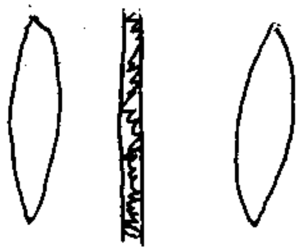
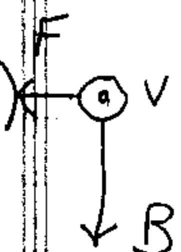
27. 5, 14, 21, 27

5) 

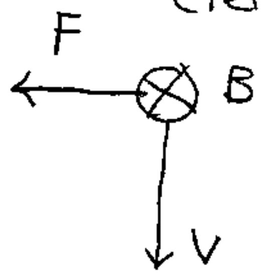
$\vec{F} = I\vec{\ell} \times \vec{B}$

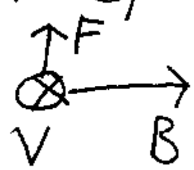
$1.18\,N = (8.75\,A)(.555\,m)\,B$

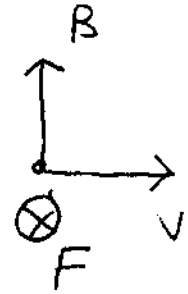
$B \simeq .24\,T$

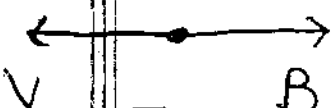
14) 

negative charge $\bar{F} = q\bar{v} \times \bar{B}$
(left hand rule)

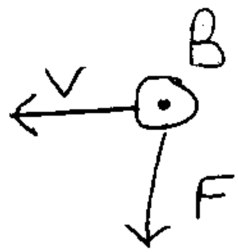








$F = 0$



21) $\frac{mv^2}{r} = qvB$ so $r = \frac{mv}{qB}$

$5\,MeV = 8.0 \times 10^{-13}\,J = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2(8 \times 10^{-13}\,J)}{m}} = 3.1 \times 10^{7}\,m/s$

so $r = \frac{(m_p)\,V}{q_p\,B} = 1.6\,m$

27. $\vec{F} = q\vec{E} + q\vec{v} \times \vec{B}$

$= (1.6 \times 10^{-19} C)(3\hat{i} - 4.2\hat{j}) \times 10^3 \frac{V}{m}$

$+ (1.6 \times 10^{-19} C)(6.0\hat{i} + 3\hat{j} - 5\hat{k}) \times 10^3 \, m/s \times (.45\hat{i} + .20\hat{j}) \, T$

$$\vec{v} \times \vec{B} = (V_y B_z - V_z B_y)\hat{i} + (V_z B_x - V_x B_z)\hat{j} + (V_x B_y - V_y B_x)\hat{k}$$

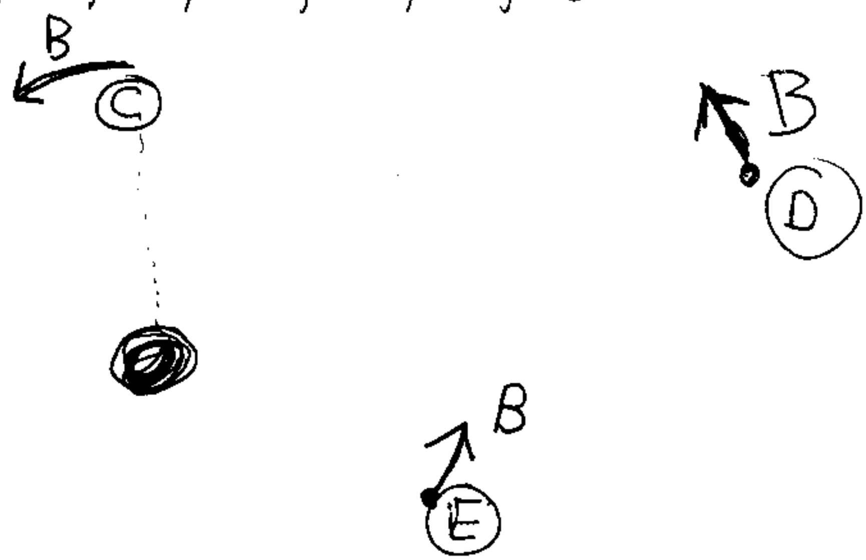
$\vec{F} = (1.6 \times 10^{-19} C)(3\hat{i} - 4.2\hat{j}) \times 10^3 \, V/m$

$+ (1.6 \times 10^{-19} C)(1 \times 10^3)\hat{i} - (2.25 \times 10^3)\hat{j} - (.15 \times 10^3)\hat{k}$

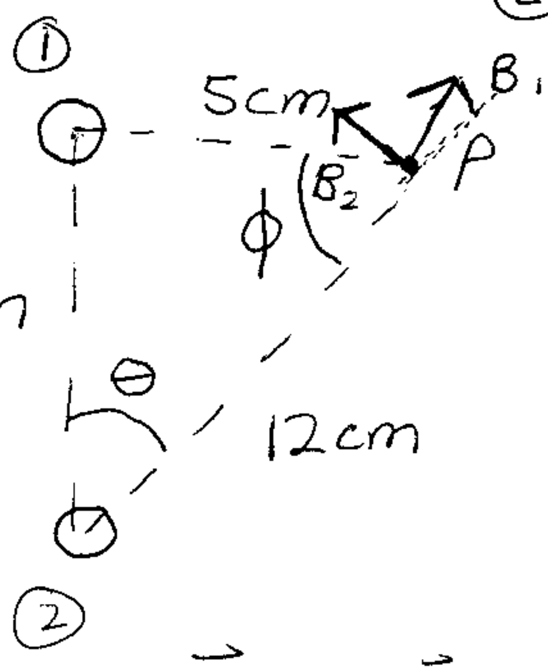
$= (1.6 \times 10^{-19} C)(4000\hat{i} - 6450\hat{j} - 150\hat{k}) \, Tm/s$

28 5, 7, 17, 21, 22, 27, 31, 36

5)



7)



(tangent to circle)

angle between $\vec{B}_1$ and $\vec{B}_2$ is ϕ.

$15^2 = 5^2 + 12^2 - 2(5)(12)\cos\phi$

$\phi = 62.2^\circ$

$\vec{B}_{TOT} = \vec{B}_{TOTx} + \vec{B}_{TOTy}$

Let x be along $\bar{B}_2$

Mistake $\phi > 90$! $= 117.8°$

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

$B_x = B_2 \oplus B_1 \cos(62.2^\circ)$

$B_y = B_1 \sin(62.2^\circ)$

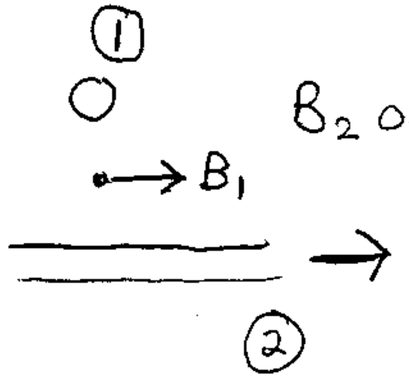
$B_1 = 1\times10^{-4}\,T$

$B_2 = 4.17\times10^{-5}\,T$

$B = \sqrt{B_x^2 + B_y^2} = 1.25\times10^{-4}\,T$

ch28)

17)



B_2 out of paper

$$\vec{B}_{TOT} = \vec{B}_1 + \vec{B}_2$$

$$|B_1| = \frac{\mu_0 I_1}{2\pi (.1m)} = 4\times10^{-5}\,T$$

$$|B_2| = \frac{\mu_0 I_2}{2\pi (.1m)} = 1\times10^{-5}\,T$$

Since $B_1 \perp B_2$ then $B_{TOT} = \sqrt{B_1^2 + B_2^2}$

$$= 4.12\times10^{-5}\,T$$

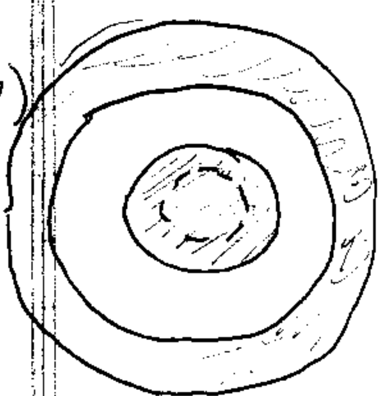
21. $B = \mu_0 n I$ $\quad n = \frac{N}{L}$ $\quad B = \frac{\mu_0 N}{L} I$

$$B = (4\pi\times10^{-7})\frac{Tm}{A}\frac{(1000)}{(.40m)} I = .385\times10^{-3}\,T$$

$$I = \cancel{\ \ } .12A$$

22. $N = \frac{BL}{\mu_0 I} = \frac{(.3T)(.32m)}{(4\pi\times10^{-7})(5.7A)} = 1340$

27)



a) $r < r_1$ $\quad I_{enc} = \frac{\pi r^2}{\pi r_1^2} I_0 = \frac{r^2}{r_1^2} I_0$

$$B(2\pi r) = \frac{\mu_0 r^2}{r_1^2} I_0$$

so $B = \frac{\mu_0 r}{2\pi r_1^2} I$

b) $r_1 < r < r_2$ $\quad I_{enc} = I_0$

so $B = \frac{\mu_0 I_0}{2\pi r}$

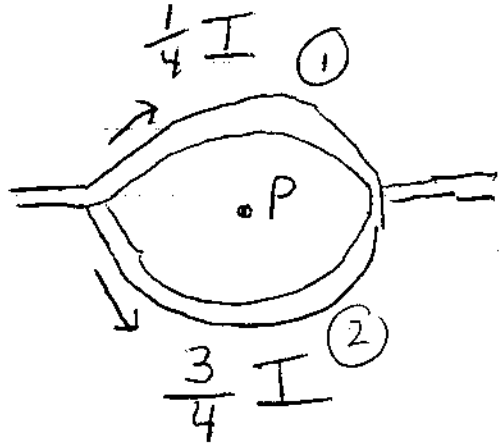
c) $I_{enc} = I_0 + \frac{\pi r^2 - \pi r_2^2}{\pi r_3^2 - \pi r_2^2}(-I_0)$

$$= I_0 \frac{(\pi r_3^2 - \pi r_2^2 + \pi r_2^2 - \pi r^2)}{\pi r_3^2 - \pi r_2^2} = \left(\frac{r_3^2 - r^2}{r_3^2 - r_2^2}\right) I_0$$

so $B = \frac{\left(\frac{r_3^2 - r^2}{r_3^2 - r_2^2}\right) \mu_0 I_0}{2\pi r}$

d) $B = 0$

31)



for loop $B = \dfrac{\mu_0 I}{2R}$

for half loop

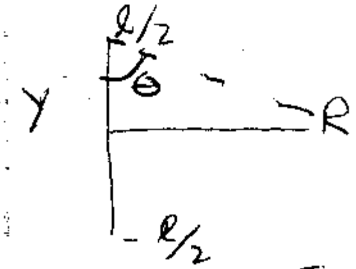
$$B = \frac{\mu_0 I}{4R}$$

Top at P into page Bottom out of page

$$B = -\frac{\mu_0 (\frac{1}{4} I)}{4R} \qquad B = +\frac{\mu_0 (\frac{3}{4} I)}{4R}$$

$$B_{TOT} = \frac{\mu_0 I}{R}\left(\frac{3}{16} - \frac{1}{16}\right) = \frac{\mu_0 I}{8R}$$

36) $B = \dfrac{\mu_0}{4\pi}\displaystyle\int \frac{I\, d\vec{l} \times \hat{r}}{r^2} = \dfrac{\mu_0}{4\pi} I \displaystyle\int \frac{dl \sin\theta}{r^2}$

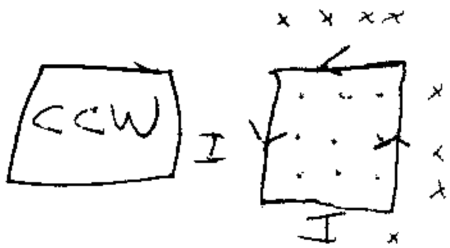


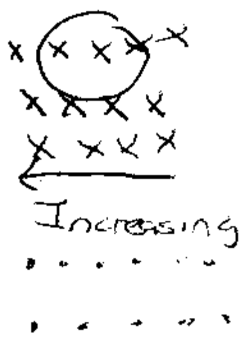
$\sin\theta = \dfrac{R}{\sqrt{R^2+y^2}}$ $r^2 = R^2 + y^2$

so $B = \dfrac{\mu_0 I}{4\pi} \displaystyle\int_{-\ell/2}^{+\ell/2} R\,dy \Big/ (R^2+y^2)^{3/2}$

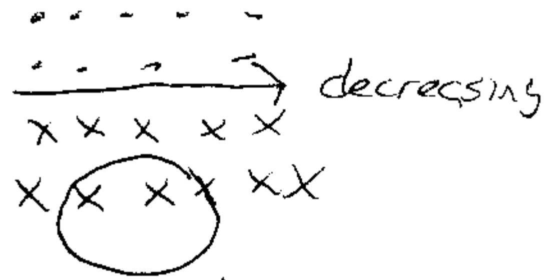
Ch 29 3, 7, 14, 19, 22, 23, 39, 43

3) ~~[struck out]~~ increased flux so oppose with dots (out of page)

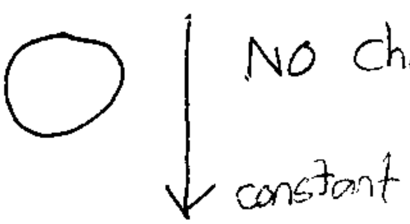
so 

7. 

produce dots
CCW

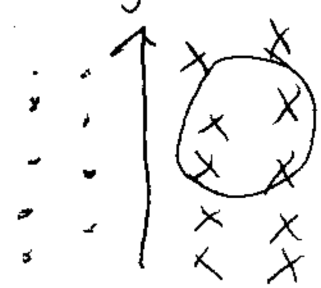


produce 'X's
CW



No change
$\mathcal{E} = 0$

I increasing



"more dots"
CCW

14. Follow derivation of Ex(29-4) pg 790

$$F = \frac{B^2 \ell^2}{R} v = \frac{(.45T)^2 (.35m)^2 (3.4m/s)}{.230\Omega}$$

$$= .367\ N$$

19) $\mathcal{E} = -\frac{d\Phi_B}{dt} = -\frac{d}{dt}(BA) = -B\frac{d}{dt}(A)$

$= -(.48T)(-3.50\times10^{-2}\ m^2/s) = .0168\ V$

22) $|\mathcal{E}| = B\ell V = .0356\ V$

23) a) $\mathcal{E} = B\ell V = .151\ V$

b) $I = \frac{\mathcal{E}}{R_T}$ $R_T = 26\Omega + 2.2\Omega = 28.2\Omega$

$I = \frac{.151V}{28.2\Omega} = 5.35\times10^{-3}A$

c) $F = B\ell I$

$= (.35T)(.24cm)(.00535A) =$
$4.5\times10^{-4}N$

39) 29-6: $\frac{I_s}{I_p} = \frac{N_P}{N_S}$ $\frac{N_P}{N_S} = \frac{V_P}{V_S} = .183$

$.183 = \frac{I_s}{I_p}$

43) $\frac{330}{1510} = \frac{120V}{V_S}$ so $V_S = 549V$ | $\frac{330}{1510} = \frac{15A}{I_p}$

$I_p = 68.6A$

30-1 (Skip)

30-9 Look at Ex 30.4 pg 760

$$L = \frac{\mu_o l}{2\pi} \ln \frac{r_2}{r_1} = 2.46 \times 10^{-6} H$$

15 Same as Resistors

Series

$$\mathcal{E} = \mathcal{E}_1 + \mathcal{E}_2$$

$$-L_{series} \frac{dI}{dt} = -(L_1 + L_2)\, dI/dt$$

parallel

$$\mathcal{E} = \mathcal{E}_1 = \mathcal{E}_2$$

but $I = I_1 + I_2$

so $\frac{dI}{dt} = \frac{dI_1}{dt} + \frac{dI_2}{dt}$

$$\frac{-\mathcal{E}}{L_{parallel}} = \frac{-\mathcal{E}}{L_1} - \frac{\mathcal{E}}{L_2} \quad \text{so} \quad \frac{1}{L_{Parallel}} = \frac{1}{L_1} + \frac{1}{L_2}$$

$j \left[\begin{array}{l} 27.2 \\ 28.6 \\ 29.3 \end{array}\right.$

j 27.2 configuration 3

j 28.6 $\frac{F}{l} = I_1 B$ $B = \frac{\mu_0 I_2}{2\pi r}$

so $\frac{F}{l} = \frac{\mu_0}{2\pi} \frac{I_1 I_2}{r}$

with current off

$$5 \times 10^{-5} T = \frac{4\pi \times 10^{-7} I_2}{2\pi (.02m)}$$

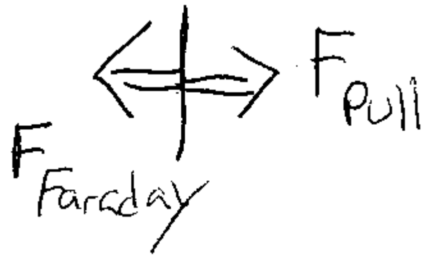
so I_2 (Blue Ring) $= \frac{5 \times 10^{-5} T}{2 \times 10^{-7}} (.02m) = \boxed{5A}$

$\frac{F}{L} = 3.5 \times 10^{-5} \frac{N}{m} = \frac{(2 \times 10^{-7}) I_1 (5A)}{.02m} = \boxed{.7A}$

j29.3

$$\mathcal{E} = B \ell v$$

b)



$$F_{pull} + F_{Faraday} = 0$$

see book

$$F = I\ell B = \frac{\mathcal{E}}{R}\ell B = \frac{B^2 \ell^2 v}{R}$$

d) after ~~No~~ Magnetic Field then only

$$F_{push} = ma = \frac{B^2 \ell^2 v}{R}$$

so $a = \text{const}$ so $\Delta x = vt + \frac{1}{2}at^2$

accelerating!