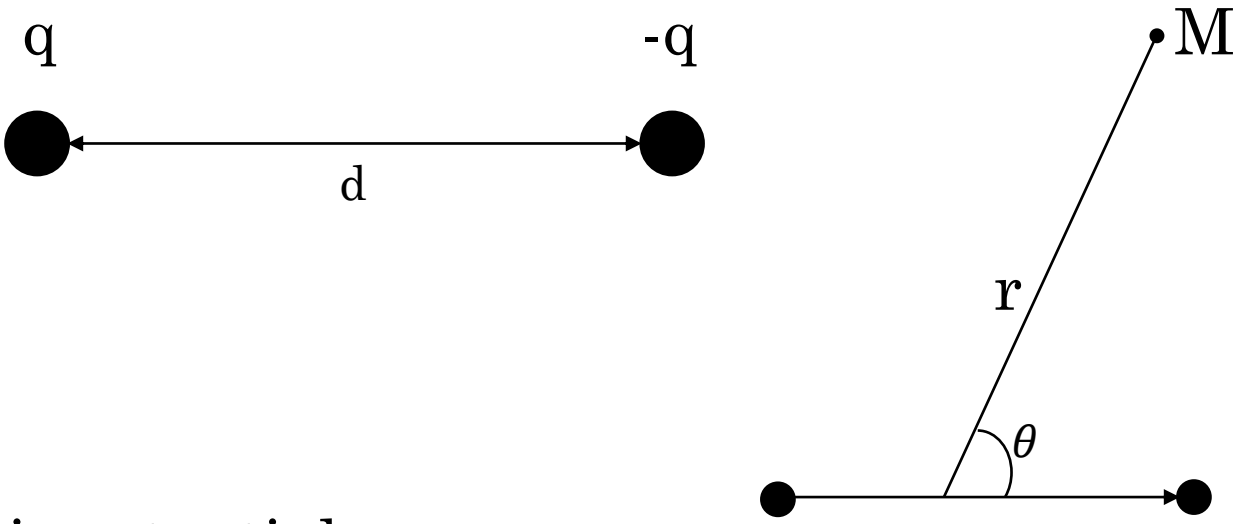
Electrical dipole

- It's a system created by two points charges with opposites signs and separated by a distance d



Electric potential

The electric potential created by a dipole on a point M, spotted by it's polar coordinates by is given by:

$$V = \frac{kdcos\theta}{r^2}$$

- The electrical field created by this dipole is given by :

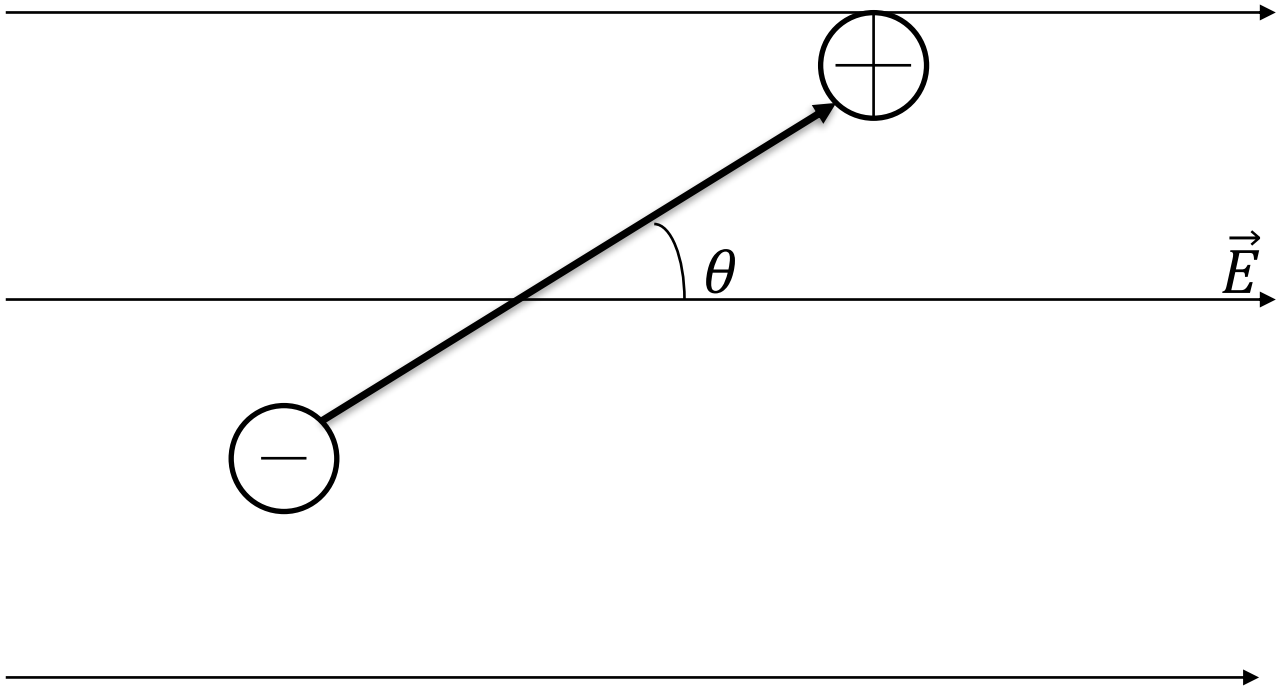
- $E = -\overrightarrow{\text{grad}}(V) \Rightarrow \begin{cases} E_r = -\frac{\partial y}{\partial r} = \frac{2kd\cos\theta}{r^3} \\ E_\theta = -\frac{1}{r}\frac{\partial y}{\partial \theta} = \frac{kd\cos\theta}{r^3} \end{cases}$

- **Dipolar moment:**

Dipolar moment P is the product of the charge q and the vector r

$\vec{p} = q.\ \vec{d}$

Action of an electric field on a dipole



- **Potential energy**

  The potential energy (U) of an electric dipole in an external electric field is defined as the work done by the electric field to orient the dipole relative to its natural direction

  $Ep = - \vec{E}. \vec{p} = -E\ p \cos\theta$

Moment of torque

The moment of torque (τ) of an electric dipole in an external electric field measures the tendency of the dipole to align with the field.

When the dipole undergoes an electric field, it undergoes , the torque acts to orient the dipole so as to reduce the angle θ

$\vec{\tau} = \vec{p} \times \vec{E}$

$|\vec{\tau}| = |\vec{E}||\vec{p}| \sin\theta$