

# ELECTROSTATICS

charges at rest

**1. Charge:** "Charge is an intrinsic property of matter. The amount of charge that an object has cannot be changed by changing size shape or form but can be changed by adding or removing electrons or by breaking down atoms."  $Q = ne$  Charge is quantized i.e., it is always an integral multiple of elementary charge (unit charge) PKMZ:  $Q = 3e$   $\left[ \frac{e}{3} \right]$  \* Only n is always a whole no

**2. Coulomb's Law:** "The magnitude of the force between two point charges (point charges are such charges which have very small size as compared to the distance by which they are separated) is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance b/w them."

Mathematically:

$F \propto \frac{q_1 q_2}{r^2}$  and  $F \propto \frac{1}{r^2}$   
 thus  $F \propto \frac{q_1 q_2}{r^2}$  or  $F = k \frac{q_1 q_2}{r^2}$

Vectorially

$F_{21} = k \frac{q_1 q_2}{r^2} \hat{r}_{12}$  [w/ respect to diagram (a)]

$F_{12} = k \frac{q_1 q_2}{r^2} \hat{r}_{21}$  [w/ respect to diagram (b)]  
 with vectors  $\hat{r}_{12}$  and  $\hat{r}_{21}$  are in opposite directions thus

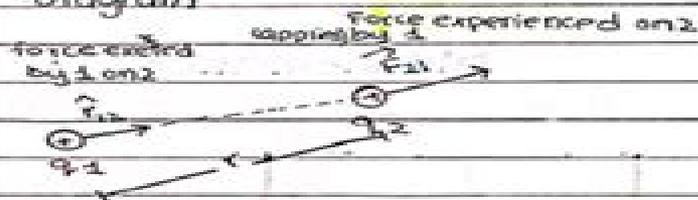
$\hat{r}_{12} = -\hat{r}_{21}$

or (action reaction are equal but opposite: figure c)

$\vec{F}_{21} = -\vec{F}_{12}$

$k \frac{q_1 q_2}{r^2} \hat{r}_{12} = -k \frac{q_1 q_2}{r^2} \hat{r}_{21}$

Diagram



(a)

$\hat{r}_{12}$ : tells us the direction in which force is applied i.e. intrinsic case indicates that force is applied in the direction from  $q_1$  to  $q_2$ .

$\vec{F}_{21}$ : Tells us by which charge the force is experienced under the influence of the other  $q_1$  here indicates that the force is experienced by charge  $q_2$  under the influence of charge  $q_1$ .

# Physics 12 Electrostatics Notes

**Hussin A.Rothana**



## **Physics 12 Electrostatics Notes:**

## Whispering the Techniques of Language: An Emotional Quest through **Physics 12 Electrostatics Notes**

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