Electrostatics
one page notes

Date ....
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- study of charges at rest.

Property of mater through which it attracts or repels other things.

A neutral body has no charge but; N.B + N.B ⇒ charges produced.

- like charges → repel
- unlike charges → attract.

Coulomb's law.

$F \propto q_1 q_2$, $F \propto \frac{1}{r^2}$

$F \propto \frac{q_1 q_2}{r^2}$

$F = \frac{k q_1 q_2}{r^2}$

where 'k' is propotionality constant.

$k = \frac{1}{4\pi\varepsilon_0}$ So, $F = \frac{1}{4\pi\varepsilon_0} \times \frac{q_1 q_2}{r^2}$

ε_0 → permittivity of free space.

$\varepsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$

value of k: $\frac{1}{4(3.14)(8.85\times10^{-12})} \Rightarrow 9.9\times10^9 Nm^2C^{-2}$
↓ medium = air

Electrostatic induction:

charges at rest — getting influence without being touch.

Activity 13.4

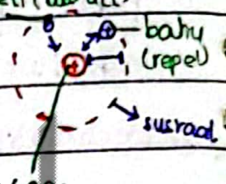
1) Take two neutral spheres A & B.
2) Bring a +ve charged rod.
3) +ve charges will attract the -ve & repel +ve.
4) -ve charges appear on the left side of A sphere. & +ve on the right side of B.
5) separate the spheres: charges will distribute equally in each sphere.

Electroscope.

grounding is done to protect the leaves from external electrical disturbence.

Electric field:

Area around charge from where it can attract or repel other charge



Electric field Intensity:

more force of repulsion, more intensity.

→ Force per unit charge.

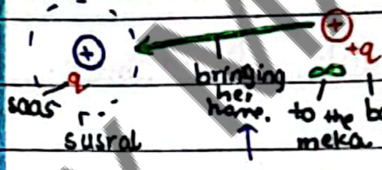
$E = \frac{F}{q_0} = \frac{N}{C} = NC^{-1}$

$F = qE$.

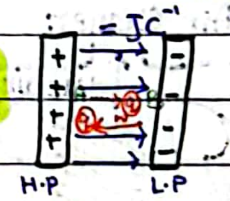
Electric field lines:

Field lines are always directed from ⊕ → ⊖.

Electrostatic Potential:



Electric potential (V): $\frac{W}{q}$ = $\frac{\text{workdone}}{\text{charge}} = \frac{J}{C} = JC^{-1}$



more repulsion at point A.

V_B = potential at B = $\frac{W_B}{q}$

V_A = potential at A = $\frac{W_A}{q}$

$V_A - V_B = \frac{W_A}{q} - \frac{W_B}{q}$

$V_A - V_B = \frac{W_A - W_B}{q}$

$(V_A - V_B)q = W_A - W_B$.

$\Delta W = q(V_A - V_B)$

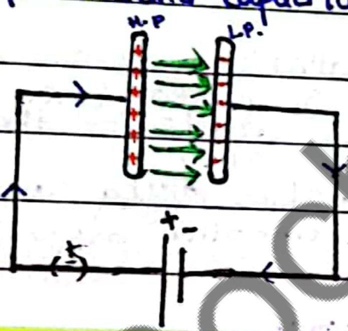
Energy supplied = $q(V_A - V_B)$.

potential ∝ to the repulsion.

Capacitors and Capacitance:

→ used to store charges

→ ability to store charges.



$\uparrow Q \propto V \uparrow$ [more charges more p.d.]

$Q = CV$

$\frac{Q}{V} = C$

$C = \frac{1 \text{ coulomb}}{1 \text{ volt}} = \frac{1C}{1V} = 1$ Farad (فاراد).

Parallel combination of capacitors.

- capacitors are independent on eachother.

$Q = CV$

Q ∝ V — change, same.

- $Q_T = Q_1 + Q_2 + Q_3$. —(x)

For C_1: $Q_1 = C_1 V$ —(i)

For C_2: $Q_2 = C_2 V$ —(ii)

For C_3: $Q_3 = C_3 V$ —(iii)

$Q = CV$ —(iv)

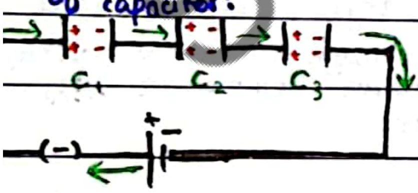
putting (i),(ii),(iii),(iv) in (x)

$CV = C_1V + C_2V + C_3V$.

$CV = V(C_1 + C_2 + C_3)$

$C_{eq} = C_1 + C_2 + C_3$

Series combination of capacitors:



- first one capacitor consumes more voltage & second one consumes the rest, least is left for 3rd C.

V changes, Q same.

$V_{Total} = V_1 + V_2 + V_3$ —(x)

$Q = Q_1 = Q_2 = Q_3$ (due to

For C_1; $Q = C_1V_1 \Rightarrow V_1 = \frac{Q}{C_1}$ —(i)

For C_2; $Q = C_2V_2 \Rightarrow V_2 = \frac{Q}{C_2}$ —(ii)

For C_3; $Q = C_3V_3 \Rightarrow V_3 = \frac{Q}{C_3}$ —(iii)

Putting (i) & (ii) & (iii) in eq (x)

$\frac{Q}{C} = \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3}$

$\frac{Q}{C} = Q\left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right]$

$\frac{1}{C} = \left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right]$.

Dielectric: is a poor conductor (good insulator) but an efficient supporter of electrostatic fields.

Date:..

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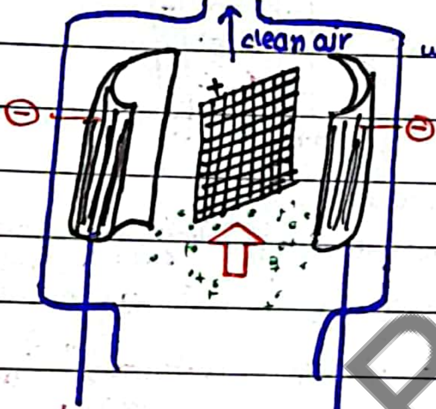
Types of capacitors:

capacitor	dielectric	construction.
① parallel plate capacitor	flexible material	• rolled and put in a cyllinder.
② Elecholytic capacitors	electrolytes	• chemical reactions are used to store charges.
③ Paper capacitor.	oiled paper	• rolled in a form and cylinder and enclosed into a plastic case.
④ Mica capacitor.	mica sheet.	• mica sheet placed b/w 2 plates and then enclosed in a plastic case.
⑤ variable capacitor	air	• two sets of plates. one set is fixed other is moveable

Uses of capacitors:

pg:83 : many uses are give

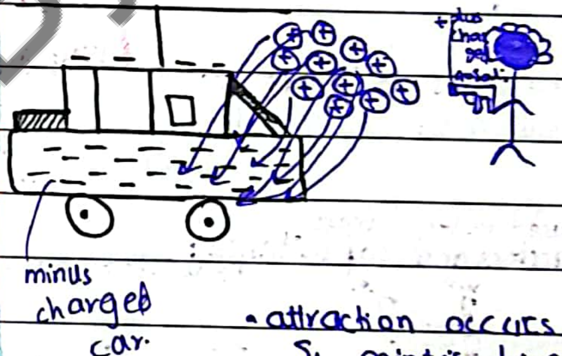
Air Cleaner:



• Due to conduction the particles striking with wire gauze will get +ve charge.

• positive particles will get attracted towards the negative plates

• clean air will move out.

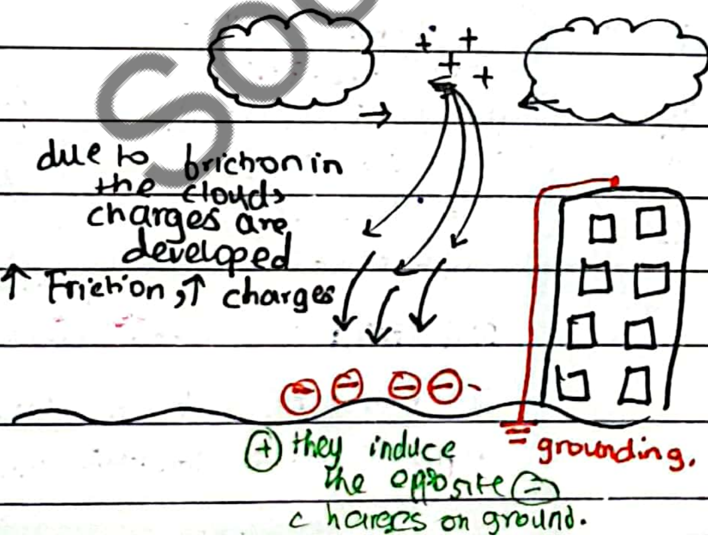


• attraction occurs & paint is finely attached to the car.

• after drying car is smoothly painted.

Hazards of Static electricity.

→ lightning:



Fires or explosions:

• if static charges are allowed to discharge through the areas where there is petrol vapour a fire can occur.