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Study on Electrostatic and Electric Field

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A B S T R A C T

An electric field (some of the time E-field), is a vector amount that shifts from highlight point. We all have the experience of looking for a flash or hearing a snap when we remove our sweater especially in dry climate. This is practically unavoidable with pieces of clothing like polyester sari. The explanation behind these encounters is release of electric charges. Electrostatics manages the investigation of forces, fields and possibilities emerging from static charges.

Keywords: Electric field, Conductor, Insulator, Coulomb's law, Static electricity

1. Introduction

There are two charges exist: (a) positive charge (b) negative charge. At the point when a metal pole held close by and scoured with fleece won't give any indication of being charged. Nonetheless, if a metal pole with a wooden or plastic handle is scoured without contacting its metal part, it gives indications of charging. Some substance promptly permit entry of electricity through them, others don't. Those which permit electricity to go through them effectively are called CONDUCTOR. They have electric charges (electron) that are nearly allowed to move inside the materials. Metals, human and creature bodies and earth are conduits. The non-metals like glass, plastic, nylon, wood offer high protection from the entry of electricity through them. They called INSULATOR.

2. Theory

Coulomb's law- As demonstrated in Equation (1)

$$F = k\frac{q_1 q_2}{r^2} \qquad (1)$$

Where, k= $\frac{1}{4\pi\varepsilon}$ is constant of proportionality; r is distance between the charges; ε is permittivity of medium between the charges. If ε_0 is permittivity of free space and K the dielectric constant of medium, then $\varepsilon = k\varepsilon_0$

Point charges $q_{1,}q_{2,}q_{3,\dots,}q_n$ at distance $r_{1,}r_2,r_{3,\dots,}r_n$ from Q, the total force on Q is evidently

$$F = F_1 + F_2 + \dots = \frac{1}{4\pi\varepsilon_0}\frac{q_1}{r_1^2}Q + \frac{q_2}{r_2^2}Q + \dots$$

$$E(r) = \frac{1}{4\pi\varepsilon_0}\sum_{i=1}^{n} \frac{q_1}{r_i^2}$$

$$\boxed{F = QE}$$

E is called the Electric field. E(r) is the force per unit charge. Electrostatic is all about static electricity. Electric charge produces electric field. Static electricity work best, with poor conductor of electricity you also call them insulator. Electrostatic is also useful in photocopies. Electric field is imaginary

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lines, the tangent to which, at any point, gives the direction of the electric field. Accordingly nearer the electric field lines, stronger is the electric field.

What is electric field at point ‘P’ (P lies outside the surface) -

1) Due to point charge $\vec{E} = \frac{k\,Q}{r^2}\hat{r}$

2) Due to ring $\vec{E} = \frac{k\lambda z(2\pi r)}{(z^2 + r^2)^{3/2}}\,\hat{r}$

(a) $\vec{E} = 0$ (inside)

(b) $\vec{E} = \frac{KQ}{Z^2}\,\hat{z}$ (outside)

3) Due to disc $\vec{E} = 2k\pi\sigma\left(1 - \frac{z}{\sqrt{z^2+r^2}}\right)\hat{z}$

4) Due to spherical shell (conductor) -

(a) $\vec{E} = 0$ (inside)

(b) $\vec{E} = \frac{\sigma}{\varepsilon_0}\frac{R^2}{r^2}\hat{r}$ (outside)

5) Due to solid sphere -

(a) $\vec{E} = \rho\frac{r}{3\varepsilon_0}\hat{r}$ (inside)

(b) $\vec{E} = \frac{\rho}{3\varepsilon_0}\frac{R^3}{r^2}\hat{r}$ (outside)

6) Due to solid cylinder -

(a) $\vec{E} = \rho\frac{r}{2\varepsilon_0}\hat{r}$ (inside)

(b) $\vec{E} = \frac{\rho}{3\varepsilon_0}\frac{R^2}{r}\hat{r}$ (outside)

Here, λ - line charge density

σ – surface charge density

ρ – volume charge density

3. Conclusion

S.I. unit -of electric field is newton per coulomb. Additionally, I have learned to determine the electric field of an object and the direction of electric field. Electric fields never move and never intersect each other. When the electric field is strong then electric field lines will either be dense or rare. When electric field is weak then electric field lines will be far apart.

Furthermore, I have figured out how to decide the electric field of an article and the bearing of electric field. Electric fields never move and never intersect one another. At the point when the electric field is close then electric field lines will either be (dense)thick or (rare)uncommon. At the point when electric field is weak then electric field lines will be far separated.

$q>0$ - radially outward.

$q<0$ - radially inward.

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