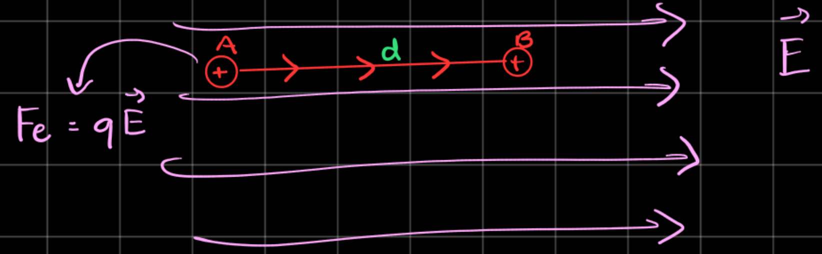
Chapter 25 Electric Potential

↳ Voltage



$$\vec{a} = \frac{q\vec{E}}{m}$$

$W = \vec{F} \cdot \vec{d} \cos\theta$

↳ angle between force and displacement

$W = -\Delta u \longrightarrow$ change in potential energy

$= -[u_B - u_A]$

$W = -\Delta u = \vec{F} \cdot \vec{d} = q\vec{E} \cdot \vec{d}$

$\frac{W}{q} = \vec{E} \cdot \vec{d}$

$= -\Delta V \longrightarrow$ change in potential difference

$= -[V_B - V_A]$

$$\boxed{\Delta V = -\frac{W}{q} = \frac{\Delta u}{q}}$$

Potential energy decreases as a +ve charge moves in the same direction as the electric field. ⇓

Δu is negative

W is positive

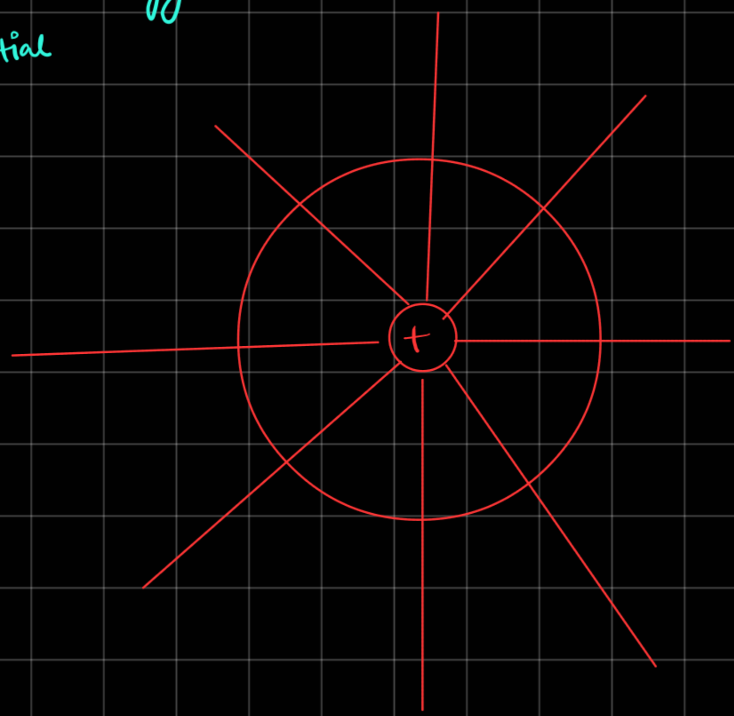
The potential decreases along the electric field ...

the potential decreases along the electric field $\Downarrow$

ΔV is negative

Units

W	J			
ΔU	J		$\longrightarrow$	potential energy
ΔV	V	J/C	$\longrightarrow$	potential



Equipotential Surfaces

$$\vec{E} = \frac{k_e q}{r^2}$$

(B)

$$V_B = V_C$$

(C)

Finding Potential Difference (V)

$$V = \frac{k_e q}{r}$$

Voltage is scalar

$$V_+ = \frac{kq}{r} = \frac{k_e (2 \times 10^{-6})}{4} \longrightarrow (i)$$

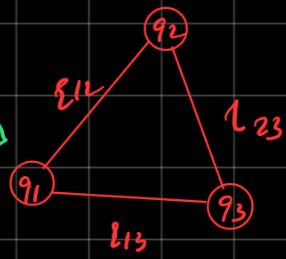
$$V_- = \frac{kq}{r} = \frac{k_e (-6 \times 10^{-8})}{5} \longrightarrow (ii)$$

$$V_P = (i) + (ii)$$

Finding Potential Energy (U)

$$U = \frac{k\, q_1 q_2}{r}$$

$$U = k_e \left[\frac{q_1 q_2}{r_{12}} + \frac{q_1 q_3}{r_{13}} + \frac{q_2 q_3}{r_{23}} \right]$$



$$\Delta V = -\vec{E} \cdot \vec{d} = -Ed$$

if E is uniform
and d ∥ E

$$\Delta V = -\int_A^B \vec{E} \cdot d\vec{s}$$

if the electic field
is not uniform

$$\vec{E}_x = \frac{-dV}{dx} \; ; \quad \vec{E}_y = \frac{-dV}{dy} \; ; \quad \vec{E}_z = \frac{dV}{dz}$$