$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{q}{|r|^3} \vec{r} \, \hat{a}_r$$

* for infinite line of charge

$$\boxed{\vec{E} = \frac{\rho_L}{2\pi\epsilon_0 r}}$$

* for Ringe of charge

$$\boxed{\vec{E} = \frac{\rho_L . a . h}{2\epsilon_0 (a^2 + h^2)^{3/2}} \hat{a}_z}$$

* for Disk of charge

$$\boxed{\vec{E} = \frac{\rho_s . h}{2\epsilon_0} \left[\frac{1}{h} - \frac{1}{(a^2+h^2)^{1/2}}\right]}$$

* work $= \vec{F} . \vec{r}$

potential $(V) = \frac{\text{work}}{\text{charge}} = \frac{\vec{F}.\vec{r}}{Q}$

$= \vec{E} . \vec{r}$

$$\boxed{V = -\int_a^b \vec{E} . d\vec{r}}$$

$$\Rightarrow V = \frac{q}{4\pi\epsilon_0} \left[\frac{1}{b} - \frac{1}{a}\right]$$

Absolute Potential

$$\boxed{V = \frac{q}{4\pi\epsilon_0 r}}$$

$$\boxed{\vec{E} = -\vec{\nabla} V}$$

Potential for infinite line of charge

$$\boxed{V = \frac{\rho_L}{2\pi\epsilon_0} \ln(b/a)}$$

Potential ~~for~~ ~~on~~ at center of Ring of charge

$$\boxed{V = \frac{\rho_L}{2\epsilon_0}}$$

$$\vec{D} = \epsilon_0 \vec{E}$$

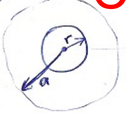
$$\oint\!\!\oint \vec{E} . d\vec{s} = \frac{q}{\epsilon}$$

$$\boxed{\oint\!\!\oint \vec{D} . d\vec{s} = q}$$

$$\vec{\nabla} . \vec{D} = \rho_v$$

$$\boxed{\oint\!\!\oint \vec{D} . d\vec{s} = \iiint_{\text{Volume}} \rho_v \, dV}$$

important



R E

$r \leq a$

$$\boxed{\vec{E} = \frac{\rho_v r}{3\epsilon_0}}$$

$R > a$

$$\boxed{\vec{E} = \frac{\rho_v a^3}{3\epsilon_0 R^2}}$$

$$\boxed{\nabla^2 V = -\frac{\rho_v}{\epsilon_0}}$$ Poisson equation

In the absence of charge

$$\boxed{\nabla^2 V = 0}$$ Laplace equation

Boundary Relation :

$$\boxed{E_{t1} = E_{t2}}$$

$$\boxed{D_{n1} = D_{n2}}$$

$$\boxed{\epsilon_1 E_{n1} = \epsilon_2 E_{n2}}$$

$$\boxed{\frac{\epsilon_2}{\epsilon_1} \tan\alpha_1 = \tan\alpha_2}$$

$$\boxed{C = \frac{Q}{V}} = \frac{\epsilon A}{d}$$

$$\boxed{\frac{C}{l} = \frac{2\pi\epsilon}{\ln(b/a)}}$$

$$\boxed{L = \frac{\mu}{2\pi}\ln(b/a)}$$

for Coaxial Cable

$$\vec{J} = \sigma\vec{E} = \frac{I}{A}$$

BIOT SAVART LAW

$$\boxed{H = \int \frac{I\, dl \sin\theta}{4\pi r^2}}$$

For Infinit line

$$\boxed{H = \frac{I}{2\pi R}}$$

for finite line

$$H = \frac{I}{2\pi R}(\sin\alpha_2 - \sin\alpha_1)$$

magnetic field in the center of Ringe

@ $h=0$

$$\boxed{H = \frac{I}{2a}}$$

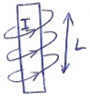
@ $h=1$

$$\boxed{H = \frac{I\,a^2}{2(a^2+h^2)^{3/2}}}$$

$$\boxed{I = \oint \vec{H}\cdot d\vec{l} = \iint_s \vec{J}\cdot d\vec{s}}$$

Amper's law

$$\boxed{\vec{B} = \mu \vec{H}}$$



$$\boxed{H = \frac{NI}{L}}$$

$$\Psi_m = \iint_s \vec{B}\cdot ds \equiv \text{flux}$$

Generator Action

$$\boxed{V = (\vec{v}\times\vec{B})\cdot L}$$

Faradys law

$$\boxed{V = -\frac{\partial \Psi_m}{\partial t}}$$

$$\boxed{\vec{\nabla}\times\vec{E} = -\frac{\partial B}{\partial t} = -\mu\frac{\partial \vec{H}}{\partial t}}$$

$$\boxed{\vec{\nabla}\times\vec{H} = \vec{J} = \sigma\vec{E} + \epsilon\frac{\partial \vec{E}}{\partial t}}$$

Stokes Theorem

$$\oint \vec{E}\cdot dl = \iint_s (\vec{\nabla}\times\vec{E})\, ds$$

$$= -\iint \frac{\partial B}{\partial t}\cdot ds$$

$$\boxed{\vec{\nabla}\times\vec{E} = \frac{-\partial B}{\partial t}}$$