## **Relation Between Electric Field and Electric Potential**

In electrostatics, electric field (E) and electric potential (V) are related. The electric field is defined as the negative gradient of electric potential.

## **Mathematical Relation:**

E = - dV/dr

## **Derivation for a Point Charge:**

Consider a point charge q placed at the origin. The electric potential at a distance r is:  $V = (1 / 4^*pi^*epsilon_0)^* (q / r)$ 

The electric field is given by the negative gradient of potential: E = - dV/dr

Differentiating V with respect to r:  $dV/dr = -(1 / 4*pi*epsilon_0) * (q / r^2)$ 

Thus, the electric field magnitude is:  $E = (1 / 4*pi*epsilon_0) * (q / r^2)$ 

This result matches Coulomb's law for the electric field due to a point charge.

## **Conclusion:**

The electric field is the negative gradient of electric potential, meaning it points in the direction of the steepest decrease in potential. This relation is fundamental in electrostatics.