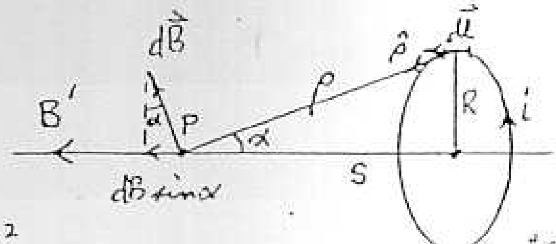
) $\vec{F} = e(\vec{v} \times \vec{B}) = m\vec{a}_c$, or, $Bev = \frac{mv^2}{r}$, thus, $v = \frac{e}{m}(Br)$.

) $V_p e = \frac{1}{2}mv^2$, or, $V_p e = \frac{1}{2}m\left[\frac{e^2}{m^2}(Br)^2\right]$, thus, $\frac{e}{m} = \frac{2V_p}{(Br)^2}$.

) $d\vec{B} = k'i\,\frac{d\vec{l} \times \hat{\rho}}{\rho^2}$, or,

$B' = \int dB \sin\alpha = k'N\frac{i\sin\alpha}{\rho^2}\int dl$, or,

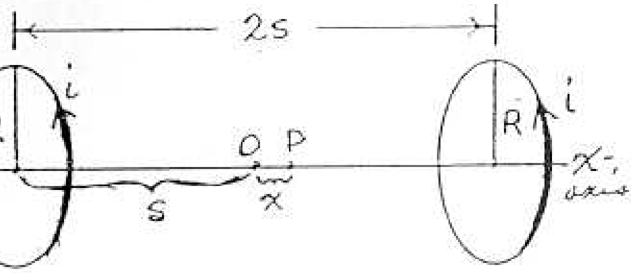


$$B' = \frac{\mu_0}{2}\,\frac{NiR\sin\alpha}{\rho^2} = \frac{\mu_0}{2}\,\frac{NiR^2}{[s^2 + R^2]^{3/2}},$$ for N turns of "flat" coil.

) Optimum value of 2s:

For field at P:

$$B_p = \frac{\mu_0}{2}NiR^2\left\{\frac{1}{[(s+x)^2+R^2]^{3/2}} + \frac{1}{[(s-x)^2+R^2]^{3/2}}\right\}$$



Expand by binomial theorem in powers of x:

$$B_p = \frac{2\mu_0 NiR^2}{2[s^2+R^2]^{3/2}}\left\{1 + \frac{3(4s^2 - R^2)}{2(s^2+R^2)^2}x^2 + ---\right\}.$$ For $2s = R$,

the coefficient of x^2 vanishes. Thus, the field is uniform around a point (O) which is mid-way between two coils placed a distance $2s = R$ apart.

) Thus, $$B_0 = \frac{\mu_0 NiR^2}{[s^2+R^2]^{3/2}} = \frac{8\mu_0 Ni}{[5]^{3/2}R} = 8.995 \times 10^{-7}\left(\frac{I_F N}{R}\right)$$ (m.k.s. unit)

)* $$\frac{e}{m} = \frac{2V_pR^2}{8.995\times10^{-7}(I_FN)^2 r'^2} = 6.596 \times 10^6\,\frac{V_p}{I_F^2 d^2},$$ where $d = r'$, and r' = radii of various rings.

$\frac{e}{m}$ in m.k.s. units, $\left(\frac{\text{coulomb}}{\text{kilogram}}\right)$.