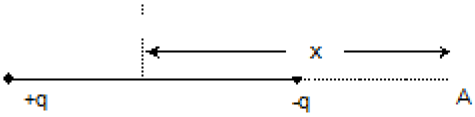
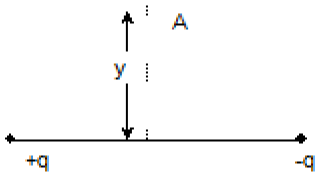


Alt Tag: Electric field due to an electric dipole on the axial line.

$$E = \frac{1}{4\pi\varepsilon_0}\frac{2px}{\left[x^2 - a^2\right]^2}$$

$$\text{For } x \gg a, \vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{2\vec{p}}{x^3}$$

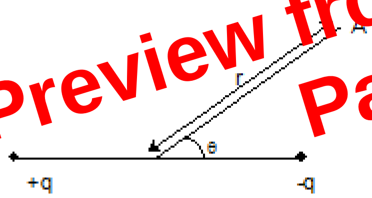
(b) At a point on the equatorial line (perpendicular bisector):-



$$E = \frac{1}{4\pi\,\varepsilon_0}\,\frac{p}{[a^2 + y^2]^{3/2}}$$

$$\text{For } y \;>>\; a, \vec{E} = -\frac{1}{4\pi\,\epsilon_0}\,\frac{\vec{p}}{y^3}$$

(c) At any point:-



$$E_r = \frac{1}{4\pi\,\varepsilon_0}\,\frac{2p\cos\theta}{r^3}$$

$$E_\theta = \frac{1}{4\pi\varepsilon_0}\,\frac{p\sin\theta}{r^3}$$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{p}{r^3}\sqrt{3\cos^2\theta + 1}$$

$$\text{Angle, } \alpha = \tan^{-1}\left(\frac{1}{2}\tan\theta\right)$$

- **Torque (τ) acting on a electric dipole in a uniform electric field (*E*):-**

  $\tau = pE\sin\theta$

Here, p is the dipole moment and θ is the angle between direction of dipole moment and electric field E.

- **Electric Flux:-** Electric flux ?$_E$ for a surface placed in an electric field is the sum of dot product of $\vec{E}$ and $d\vec{a}$ for all the elementary areas constituting the surface.

$$\Phi_E = \int_s \vec{E}.d\vec{a}$$

- **Gauss Theorem:-** It states that, for any distribution of charges, the total electric flux linked with a closed surface is $1/\varepsilon_0$ times the total charge with in the surface.

$$\int_S \vec{E}\cdot d\vec{S} = \frac{q_{in}}{\varepsilon_0}, \text{ for free space}$$

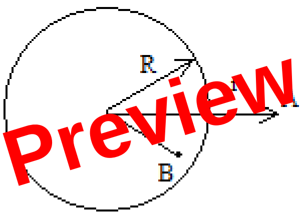
$$\int_S \vec{E}\cdot d\vec{S} = \frac{q_{in}}{\varepsilon_0\varepsilon_r}$$

- **Electric field (*E*) of an infinite rod at a distance (*r*) from the line having linear charge density (λ):-**

  $E = \lambda/2\pi\varepsilon_0 r$

  The direction of electric field *E* is radially outward for a line of positive charge.

- **Electric field of a spherically symmetric distribution of charge of Radius *R*:-**



(a) Point at outside ($r > R$):- $E = (1/4\pi\varepsilon_0)(q/r^2)$, Here *q* is the total charge.

(b) Point at inside ($r < R$):- $E = (1/4\pi\varepsilon_0)(qr/R^3)$, Here *q* is the total charge.

- **Electric field due to an infinite non-conducting flat sheet having charge σ:-**

  $E = \sigma/2\varepsilon_0$