XII Physics 1

Rashmi Lata

CLASS : Subject : Chapter : Topic : By :

Electric charges & fields

UNIT-1

Electric Charges & Fields

* Electrical Charge

- Charge is the property associated with matter due to which it produces & experiences electrical & magnetic effects.
- There are 2 types of charges in nature :-

  i.) Positive ii.) Negative
- Charges with same electrical sign repel each other & with opposite attract each other

- SI unit - coulomb, Dimensional formula = [AT]

* Properties of Charge

i. Charge is scalar quantity - can be added or subtracted algebrically

ii. Charge is transferable - A charged body is placed in contact with uncharged body, uncharged body becomes charged due to transfer of electrons from one body to another.

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* Conservation of Charge

- Conservation of charge is the property by which total charge of an isolated system always remains constant & conserved.
- For eg. when we rub two insulating bodies, what one body gains in charge, the outer body loses the same amount of charge
- Charges, thus it is not possible to create or destroy net charge carried by any isolated system.

* Diff. b/w Charge & Mass

Charge	Mass
• Electric charge on a body may be +ve or -ve or zero	• Always +ve
• Charge is quantized	• Quantization of mass is yet to be established
• Always conserved	• Not conserved
• Force b/w 2 charges follows inverse square law.	• Follows inverse square law too.
• Charge can't exist without mass.	• Mass can exist without charge
• Unit of charge is a derived unit ($1\,C = 1\,As$)	• Unit of mass is a fundamental unit
• An accelerated charge emits radiation.	• Accelerated mass emits no radiation.

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* Coulomb's law

"According to coulomb's law, the force of interaction b/w any 2 point charges is directly proportional to the product of charges & inversely proportional to square of distance b/w them."

Suppose two point charges q_1 & q_2 are separated in vaccum by a distance r.

$$F \propto \frac{q_1 \cdot q_2}{r^2}$$

or

$$\boxed{F = K \frac{q_1 \cdot q_2}{r^2}} \quad \text{——— (I)}$$

where, K is electrostatic force constant
Value of K depends on medium separating two charges & system of units

In SI, $K = 9 \times 10^9 \ Nm^2 C^{-2}$

$$\boxed{K = \frac{1}{4\pi\varepsilon_0}} \quad \text{——— (II)}$$

where ε_0 is permitivity of free space

from (I) & (II)

$$\boxed{F = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1 q_2}{r^2}} \quad \text{——— (III)}$$

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