

Armisael Ramirez

PHYS 180

Mid 3

1)

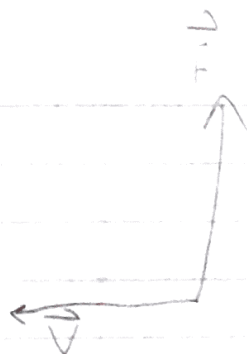
a)



b)



c)



- a) B field out of page
b) B field right
c) B field into page

2) a)

$$F_{\text{Lorentz}} = qE$$

$$v = E/B$$

$$F_B = F_E$$

$$F = qE = qvB \sin \theta$$

$$\theta = 90^\circ \quad \sin = 1$$

$$qE = qvB$$

$$v = E/B \checkmark$$

b) $E = \Delta V / \Delta x$

$\Delta v = E \Delta x$ (with vB above E)

$\Delta v = vB \Delta x$

$$\Delta V = \frac{B \Delta x I}{n q_e A}$$


would be drift
 $= \frac{I}{n q_e A}$

$$\Delta V = \frac{B \Delta x I}{n q_e A} \checkmark$$

c) $\Delta V = \frac{1.33 \text{ T} (.02 \text{ m}) (10 \text{ A})}{(2 \times 10^{28} \text{ m}^{-3}) (1 \text{ mm}^2) (1.6 \times 10^{-19})}$

$$\Delta V \approx 8.3 \times 10^{-5} \text{ V}$$

3)



$$r = .65 \times 10^{-6} \text{ m}$$

$$I = 1.05 \times 10^4 \text{ A}$$

$$B = 2.50 \text{ T}$$

$$\tau = N I A B \sin \theta$$

$$N = 1 \quad \tau = I A B$$

$$\theta = 90$$

$$A = \pi r^2$$

$$A = .65 \times 10^{-6} \text{ m}^2 \pi$$

$$= 1.3 \times 10^{-10} \text{ m}^2$$

$$\tau = (1.05 \times 10^4 \text{ A})(1.3 \times 10^{-10} \text{ m}^2)(2.50 \text{ T})$$

$$= 1.365 \times 10^{-26} (2.50)$$

$$= \boxed{3.43 \times 10^{-26} \text{ N} \cdot \text{m}}$$

4) (a) $n = 500$
 $I = .3 \text{ A}$

(b) $B = \frac{\mu_0 n I}{L}$

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

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

$$(62.8 \times 10^{-4}) 500 (.30)$$

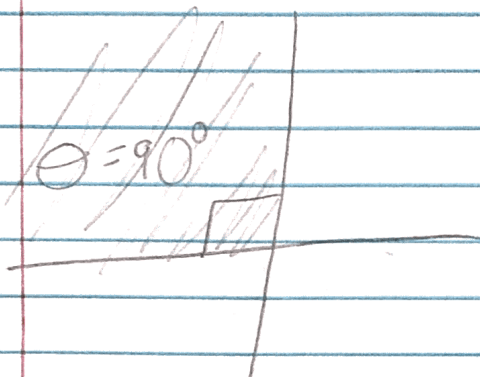
$$500 \text{ turns } (.3 \text{ A})$$

$$= \boxed{1.9 \times 10^{-4} \text{ T}}$$

$$= \boxed{9.42 \times 10^{-4} \text{ T}}$$

5) $v = EB$ iff $F_{\text{net}} = 0$

$$F = qE \times B \cos \theta$$



$$F_{\text{net}} = qE \times B \cos 90^\circ$$

$$qE \times B (0)$$

$$F_{\text{net}} = 0 \checkmark$$

$$b) \frac{mv^2}{r} = \frac{mE^2}{rB^2} = qvB \sin \theta$$

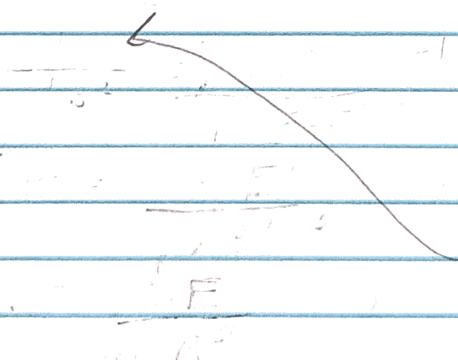
$$\theta = 90^\circ$$

$$\theta = 90^\circ$$

$$v = E/B$$

$$r = \frac{mv}{qB}$$

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



$$\frac{mv^2}{r} = qvB$$

$$\left(\frac{1}{r}\right) = \left(\frac{qvB}{mv^2}\right) \cdot 1$$

$$r = \frac{mv}{qB}$$

$$r = \frac{mv}{qB}$$

$$c) \frac{16(1.67 \times 10^{-27} \text{ kg}) \times 10 \text{ V}}{(1.6 \times 10^{-19}) (0.01 \text{ T})} \text{ m}$$

$$r = 1.7 \times 10^{-4} \text{ m}$$

$$6) B(t) = B_0 \left(\frac{1}{2} + \frac{2}{\pi} \sin(2\pi f t) + \frac{2}{3\pi} \sin(6\pi f t) + \frac{2}{5\pi} \sin(10\pi f t) \right)$$

$$a) e = \left(\frac{d\Phi}{dt} \right) \quad \frac{dBA}{dt} \quad A$$

$$\frac{dB}{dt} = A B_0$$

$$\pi r^2 \times B_0 \left(\frac{1}{2} + \frac{2}{\pi} \sin(2\pi f t) + \frac{2}{3\pi} \sin(6\pi f t) + \frac{2}{5\pi} \sin(10\pi f t) \right)$$

$$b) t=0 \quad f=10^3 \text{ Hz}$$

$$r = .1 \text{ m}$$

$$B_0 = 0.1 \text{ T}$$

$$\pi (.1 \text{ m})^2 (.1) \cdot \frac{1}{2}$$

$$= .002 \text{ V}$$

$$c) t=1$$

$$e = .006 \text{ V} \quad \frac{V}{\pi R}$$

$$I = \frac{V}{R} \quad \frac{.006 \text{ V}}{5.0 \Omega}$$

$$\approx 1.2 \text{ mA}$$

7) $.50 \text{ H}$
 $\text{emf} = .150 \text{ V}$

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

$$\frac{dI}{dt} = \frac{-\text{emf}}{L} = \frac{-.150 \text{ V}}{.50}$$

$$\left| \frac{dI}{dt} \right| = 1.3 \text{ A/s}$$

$$= .3 \text{ A/s}$$

8) $.100 \text{ A}$

2.00 mH

500 V emf

$$\frac{dI}{dt} =$$

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

$$= \frac{(2.00 \times 10^{-3} \text{ H}) (.100 \text{ A/s})}{500 \text{ V}}$$

$$= 4. \times 10^{-7} \text{ s}$$