

PHYSICS – Electrostatics: Electric Field & Electric Field Lines

Electric Field Due to a Point Charge

- A point charge produces an electric field around it, which means it creates a force that can act on other charges nearby.
- The electric field strength E at a distance r from a charge q is given by:

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

where ϵ_0 is a constant called the permittivity of free space.

- The direction of the field is away from the charge if it is positive and toward the charge if it is negative.
- The farther you are from the charge, the weaker the field (it decreases by the square of the distance).

Electric Field Due to Multiple Charges (Superposition)

- When there are multiple charges, the electric field at any point is the vector sum of the fields produced by all the individual charges.
- You calculate the field due to each charge independently and then add them, considering both magnitude and direction.

Electric Field Lines: Properties and Patterns

- Electric field lines start from positive charges and end on negative charges.
- Lines never cross because each point in space can have only one electric field direction.
- The density of lines shows the strength of the field; closer lines mean stronger fields.
- For a positive or negative charge alone, lines radiate outward or inward symmetrically.
- For a dipole (a positive and negative charge close together), the lines begin on the positive charge and curve toward the negative charge.
- With two like charges, the lines repel and bend outward between the charges.