

# Electricity

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## 1 Electric field and electric charge

Two charges with the same sign are attracted. Two opposite charges are repelled.

### 1.1 Coulomb's law

The magnitude of the force between two charges is :

$$F = \frac{1}{4\pi\epsilon_0} \frac{|q_1 q_2|}{r^2}$$

$$\frac{1}{4\pi\epsilon_0} = k \cong 9.0 \times 10^9 \text{ N.m}^2/\text{C}^2$$

### 1.2 Electric Field and Electric Forces

The electric field is the electric Force per unit of charge

$$\vec{E} = \frac{\vec{F}}{q}$$

So  $\vec{E}$  can be written as :

$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r}$$

### 1.3 Electric Field Lines

Electric field lines starts at positive charge and go to negative charge.

- They never intersect
- The number of field lines can give an idea of the magnitude of the Electric Field.
- The electric field is tangeant with the electric field lines.

## 1.4 Electric Dipole

If two opposit charges are linked, they can form an electric Dipole. There is a rotation and so a couple.

The magnitude of the torque can be written as :

$$\eta = pE \sin \theta$$