#11) a: intopage

b: left

c: out of Page

#2

Force of B field on charges carrying current

a) $F = qvB\sin\theta$

V = velocity

B = magnetic field

q = charge

$\theta$ = angle between velocity of charges and B magnetic field

$\theta$ is 90 deg

$\downarrow$

$F_B = qvB$

Force of E-field on charges

$F_E = qE$

$\cancel{q}E = \cancel{q}vB$ ← Two force are equal in magnitude and opposite in direction.

$V = \frac{E}{B}$

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b) $E = \frac{\Delta V}{\Delta x}$

* $E = vB$

~~For~~.
* All charges have the same uniform cross section velocity

$\Delta V = E \Delta x$

$\Delta V = vB\Delta x$

* $I = neAv$

A = Area
n = charge density
$q_e$ = Charge
v = velocity

$\frac{I}{nq_eA} = v$

* Uniform magnetic the eletric field is the same

$V = \left(\frac{I}{nq_eA}\right) B\Delta x$

$$\boxed{V = \frac{IB\Delta x}{nq_eA}}$$

$B = 1.33\,T$
$\Delta x = 2cm = 0.02m$
$I = 10A$
$n = 2\times10^{28}\,m^{-3}$
$A : 1mm^2 \times \left(\frac{1}{1000\,mm}\right)^2 = 1\times10^{-6}\,m^2$
$q_e = 1.6\times10^{-19}\,C$

$$V = \frac{(10A)(1.33T)(0.02m)}{(2\times10^{28}m^{-3})(1.6\times10^{-19}C)(1\times10^{-6}m^2)}$$

$= \frac{0.266}{3200}$

$$\boxed{= 8.31\times10^{-5}\,V}$$

#3

$$\tau_{max} = NIAB = NI\pi r^2 B$$

*$A = \pi r^2$

b/c circle shape

$B = 2.50\,T$

$r = 0.65 \times 10^{-15}\,m$

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

$N = 1$

$$\tau_{max} = (1)(1.05 \times 10^{4}\,A)\,\pi\,(0.65 \times 10^{-15}\,m)^2(2.50\,T)$$

$$\tau_{max} = 3.48 \times 10^{-26}\,N \cdot m$$

Chapter 12

#1) a) $B_{solenoid} = \mu_0 n I$

$= (4\pi \times 10^{-7} N/A^2)(500 N/L)(0.3A)$

$n = 500 N/L$

$\mu_0 = 4\pi \times 10^{-7} N/A^2$

$I = 0.3A$

$\boxed{B_{sole} = 1.88 \times 10^{-4} T}$

b) $(4\pi \times 10^{-7} N/A^2)(5000)(500 N/L)(0.3A)$

$\boxed{B_{sole} = 0.94 T \quad \uparrow B\text{ Field}}$

#2) Electric field is from (+ve to −ve charge plate)

RHR − 1

B field = out of page

Velocity = right

*Net force = 0 the Particle is 0

$F_{electrical} = q\vec{E}$

$F_{mag} = q\vec{v} \times \vec{B}$

* $vB$ is downwards

$F_{electrical} + F_{magnetic} = 0$

$q\vec{E} + q\vec{v} \times \vec{B} = 0$

$qE - vB = 0$

$qE = vB$ → Next Page

$V = \frac{E}{B}$ for $F_{net} = 0$

* $F = qVB$

* It is perpendiculer to motion direction, so centripetal force and the particle rotats in a semi-circular arc at a distance of $2r$ with $r$ having a semi-circular path radious

centripetal force $= mv^2/r$

so,

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

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

Now we have;

$$v = \frac{E}{B} \Rightarrow r = \frac{m\left(\frac{E}{B}\right)}{qB} = \frac{mE}{qB^2} \; *$$

$$*\ r = \frac{mE}{q_e B^2}$$

$m = 16 \times m_{proton}$

$m = 16 \times 1.67 \times 10^{-27}\,kg$

$q_e = 1.6 \times 10^{-19}\,C$

$E = 10\,V/m$

$B = 0.01\,T$

$$r = \frac{(16 \times 1.67 \times 10^{-27}\,kg)(10\,V/m)}{(1.6 \times 10^{-19}\,C)\,(0.01)^2}$$

$$= \frac{2.672 \times 10^{-25}}{1.6 \times 10^{-23}}$$

$r = 0.0167\,m$ or $1.67\,cm$

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Chapter 13

$$* \ \mathcal{E} = -N \frac{\Delta \phi}{\Delta t} = -NBA = -NB(\pi r^2)$$

a) $\frac{\Delta B}{\Delta t} = \frac{B_0}{T_0} \sin(2\pi f t)$ *induced voltage is calculated by rate of change of magnetic flux

$$e = \frac{d\phi}{dt} = \frac{d(BA)}{dt}$$

$$e = A \frac{dB}{dt} \quad (\text{Area is constant})$$

* $A = \pi r^2$

$$\mathcal{E} = -N\left(\frac{\Delta B}{\Delta t}\right)(\pi r^2)$$

* $\frac{\Delta B}{\Delta t} = \frac{B_0}{T_0} \sin(2\pi f t)$

$$= -N \pi r^2 \frac{B_0}{T_0} \sin(2\pi f t)$$

b) * $t = 0$

$t = 0$, $\sin(2\pi f t) = \sin(0) = \underline{\underline{0}}$ *

Induced Emf will be 0 at $t = 0$

c) $t_1 = 0.16 ms = 0.00016 sec$

$B_0 = 0.1 T$

$$= \pi (0.1)^2 \left(\frac{0.1}{1.0 \times 10^{-3} sec}\right) \left(\sin(2\pi \times 10^3 \times 0.16 \times 10^{-3} sec\right)$$

$r = 0.1 m$

$f = 10^3 Hz$

$$= \pi \frac{\cancel{(0.1)^3}}{1.0 \times 10^{-3}} \sin(2\pi \times 10^3 \times 0.16 \times 10^{-3})$$

$T = 0.001 sec$

$t = 0.16 \times 10^{-3}$

$$= \pi \sin(2\pi \times 10^3 \times 0.16 \times 10^{-3})$$

$$= \pi \sin(0.32\pi)$$

$$= \pi (0.0175)$$

$$\boxed{= 0.055 \text{ Volts}}$$

d) $t_1$ : * $IR = V$

$R = 5 \Omega$

$I = \frac{V}{R}$ *

$V = 0.055$

$$I = \frac{0.055V}{5\Omega} = \boxed{0.011 A}$$

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# Chapter 14

1) $\mathcal{E} = -L\dfrac{\Delta I}{\Delta t}$ $|\mathcal{E}| = L\dfrac{\Delta I}{\Delta t} \Rightarrow \dfrac{\Delta I}{\Delta t} = \dfrac{\mathcal{E}}{L} = \dfrac{0.150V}{0.50H}$

$\boxed{= 0.3\ A/s}$

2) $\mathcal{E} = L\dfrac{\Delta I}{\Delta t}$ $I = 0.100A$

*$\Delta t = ?$ $\downarrow$ $\mathcal{E} = 500V$

$L = 2.00mH = 2\times10^{-3}H$

*$\Delta t = \dfrac{L\Delta I}{\mathcal{E}} \Rightarrow \dfrac{(2\times10^{-3}H)(0.100A)}{500V}$

$\boxed{\Delta t = 4\times10^{-7}\ sec}$