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Chapter # 12
ELECTROSTATICS

- Electrostatics:**
The branch of physics deal with charges at rest is called electrostatics
- Charge:**
The property by virtue of which two particles exert forces of attraction or repulsion on one another is called charge. The unit of charge is coulomb. The charge of 6.25×10^{18} electrons equal to 1 Coulomb. The minimum charge of a body can never be less than the charge of electron
 $e = 1.6 \times 10^{-19}$ C, mass of electron
- Coulomb's Law:**
Coulomb's law states that "The force of attraction or repulsion between two point charges is directly proportional to product of two charges and inversely proportional to the square of the distance between them".
The electrostatic force is $F = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r^2}$, this force may be repulsive (if both charges are like) or attractive (if both charges are unlike).
 $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$ and $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$
- Electric Field:**
The space or region around a charged body in which other charges experience an electric force is called electric field. An electric field consists of electric field lines, which are directed outward from positive charge and inward into negative charge.
- Electric field intensity:**
The strength of electric field is called electric field intensity, i.e. $E = \frac{F}{q}$
The force per unit charge is called electric field intensity, i.e. $E = \frac{F}{q}$
Electric field intensity near a point charge q is $E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$, its unit is N/C or Volt/m
It is a vector quantity.
Note: A gold-leaf electroscope is represented by the symbol $\text{---} \text{---} \text{---}$. Taking e as the elementary charge and ϵ_0 as the permittivity of free space, what is the electric field strength at the surface of an isolated sphere of radius r carrying a charge Q ?
At Distance r from the center of the sphere, the electric field strength is $E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$
- Electric Flux:**
The number of electric lines of force passing through a unit area.
The dot product of electric field and area dS , $\Phi = E \cdot dS$
The flux is a maximum when E and dS are parallel to each other.
The flux is zero when E and dS are perpendicular to each other.
The flux over the surface of sphere in which charges is enclosed, is given as $\frac{Q}{\epsilon_0}$
- Gauss's Law:**
Gauss's law states that "The total out ward flux over any closed hypothetical surface is equal to the $\frac{1}{\epsilon_0}$ times the total charge enclosed in it".
i.e. $\oint \vec{E} \cdot d\vec{S} = \frac{Q}{\epsilon_0}$
Gauss's law holds only for closed surfaces.

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