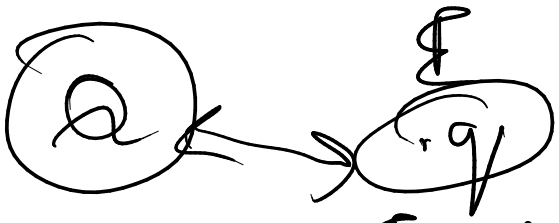
Electric Fields

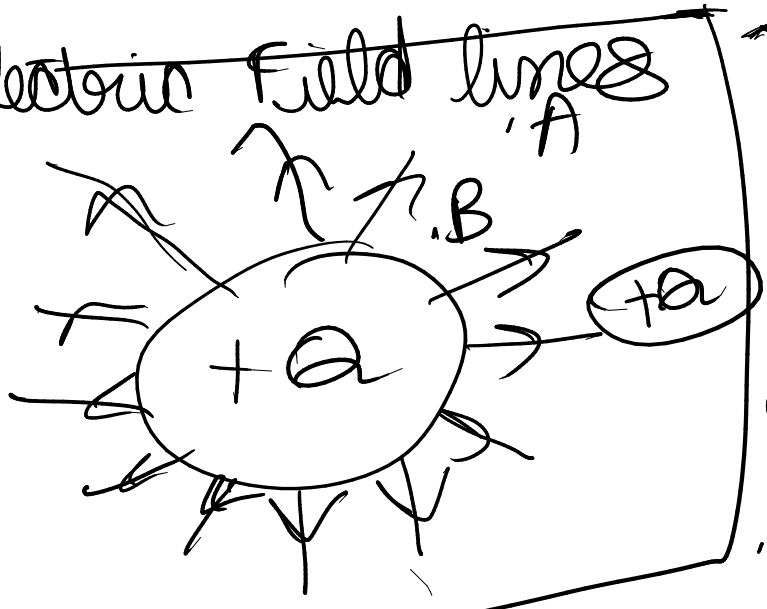
Electric field of a charge is the space around a charge in which it can exert a force on another charge placed in the field

At a point in an electric field is the force exerted on a unit +ve charge placed at that point. (E)

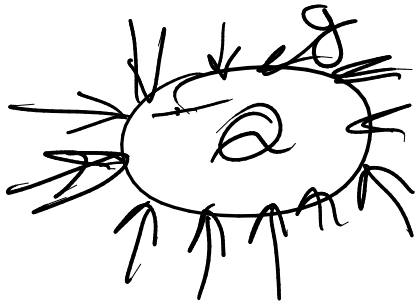


Force on $q = Eq$
due to Q

Electric Field lines

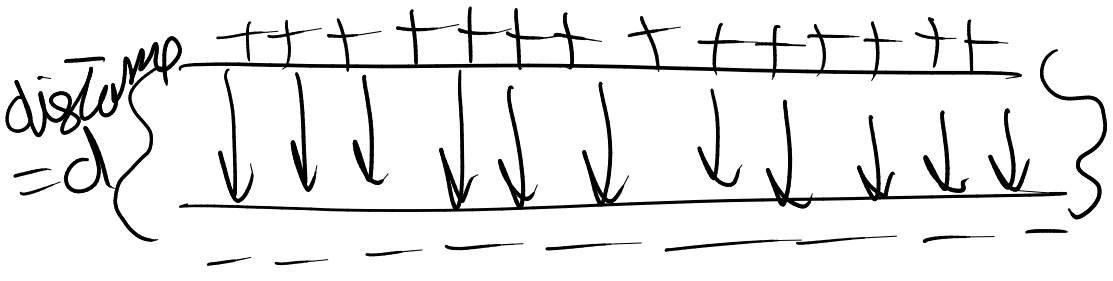


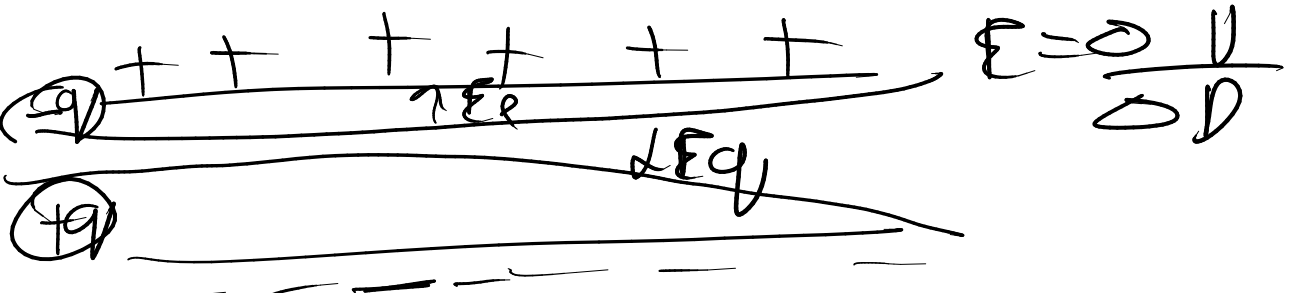
- The electric field intensity at B is greater than that at A because at B, the lines are closer together than at A.
- B is also closer than at A



If we have 2 parallel plates that have a potential difference of V b/w them, separated by a distance d b/w them then the electric field intensity b/w them is given by

$$E = \frac{\Delta V}{\Delta d}$$





If charged particles move through an electric field, they will be deflected towards the plates which have opposite charge. The e⁻ will be deflected more because their mass is lighter

$F \propto Q_1 Q_2 \propto \frac{1}{r^2}$ (inverse sq law)

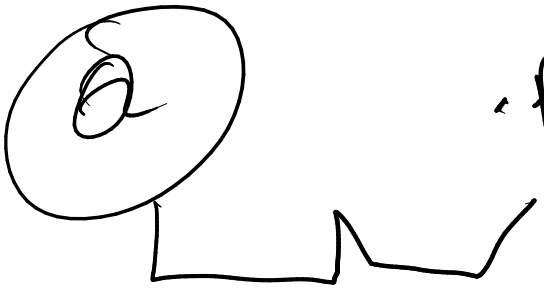
$F \propto \frac{Q_1 Q_2}{r^2}$

$F = \frac{k Q_1 Q_2}{r^2}$ k = coulomb's constant

$k = \frac{1}{4\pi\varepsilon_0}$ ε_0 – permeativity of free space

$k = 8.99 \times 10^9 \, C^{-2}$

(E) EFS of a charge at any point, distance r from the charge is defined as the force acting on a unit +ve charge placed at that point.



$$E = \frac{Q}{4\pi\varepsilon_0 r^2}$$

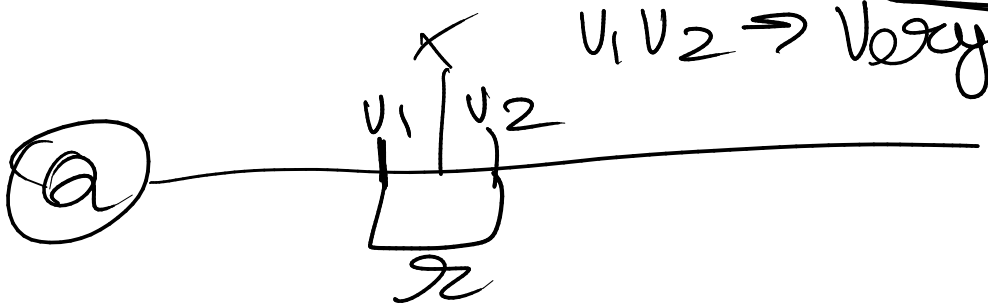
Electric Potential is the work done from ∞ in bringing a unit +ve charge from ∞ to that point.

$$V_P = \frac{Q}{4\pi\varepsilon_0 r}$$

Infinity ∞

The potential at ∞ = 0V

V_1 V_2 ⇒ Very close



$$\text{Potential at } x = \frac{V_1 - V_2}{\Delta r} = \frac{\Delta V}{\Delta r}$$

↓

potential gradient.

(a) P.
Q_1 $\frac{KQ}{r}$ or $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$

If another charge Q_1 is brought to P

Electronic Potential Energy at $P = \frac{KQ}{r}q$

or

$\frac{Qq}{4\pi\varepsilon_0 r}$