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$\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$ $\quad \mathcal{E} = -L\frac{\Delta I}{\Delta t}$ $\quad I = \frac{\Delta q}{\Delta t}$

$A = \pi r^2$ $\quad L = \frac{N\Phi}{I}$

1) $N = 5$ $\quad r = 15\,cm = .15\,m$ $\quad B_1 = .15T$ $\quad \Delta t = 3s$

$B_2 = .2T$ $\quad R = 8\Omega$ $\quad I = ?$ $\quad q = ?$

a) $\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$, $\Delta\Phi = \Phi_2 - \Phi_1 \Rightarrow (NBA)_2 - (NBA)_1$

$= 5(.2T)(\pi(.15m)^2) - 5(.15T)(\pi(.15m)^2)$

$= 1.8\times10^{-2}\,mV$

$\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t} = -5\left(\frac{1.8\times10^{-2}mV}{3s}\right) = -.03\frac{V}{s}$

$\mathcal{E} = IR \Rightarrow I = \frac{\mathcal{E}}{R} = \frac{-.03V}{8\Omega} = -3.75\times10^{-3}\,A$

b) $I = \frac{\Delta q}{\Delta t}$ $\quad \Delta q = I\Delta t = -3.75\times10^{-3}A\,(3s)$

$= -1.1\times10^{-2}\,C$

2) $\mathcal{E} = 24\,mV \quad N = 500 \quad I = 4A \quad \frac{\Delta I}{\Delta t} = 10\,\frac{A}{s}$

$\Phi = ?$

$$L = \frac{N\Phi}{I} \Rightarrow \frac{LI}{N} = \Phi$$

$$\mathcal{E} = -L\left(\frac{\Delta I}{\Delta t}\right) \Rightarrow L = -\frac{\mathcal{E}}{\frac{\Delta I}{\Delta t}} = -\frac{24\,mV\left(\frac{1V}{10^3\,mV}\right)}{10\,\frac{A}{s}}$$

$$= 2.4\times10^{-3}$$

$$\Phi = \frac{LI}{N} = \frac{(2.4\times10^{-3})(4A)}{500} = 1.92\times10^{-5}\ T/m^2$$

3) $N = 300 \quad r = 5cm = .05m \quad \ell = 20cm = .2m$

$I = .5A \quad U = ?$

$$L = \mu_0 n^2 A\ell = \mu_0 \frac{N}{\ell} A\ell = \left(4\pi\times10^{-7}\,\frac{T\cdot m}{A}\right)\left(\frac{300}{.2}\right)(\pi(.05)^2)(\ldots$$

$$= 4.4\times10^{-3}\,H$$

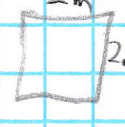
$$U = \tfrac{1}{2}LI^2 = \tfrac{1}{2}(4.4\times10^{-3}H)(.5A)^2 = 5.5\times10^{-4}\,J$$

4) $\ell = 8m \quad A = 1\times10^{-4}\,m^2 \quad V = .1V \quad B = .4T$

$\rho_c = 1.7\times10^{-8}\,\Omega m$

$$R = \frac{\rho\ell}{A} = \frac{1.7\times10^{-8}\,\Omega m\,(8m)}{1\times10^{-4}\,m^2} = 1.36\times10^{-3}\,\Omega$$

$L = ?\times4$
$\ell = 8m$



$$I = \frac{\Delta V}{R} = \frac{.1V}{1.36\times10^{-3}\,\Omega} = 73.5\,A$$

$$n = \frac{N}{\ell} = \frac{I}{8}$$

$A = (2m)(2m) = 4m^2$

$$\tau = NIBA = NIAB = 1(73.5A)(4m^2)(.4T) = 117.6\,N\cdot m$$

5) $B = ?$ $E_K = 400\,eV$ $r = .8\,m$ $m_e = 9.11\times10^{-31}\,kg$

$r = \frac{mv}{qB} \Rightarrow v = \frac{rqB}{m}$ $e = 1.6\times10^{-19}\,C$

$E_K = \frac{1}{2}mv^2 = \frac{1}{2}m\left(\frac{rqB}{m}\right)^2$

$\Rightarrow E_K = \frac{1}{2}m\left(\frac{rqB}{m}\right)^2 = \frac{1}{2}m\frac{r^2q^2B^2}{m^2} = \frac{1}{2}\frac{r^2q^2B^2}{m}$

$\Rightarrow E_K m = \frac{1}{2}r^2q^2B^2 \Rightarrow B = \sqrt{\frac{2E_K m}{r^2q^2}}$

$= \sqrt{\frac{2(400eV)(9.11\times10^{-31}kg)}{(.8m)^2(1.6\times10^{-19}C)}} = 8.4\times10^{-5}\,T$

6) $\frac{m}{\ell} = .5\,g/m = .0005\,kg/m$ $I = 2A$ $B = 4\times10^{-3}\,T$ $a = ?$ $t = ?$

$x = 50\,cm = .5\,m$

a) $F = I\ell B(\sin\theta) = I\ell B \Rightarrow ma = I\ell B$

$ma = I\ell B - mg \Rightarrow a = \frac{I\ell B - mg}{m}$

$\Rightarrow a = \frac{I\ell B}{m} - g = \frac{IB}{\frac{m}{\ell}} - g$

$= \frac{(2A)(4\times10^{-3}T)}{.0005\,kg/m} - 9.8\,m/s^2 = 6.2\,m/s^2$

b) $y = v_{0y}t + \frac{1}{2}at^2 \Rightarrow y = \frac{1}{2}at^2 \Rightarrow t = \sqrt{\frac{2y}{a}}$

$= \sqrt{\frac{2(.5m)}{6.2}} \approx 4\,s$