Concept Map-Electrostatics

Electrostatics

- Charging of a Body
  - 1.Friction
  - 2.Conduction
  - 3.Induction
- Motion of a charge particle in E
  $y = qE/^2/2mv^2$
- Gauss Theorem and its Applications
  $\phi_E = \oint \vec{E}.\vec{ds} = \frac{q}{\epsilon_0}$
  - Thin Rod $E = \lambda/2\pi r\epsilon_0$
  - Spherical Shell
    - Outside $E = \sigma R^2/\epsilon_0 r^2$
    - Surface $E = \sigma/\epsilon_0$
    - Inside $E = 0$
  - Thin Sheet $E = \sigma/2\epsilon_0$
- Properties of Charge
  - Quantization
  - Additivity
  - Like Charges –Repel
    Unlike charges-Attract
  - Conservation
- Electrostatic force
  - Coulomb's law
    $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$
    - Dielectric Constant
      $\frac{F}{F'} = \frac{\varepsilon}{\varepsilon_0} = K$
  - Superposition Principle
    $\vec{F} = kq_0 \sum_{i=1}^{n} \frac{q_i}{r_i^2}\tilde{r}_i$
- Electric Field Intensity
  $\vec{E} = \lim_{q_0 \to 0} \frac{\vec{F}}{q_0} = \frac{kq}{r^2}\tilde{r}$
  - $E_{axial} = \frac{1}{4\pi\epsilon_0}\left(\frac{2pr}{(r^2-a^2)^2}\right)$
    $E_{equatorial} = \frac{1}{4\pi\epsilon_0}\frac{p}{(r^2+a^2)^{\frac{3}{2}}}$
    - Torque on Dipole
      $\tau = p \times E$
      - Work Done on a Dipole
        $W = pE(\cos\theta_0 - \cos\theta_1)$
        - P.E of a Dipole
          $U(\theta) = -\mathbf{p}\cdot\mathbf{E}$
- Electric Flux
  $\Phi = E\,\Delta S \cos\theta$