt}$

$$\frac{dI}{dt} = \frac{-\mathcal{E}}{L}$$

$$= \left| \frac{-0.15\ V}{0.50\ H} \right|$$

$$\boxed{dI/dt = .3\ A/s}$$

2. $\mathcal{E} = -L \frac{dI}{dt}$

$$dt = \left| \frac{-L}{E}\ dI \right| = \frac{L}{E}\ dI$$

where $L = 2.00\ mH \cdot \frac{10^{-3}\ H}{1\ mH} = .002\ H$

$E = 500V$

$dI = 0.1\ A$

$$\boxed{dt = \frac{.002}{500} \cdot 0.1 = 4 \times 10^{-7}}$$