RAHEIN EDUCATION www.raheineducation.com PHYSICS

RAHEIN EDUCATION PVT. LTD.

CONTACT: 9205010851

Website: www.raheineducation.com

BY

Asst. Prof. Tarun Kumar Gautam

(B.Tech, M.Tech, PhD (P))

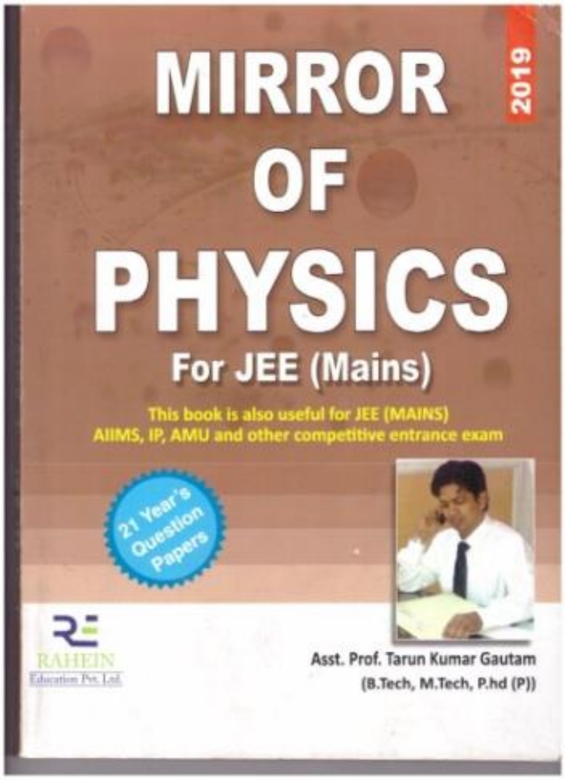
Currently working in Jamia Hamdard, (HSC), Delhi

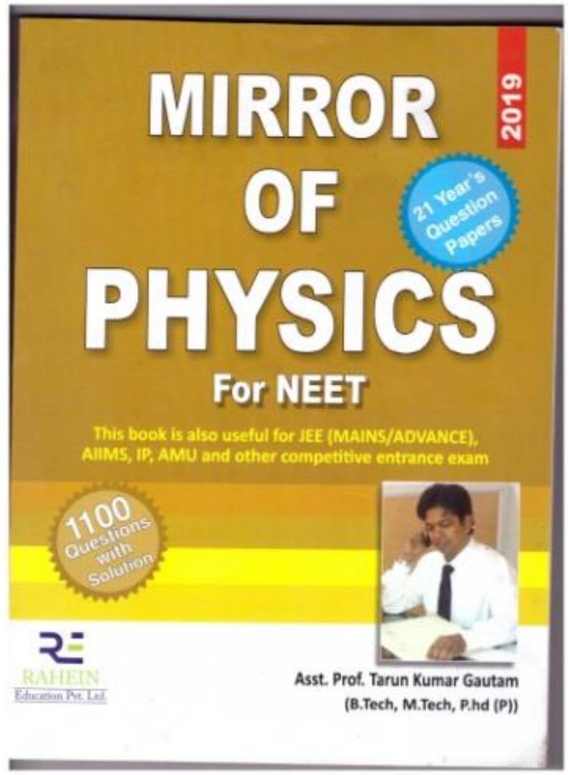
Working on Nano Technology with Rise University, USA

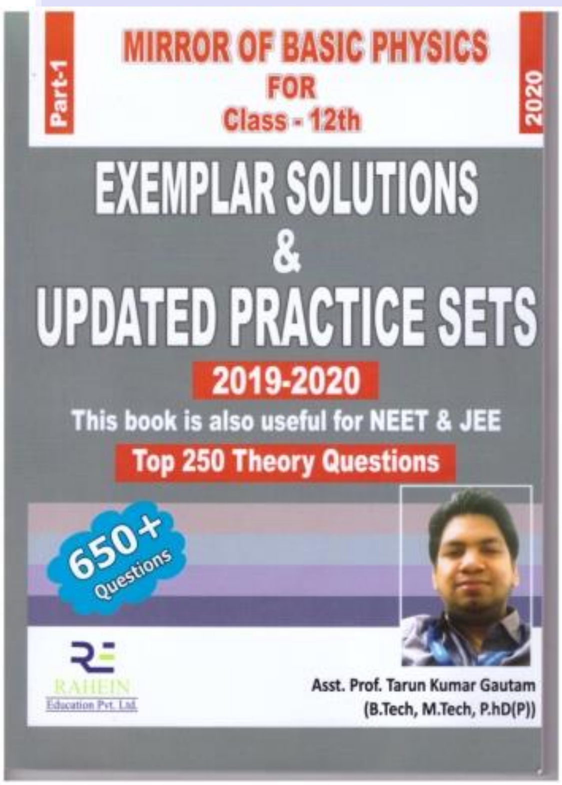
Author of 8 books regarding Physics and Engineering Subject.

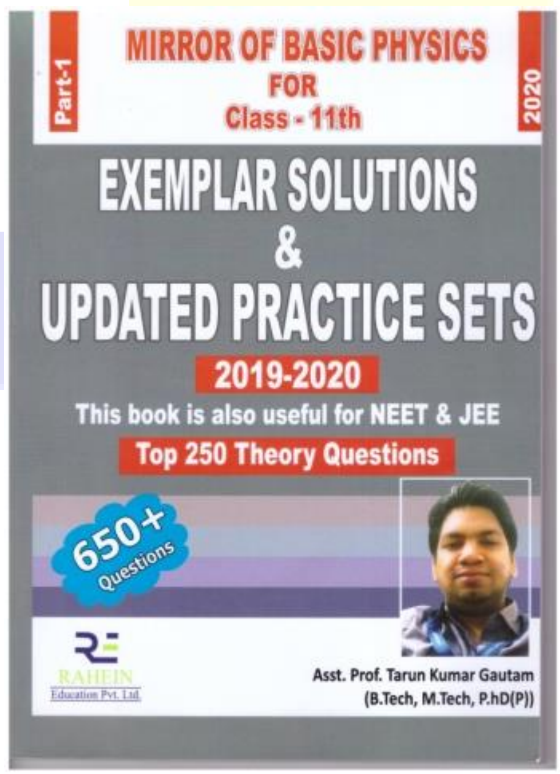
Ex-Faculty of Rajshree Institute of Management & Technology (RMIT), Braeilly, Uttar Prdesh

Ex-Faculty of Assistant professor in Krishna Engineering Collage (KEC), Ghaziabad, Uttar Prdesh
Member of Educational Project in University of Petroleum and Energy Studies (UPES), UK


MIRROR
OF
PHYSICS
For JEE (Mains)
2019
This book is also useful for JEE (MAINS)
AIIMS, IP, AMU and other competitive entrance exam
21 Year's Question Papers
RAHEIN
Education Pvt. Ltd.
Asst. Prof. Tarun Kumar Gautam
(B.Tech, M.Tech, P.hd (P))


MIRROR
OF
PHYSICS
For NEET
2019
21 Year's Question Papers
This book is also useful for JEE (MAINS/ADVANCE),
AIIMS, IP, AMU and other competitive entrance exam
1100 Questions with Solution
RAHEIN
Education Pvt. Ltd.
Asst. Prof. Tarun Kumar Gautam
(B.Tech, M.Tech, P.hd (P))


Part-1
MIRROR OF BASIC PHYSICS
FOR
Class - 12th
2020
EXEMPLAR SOLUTIONS
&
UPDATED PRACTICE SETS
2019-2020
This book is also useful for NEET & JEE
Top 250 Theory Questions
650+ Questions
RAHEIN
Education Pvt. Ltd.
Asst. Prof. Tarun Kumar Gautam
(B.Tech, M.Tech, P.hD(P))


Part-1
MIRROR OF BASIC PHYSICS
FOR
Class - 11th
2020
EXEMPLAR SOLUTIONS
&
UPDATED PRACTICE SETS
2019-2020
This book is also useful for NEET & JEE
Top 250 Theory Questions
650+ Questions
RAHEIN
Education Pvt. Ltd.
Asst. Prof. Tarun Kumar Gautam
(B.Tech, M.Tech, P.hD(P))

L-13

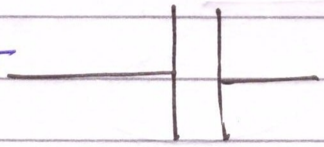
Ch-2

Capacitance

↓

* It is device → which store the charge called "Capacitor"

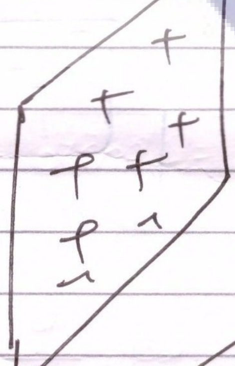
* Capacitor → Property "capacitance"

*  It store the charge

* Capacitor → denote → (C) → unit → faraday (f)

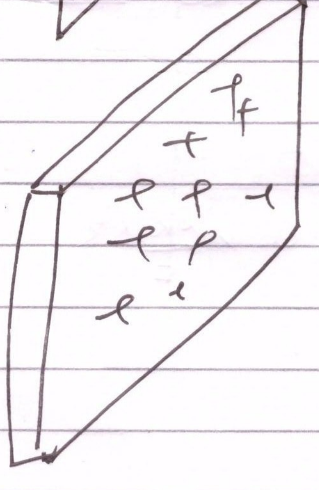
ex: 2f, 3f, 5mf, 6μf

Combination of Plane sheet

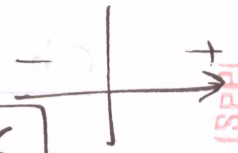


$$E = \frac{\sigma}{2\epsilon_0}$$

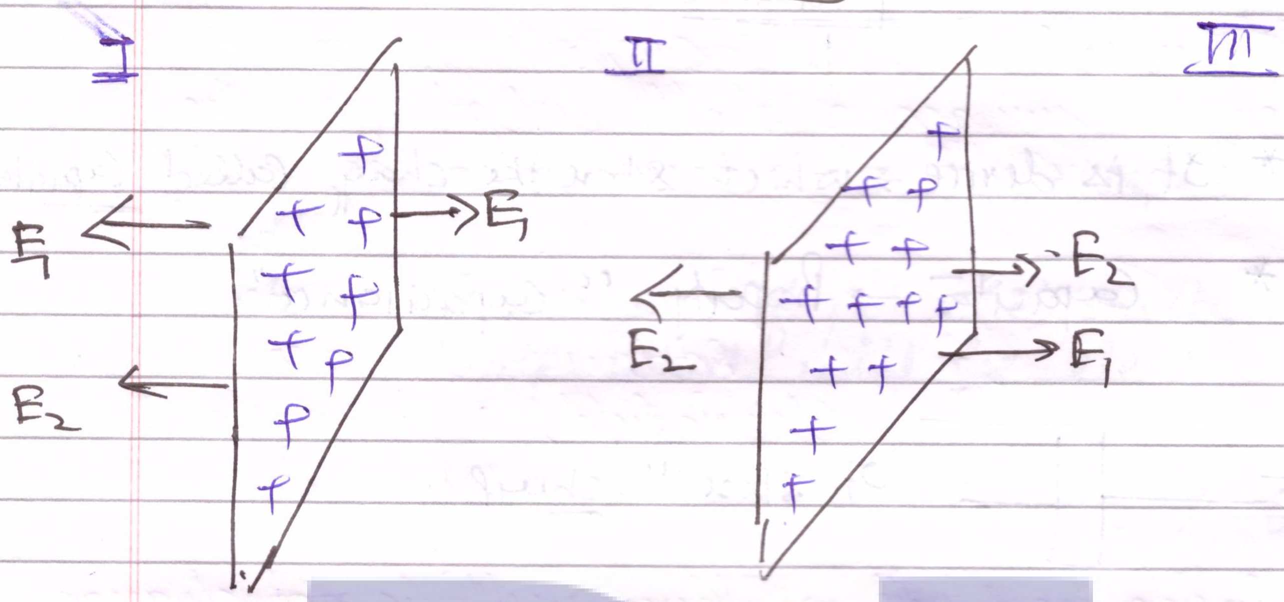
$$\left[\because \sigma = q/s\right]$$



$$E = \frac{\sigma}{\epsilon_0}$$



σ — Thin $\boxed{E_1 = \frac{\sigma_1}{2\varepsilon}}$ $\boxed{E_2 = \frac{\sigma}{2\varepsilon_0}}$



I (A)

$$\boxed{E = -E_1 - E_2}$$

$$E = -\frac{\sigma_1}{2\varepsilon_0} - \frac{\sigma_2}{2\varepsilon_0}$$

If $\sigma_1 = \sigma_2 = \sigma$

$$E = -\frac{\sigma}{2\varepsilon_0} - \frac{\sigma}{2\varepsilon_0}$$

$$E = -\frac{2\sigma}{2\varepsilon_0}$$

$$\boxed{E = -\frac{\sigma}{\varepsilon_0}}$$

II (B)

$$\boxed{E = E_1 - E_2}$$

$$E = \frac{\sigma_1}{2\varepsilon_0} - \frac{\sigma_2}{2\varepsilon_0}$$

$$\boxed{E = 0}$$

III

$$\boxed{E = E_1 + E_2}$$

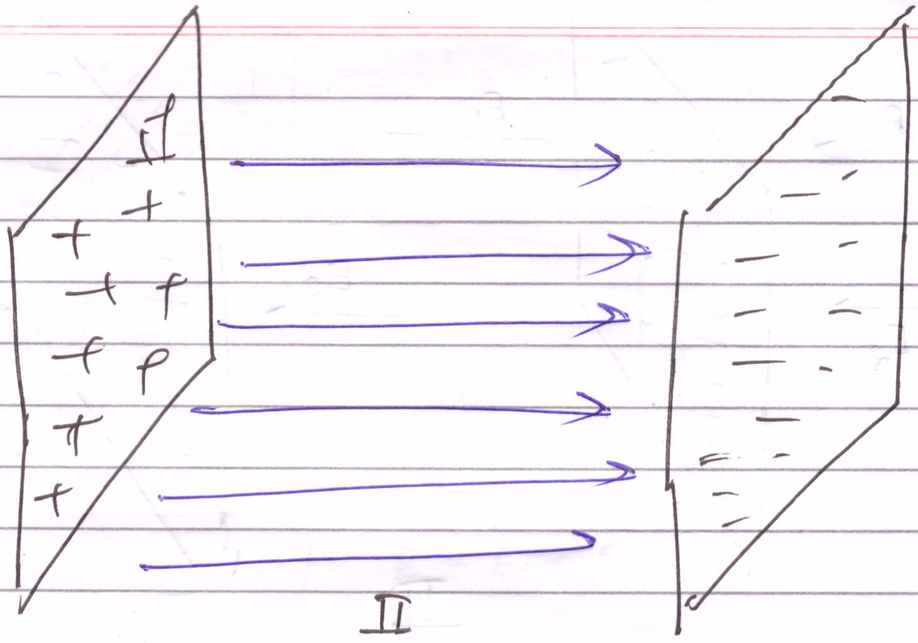
$$E = \frac{\sigma_1}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$$

$$\boxed{E = \frac{\sigma}{\varepsilon_0}}$$

C-2

$E_1 = \frac{\sigma}{2\varepsilon_0}$

$E_2 = -\frac{\sigma}{2\varepsilon_0}$



I | II | III

I

$E = -E_1 - E_2$

$E = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$

$E = 0$

II

$E = E_1 - E_2$

$E = \frac{\sigma}{2\varepsilon_0} - \left(-\frac{\sigma}{2\varepsilon_0}\right)$

$E = \frac{2\sigma}{2\varepsilon_0}$

$E = \frac{\sigma}{\varepsilon_0}$

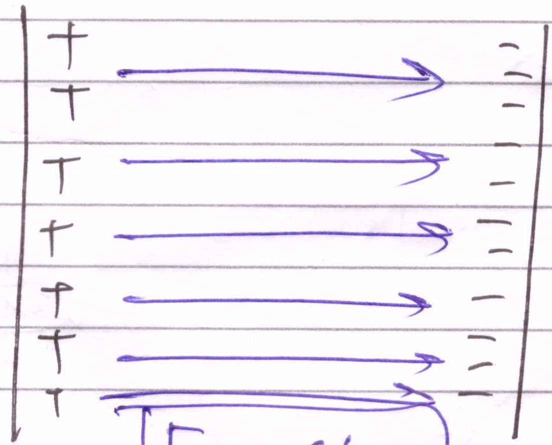
III

$E = E_1 + E_2$

$E = \frac{\sigma}{2\varepsilon_0} - \frac{\sigma}{2\varepsilon_0}$

$E = 0$

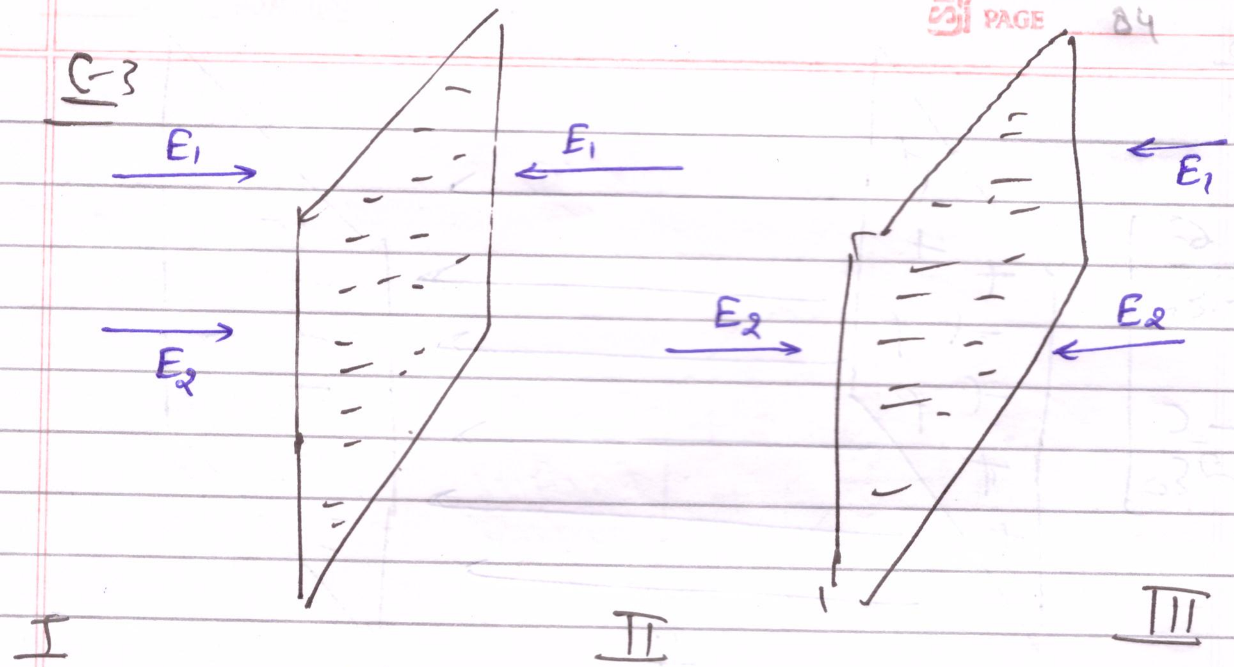
Note.



X X

$E = \sigma/\varepsilon_0$

C-3



I

$E = E_1 + E_2$

$E = \frac{\sigma_1}{2\varepsilon_0} + \frac{\sigma_2}{2\varepsilon_0}$

If $\sigma_1 = \sigma_2 = \sigma$

$\boxed{E = \frac{\sigma}{\varepsilon_0}}$

II

$E = E_2 - E_1$

$E = \frac{\sigma_2}{2\varepsilon_0} - \frac{\sigma_1}{2\varepsilon_0}$

$\boxed{E = 0}$

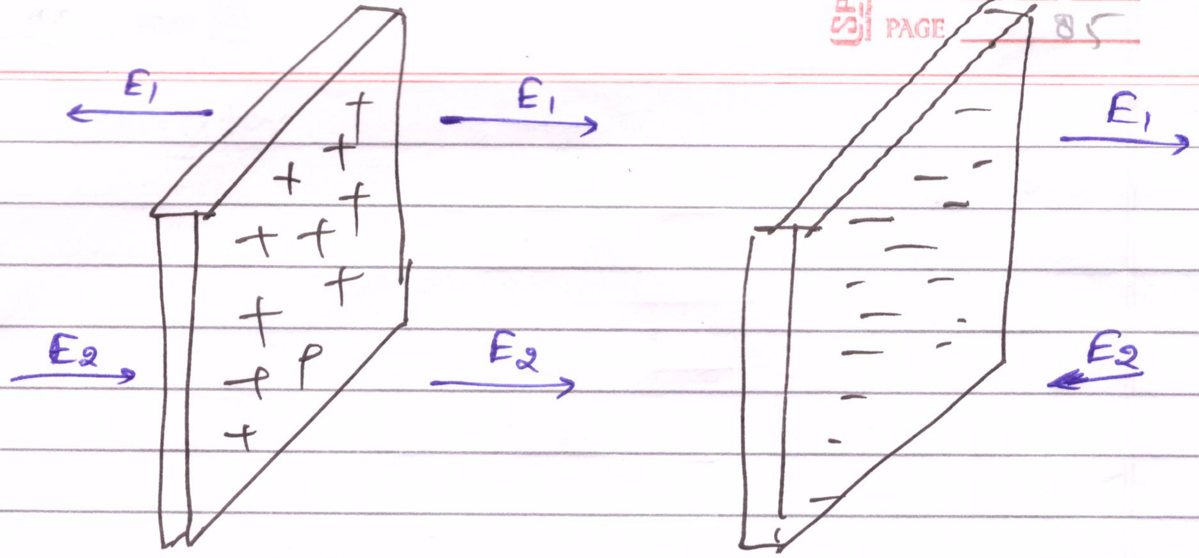
III

$E = -E_1 - E_2$

$E = -\frac{\sigma_1}{2\varepsilon_0} - \frac{\sigma_2}{2\varepsilon_0}$

$\boxed{E = -\frac{\sigma}{\varepsilon_0}}$

C-4

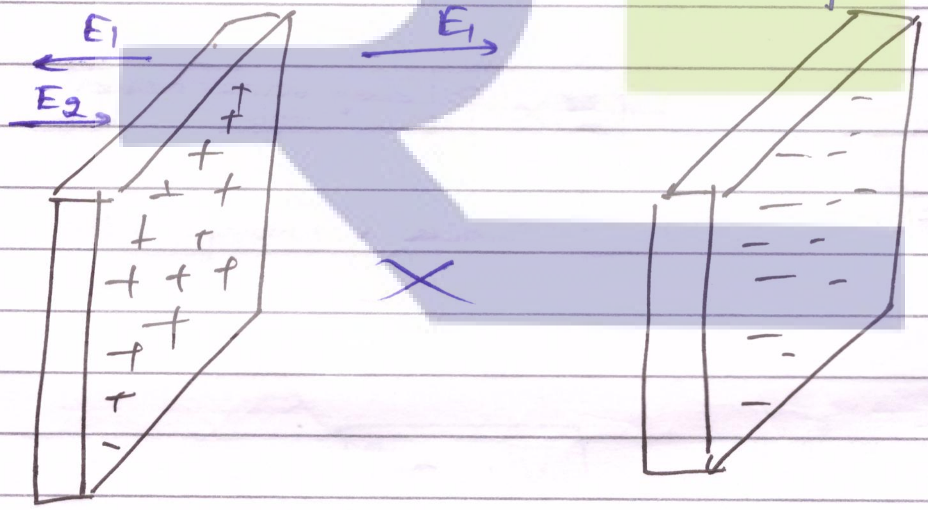


$E = E_2 - E_1$
$= \frac{\sigma_2}{\varepsilon_0} - \frac{\sigma_1}{\varepsilon_0}$
$\boxed{E = 0}$

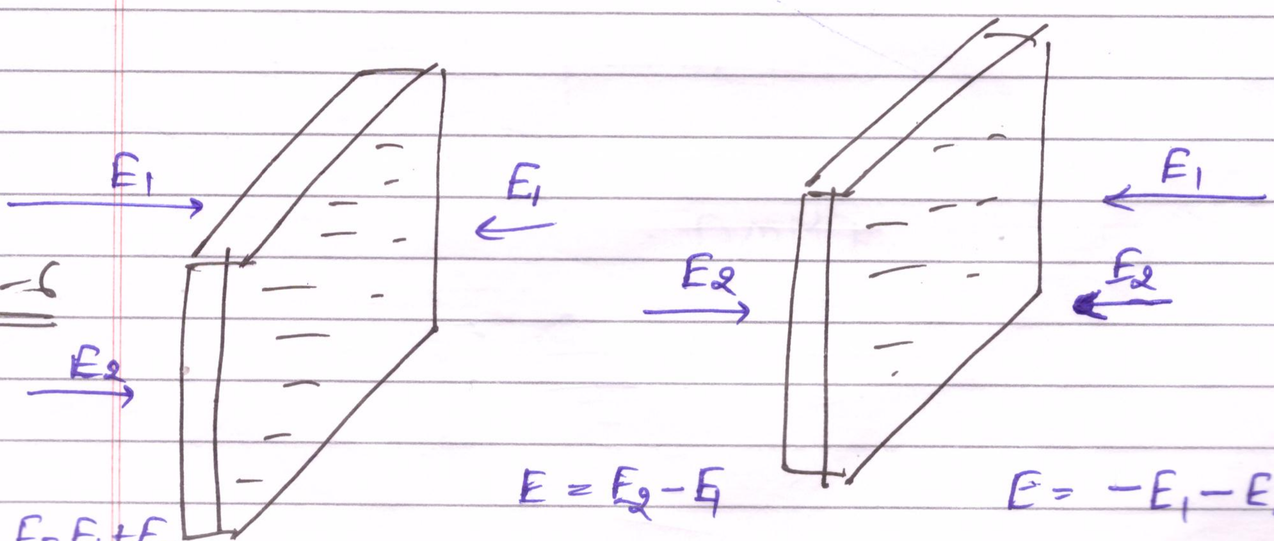
$E = E_1 + E_2$
$= \frac{\sigma_1}{\varepsilon_0} + \frac{\sigma_2}{\varepsilon_0}$
$\boxed{E = \frac{2\sigma}{\varepsilon_0}}$

$E = E_1 - E_2$
$= \frac{\sigma_1}{\varepsilon_0} - \frac{\sigma_2}{\varepsilon_0}$
$\boxed{E = 0}$

C-5



C-6



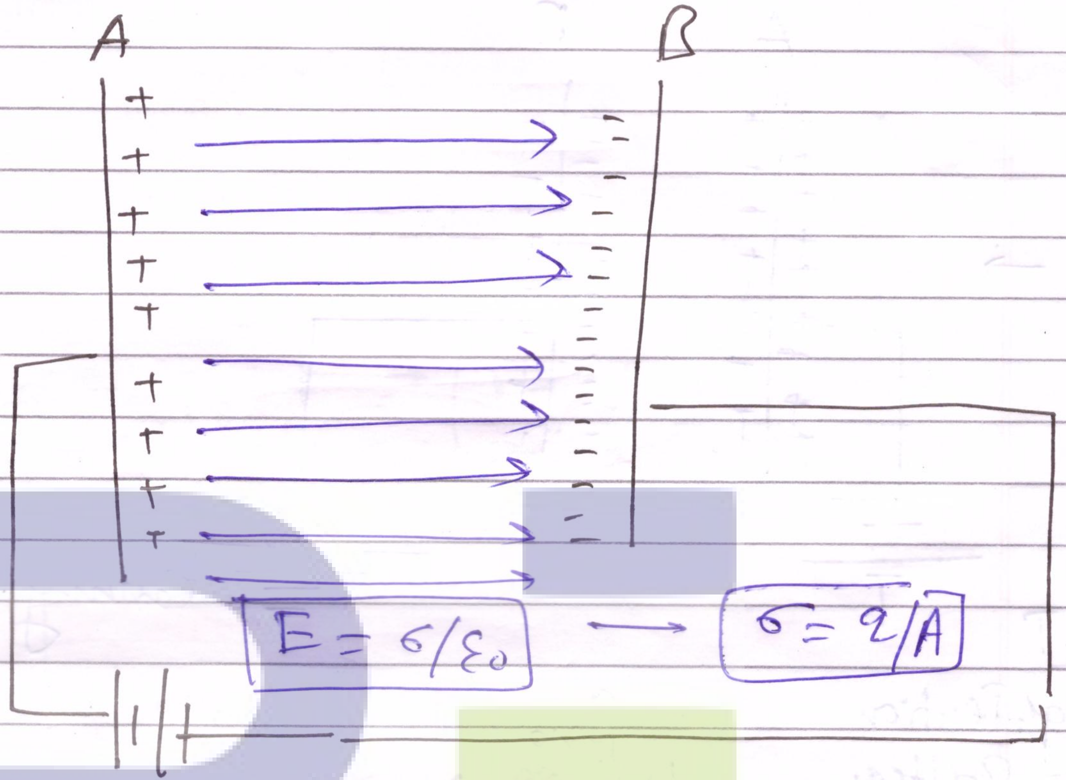
$E = E_1 + E_2$

$E = E_2 - E_1$

$E = -E_1 - E_2$

Capaciter

①



② Capacitor : $q \propto V$

Charg in capaciter is directly propotional to Potential

$\rightarrow q \propto V$

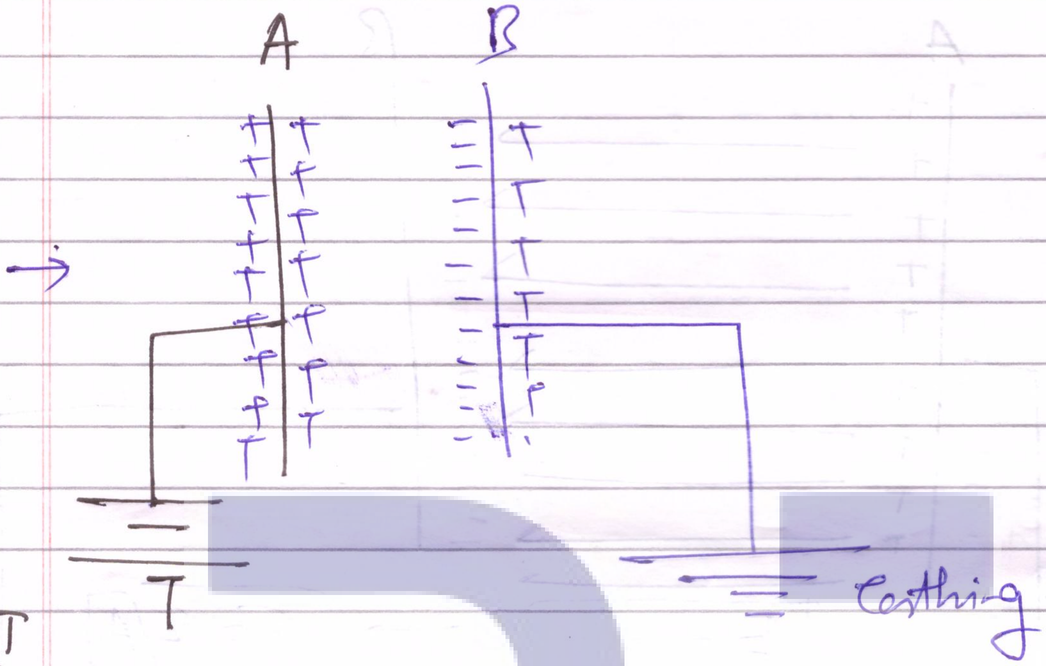
$\rightarrow \boxed{q = CV}$

[∵ C → capaciter]

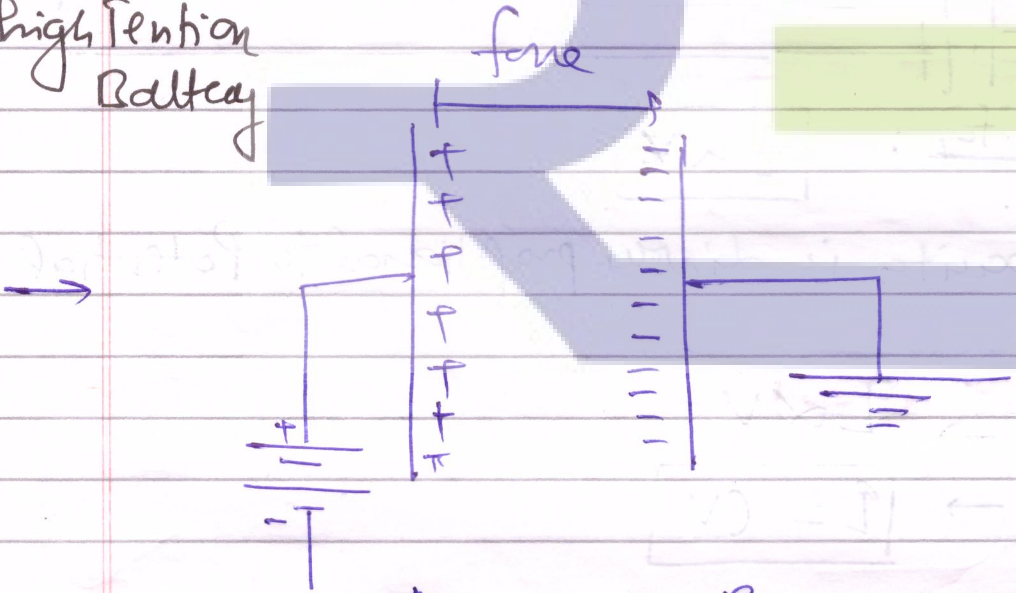
$\rightarrow C = \dfrac{q}{V} = \dfrac{[\text{Colump}]}{[\text{volt}]}$

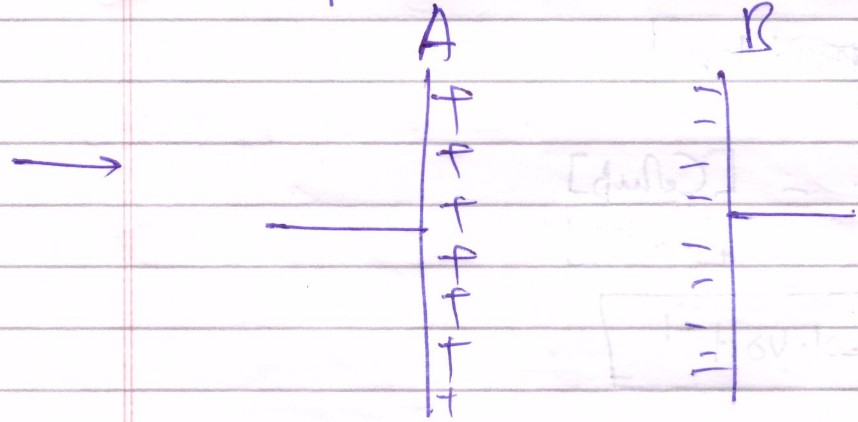
$\rightarrow \boxed{1f = \text{Col}\cdot\text{volt}^{-1}}$

(3) Principal of Capaiter



H.T
High Tention
Boltage

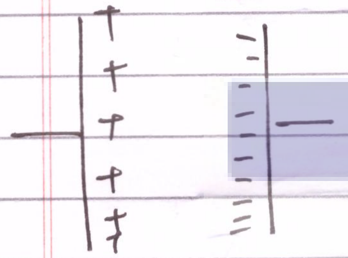




④ → $q = CV$

q → chage
C → Capaciter
V → volt

→ $E = \sigma/\varepsilon_0$ → $\sigma = q/A$



⑤ → Capaciter
① Spherical
② parallel plate capaciter

Spherical Capaciter

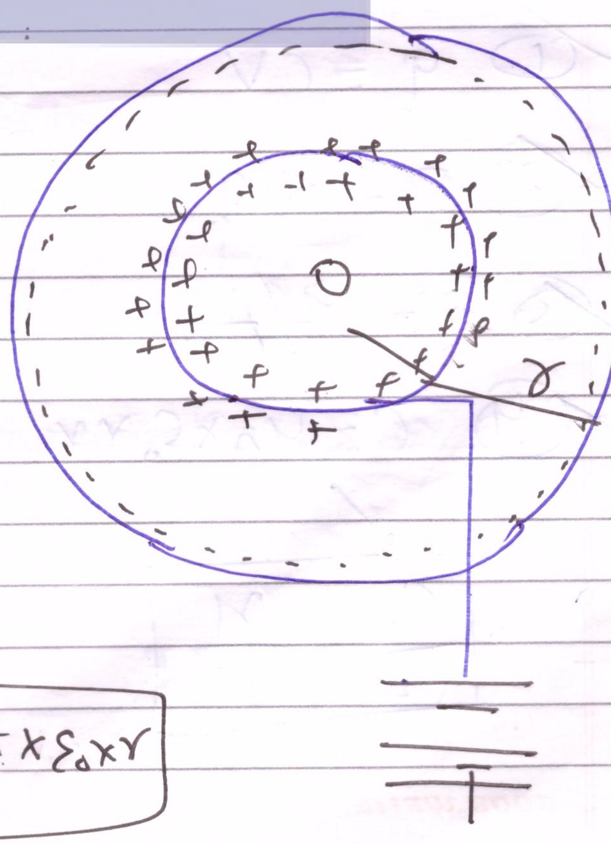
* Let 'q' is charge,
'v' is voltage

→ $q = CV$

→ $C = q/V$

$$V = \frac{kq}{r} = \frac{1}{4\pi\varepsilon_0} \times \frac{q}{r}$$

$$C = \frac{q}{\frac{1}{4\pi\varepsilon_0}\frac{q}{r}} = 4\pi \times \varepsilon_0 \times r$$



$$C = 4\pi \times \varepsilon_0 \times r$$

Q: If ratio of radius of two spherical capacitors is 5:6, find the ratio of their capacitance?

A:

$$C_1 = 4\pi \times \varepsilon_0 r_1 \quad \left[\because \frac{r_1}{r_2} = \frac{5}{6}\right]$$

$$C_2 = 4\pi \times \varepsilon_0 \times r_2$$

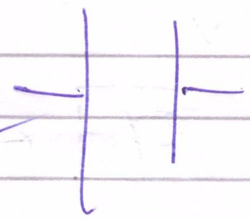
$$\frac{C_1}{C_2} = \frac{4\pi \times \varepsilon_0 \times r_1}{4\pi \times \varepsilon_0 \times r_2} = \frac{r_1}{r_2} = \frac{5}{6}$$

Note

1. $q = CV$
2. $E = \sigma/\varepsilon_0$
3. $\sigma = q/A$
4. $C = 4\pi \times \varepsilon_0 \times r$

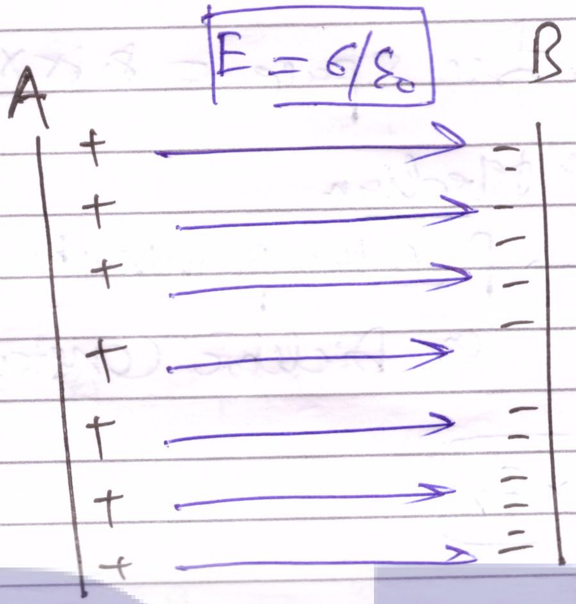
$$\frac{C_1}{C_2} = \frac{r_1}{r_2}$$

5. $V = E \times d$ — V → Potential, E → electric field, d → distance

6. 

$$C = \frac{\varepsilon_0 A}{d}$$

[Parllel Plate Capaciter]:



Let AB be the plate of Capaciter
Let 'd' is distence B/w Plates
Let 'A' is Area of Capaciter

$\rightarrow q = CV$

$\rightarrow \boxed{C = q/V}$

$\rightarrow V = E \times d$ $\quad \left[\because E = \frac{\sigma}{\varepsilon_0}\right]$

$\rightarrow V = \frac{\sigma}{\varepsilon_0} \times d$ $\quad \left[\because \sigma = q/A\right]$

$V = \frac{q \times d}{A \times \varepsilon_0}$

$\rightarrow \boxed{C = \frac{q}{\frac{q \times d}{A \times \varepsilon_0}} = \frac{A \times \varepsilon_0}{d}}$

GOOD WRITE

Note

① ε_0 → free space $= 8.85 \times 10^{-12}$

ε → Medium

ε_r → Relative permittivity or Dielectric Constant

$$\varepsilon = \varepsilon_0 \times \varepsilon_r$$

② → $f_1 = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$ → $f_2 = \frac{f_1}{\varepsilon_r}$

→ $E_1 = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2}$ → $E_2 = \frac{E_1}{\varepsilon_r}$

→ $V_1 = \frac{1}{4\pi\varepsilon} \frac{q}{r}$ → $V_2 = \frac{V_1}{\varepsilon_r}$

→ $w_2 = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r}$ → $w_2 = \frac{w_1}{\varepsilon_r}$

→ Spherical Capacitor

$C_1 = 4\pi \times \varepsilon_0 \times r$ → $C_2 = \varepsilon_r \times C_1$

Note: $C_2 = 4\pi \times \varepsilon \times r$

$C_2 = 4\pi \times \varepsilon_0 \times \varepsilon_r \times r$

$C_1 = C_1 \times \varepsilon_r$

$c = \frac{q}{v}$

$c = \frac{q\, r}{kq}$

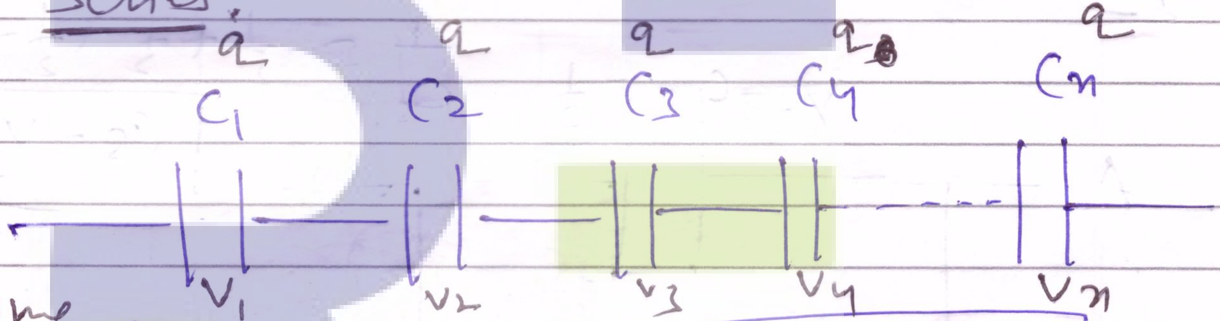
$C = 4\pi\varepsilon_0 r$

→ Parallel Plate Capacitor

$$C_1 = \frac{\epsilon_0 A}{d} \rightarrow C_2 = \epsilon_r \times C_1$$

③: Combination of Capacitor:

(i) Series:

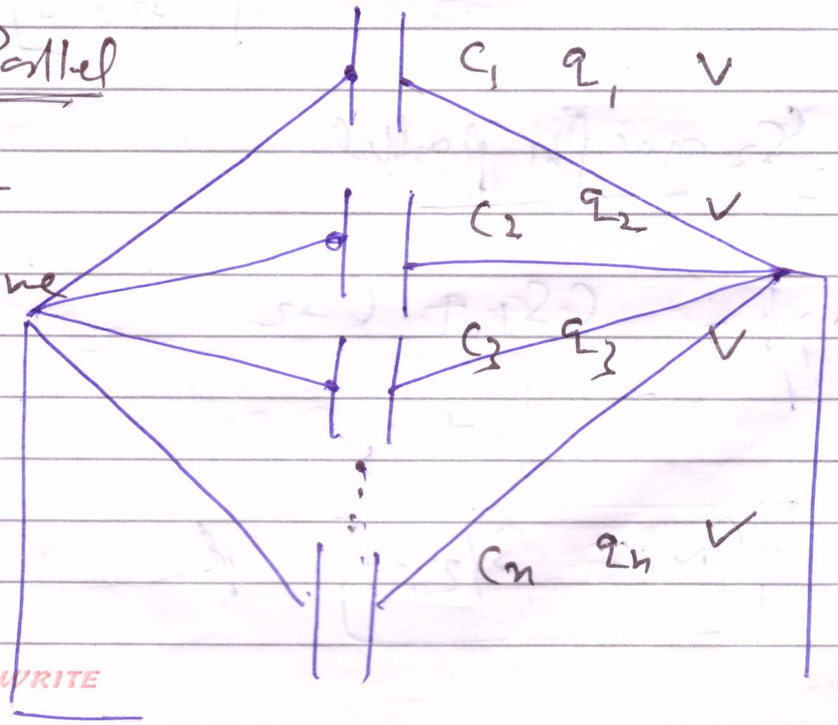


Charge → Same
Potential → different

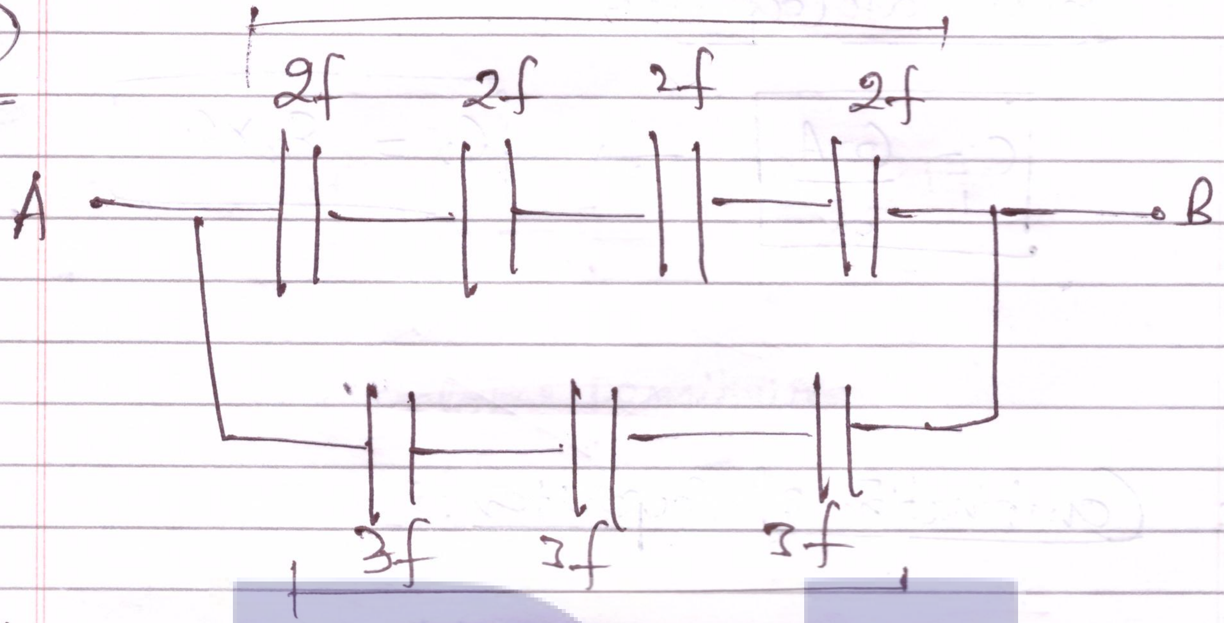
$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots \frac{1}{C_n}$$

(ii) Parallel

Charge → different
Potential → Same



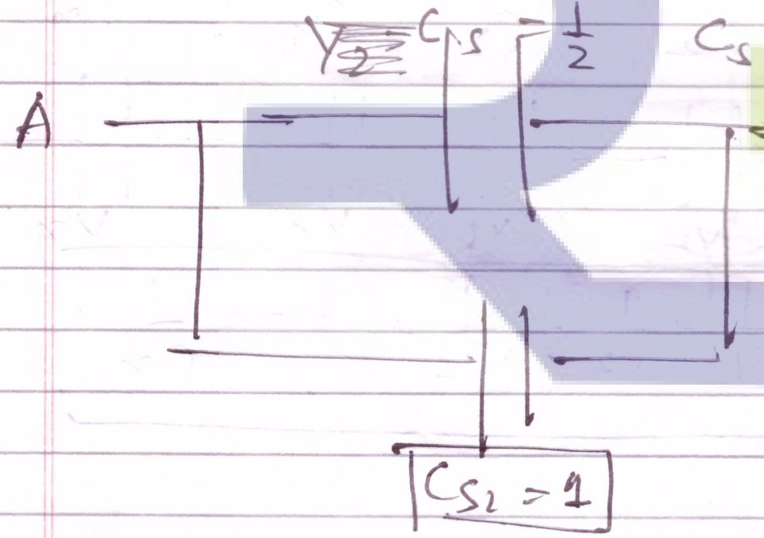
④



Ans

$$\frac{1}{C_s} = \frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2} = \frac{4}{2} = 2$$

$$\frac{1}{C_s} \quad \boxed{C_s = 1/2}$$



$$\frac{1}{C_{s_2}} = \frac{1}{3}+\frac{1}{3}+\frac{1}{3} = \frac{3}{3} = 1$$

$$\boxed{C_{s_2} = 1}$$

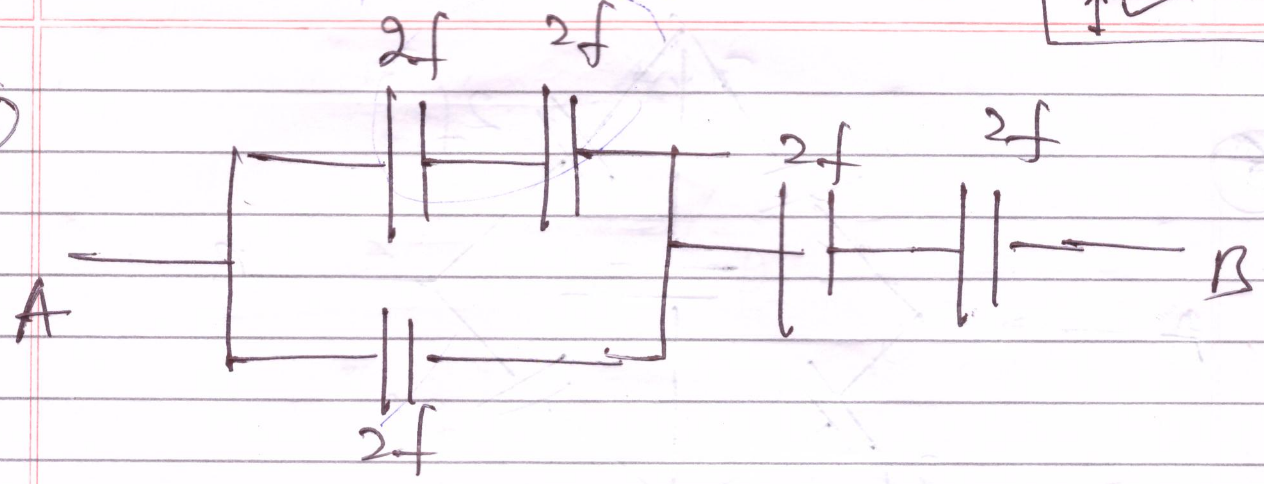
C_{s_1} & C_{s_2} are in parallel

So $C_N = C_{s_1} + C_{s_2}$

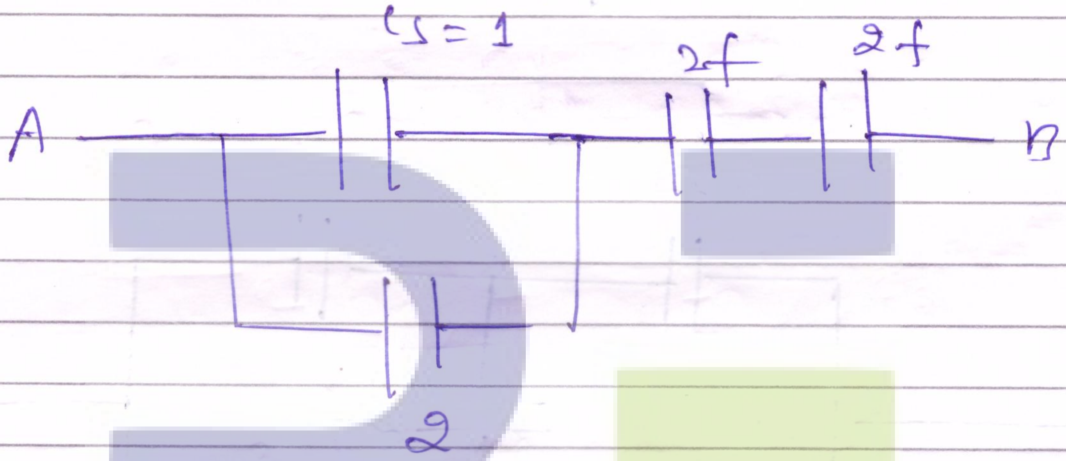
$$= \frac{1}{2} + 1$$

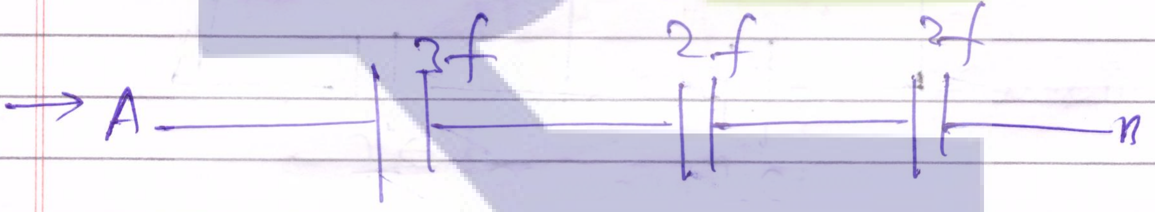
$$\boxed{C_N = 3/2\, f}$$

(5)



Ans

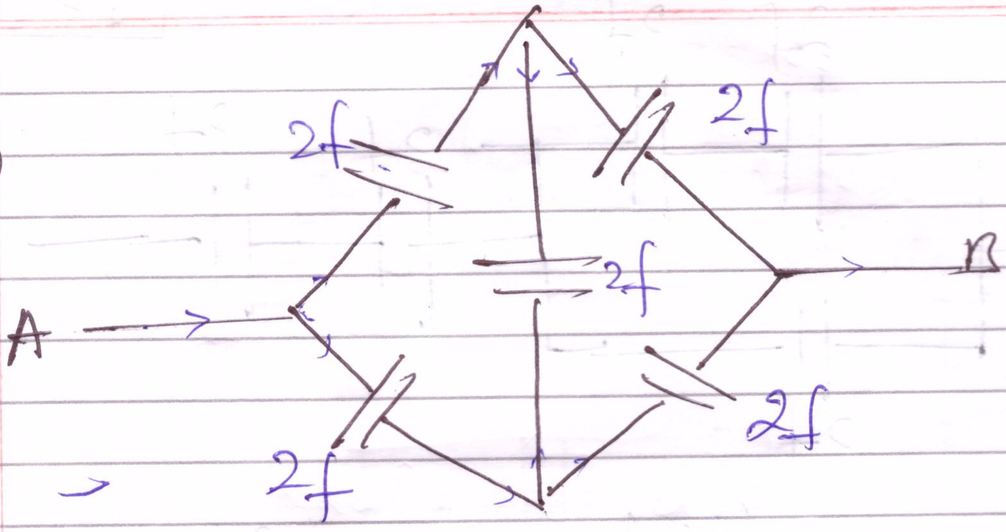




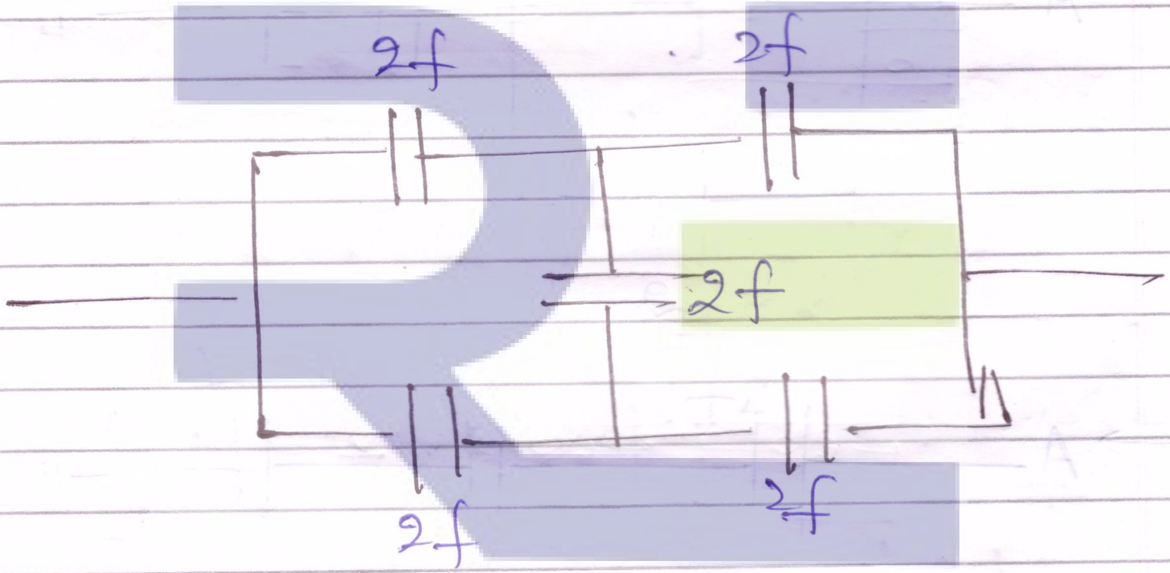
$$\frac{1}{C_N} = \frac{1}{3} + \frac{1}{2} + \frac{1}{2} = \frac{2+3+3}{6} = \frac{8}{6}$$

$$\boxed{C_N = 6/8\,f}$$ A

*(6)



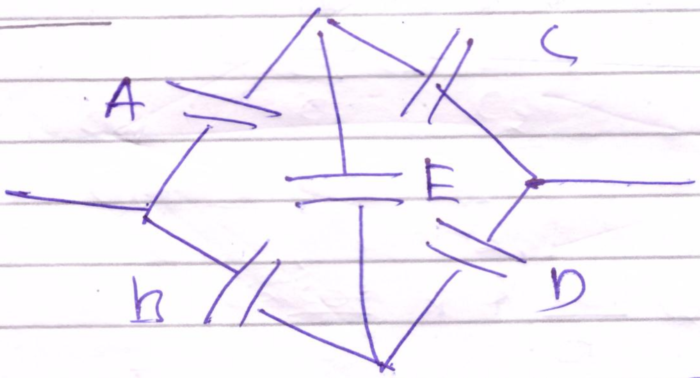
*(7)



Note

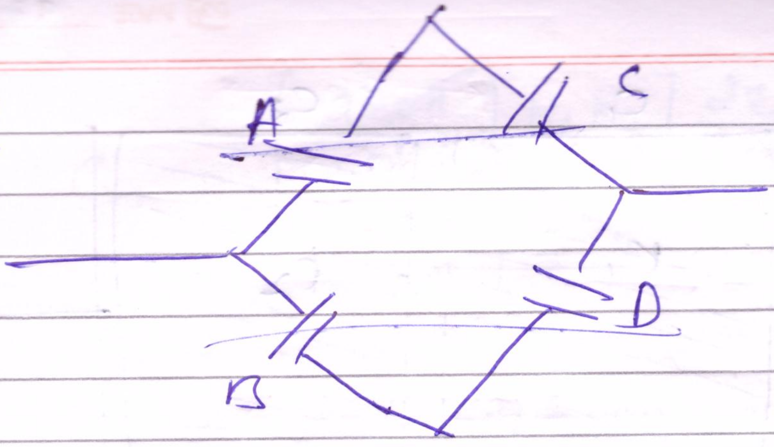
(8) **Wheatstone Bridge:**

⇒

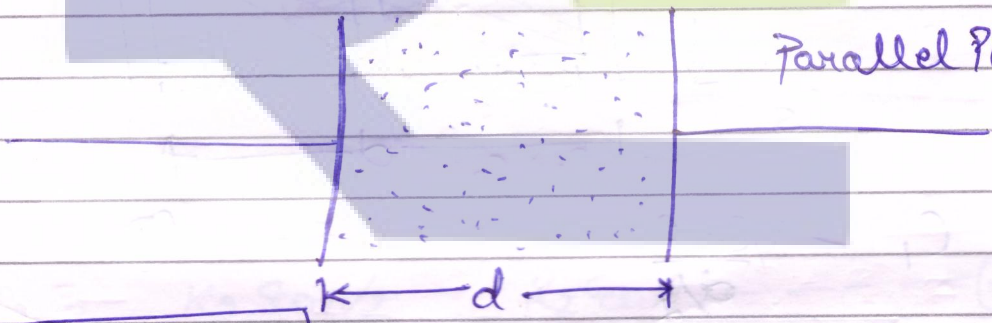


if $\boxed{\frac{A}{B} = \frac{C}{D}}$ then (E) Neglect

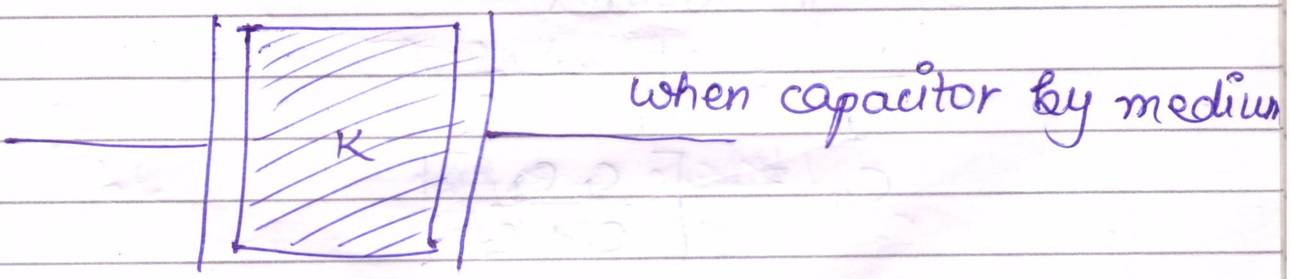
Eg



<u>Note</u> -



$$C_0 = \frac{\varepsilon_0 A}{d}$$ when capacitor filled by air



$\frac{\varepsilon}{\varepsilon_r} = \varepsilon_0$

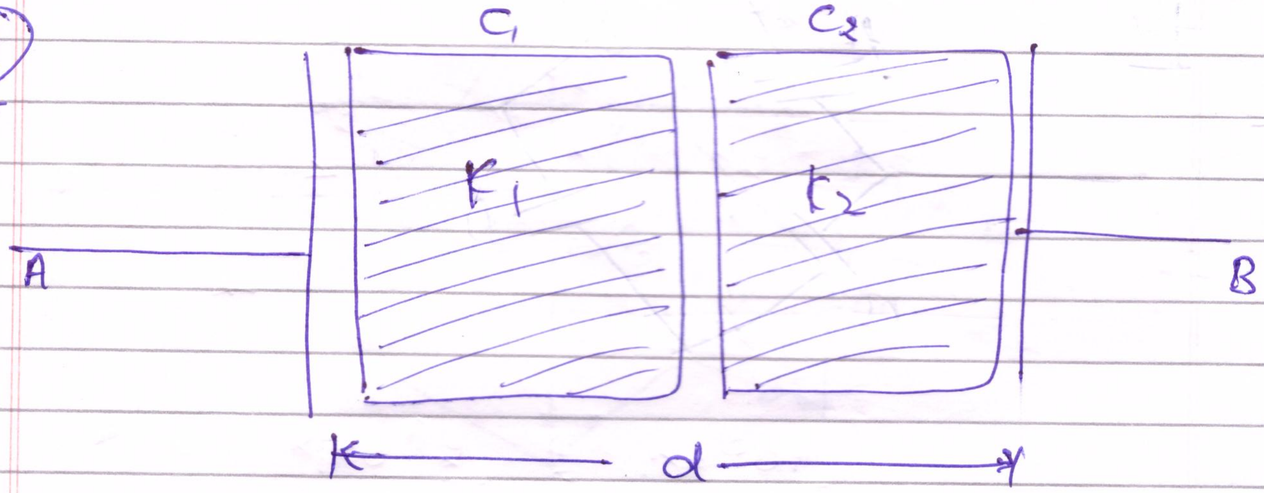
$\frac{C}{C_0} = K$

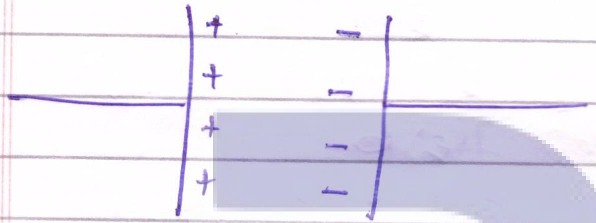
$$C = K \times C_0$$

$$C = K \times \frac{\varepsilon_0 A}{d}$$

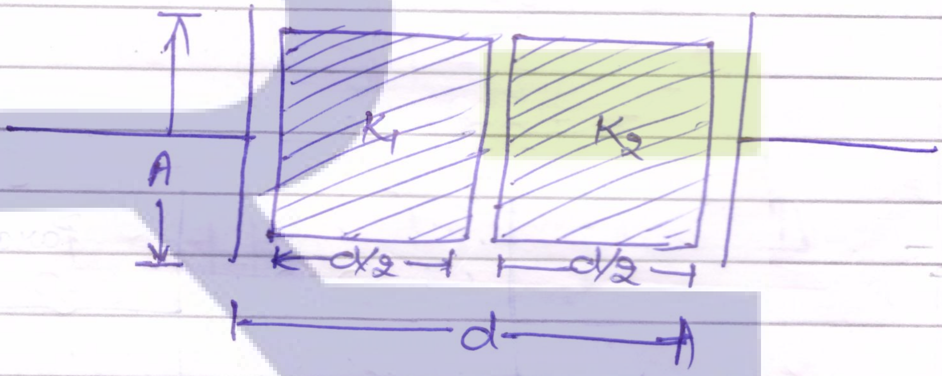
Capacitance increases when dielectric constant put b/w capacitor.

(9)





$$C = \frac{\varepsilon_0 A}{d}$$



$$C_1 = \frac{K_1 \varepsilon_0 A}{d/2} \quad \text{------ (1)}$$

$$C_2 = \frac{K_2 \varepsilon_0 A}{d/2} \quad \text{------ (2)}$$

Both in series

$$\frac{1}{C_N} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_N = \left[\frac{C_1 C_2}{C_1 + C_2}\right]$$

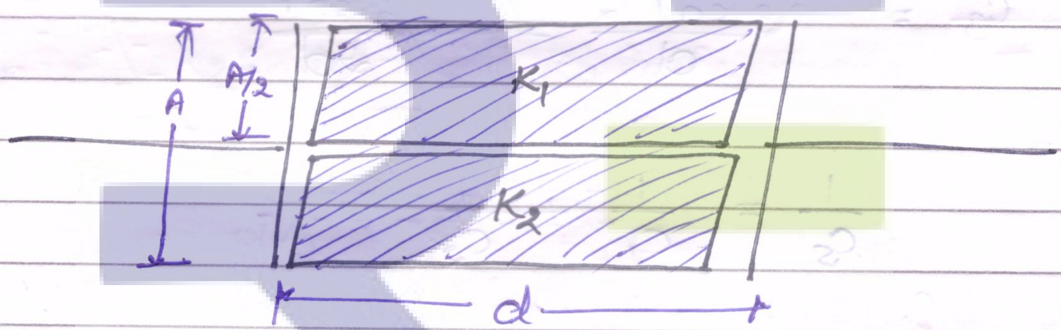
$$C_N = \left[\frac{\frac{K_1 2\varepsilon_0 A}{d} \times \frac{2\varepsilon_0 A K_2}{d}}{\frac{K_1 2\varepsilon_0 A}{d} + \frac{K_2 2\varepsilon_0 A}{d}}\right]$$

$$C_N = \left[\frac{\frac{2\varepsilon_0 A}{d}\left[K_1 K_2\right]\frac{2\varepsilon_0 A}{d}}{\frac{2\varepsilon_0 A}{d}\left[K_1 + K_2\right]}\right]$$

$$C_N = \frac{(2K_1K_2)\frac{\varepsilon_0 A}{d}}{K_1 + K_2}$$

$$\boxed{C_N = \left[\frac{2K_1K_2}{K_1+K_2}\right]\frac{\varepsilon_0 A}{d}}$$

Ans



$$C_1 = \frac{K_1\varepsilon_0 A}{2d} \quad \text{-------} \quad (1)$$

$$C_2 = \frac{K_2\varepsilon_0 A/2}{d} = \frac{K_2\varepsilon_0 A}{2d} \quad \text{-------} \quad (2)$$

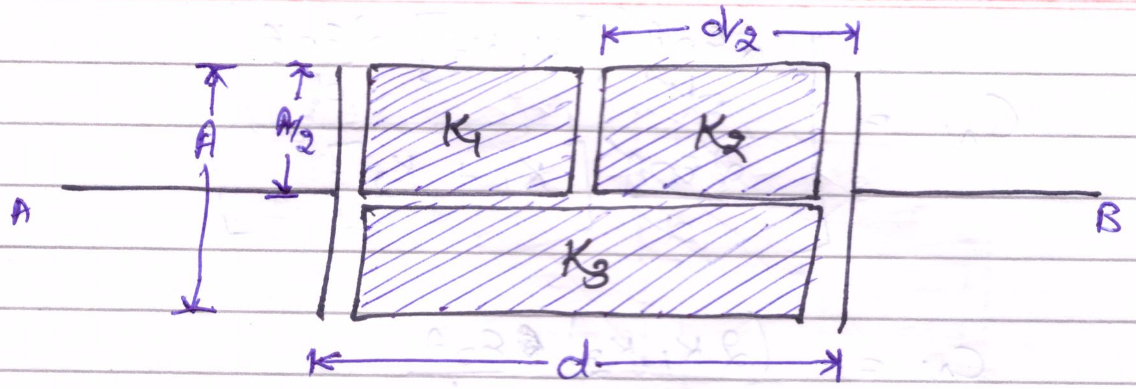
They are in parrallel

$$C_P = C_1 + C_2$$

$$= \frac{K_1\varepsilon_0 A}{2d} + \frac{K_2\varepsilon_0 A}{2d}$$

$$\boxed{C_P = \frac{\varepsilon_0 A}{2d}\left[K_1 + K_2\right]}$$

Ans



$$C_1 = \frac{K_1 \varepsilon_0 A/2}{d/2} = \frac{K_1 \varepsilon_0 A}{d} \quad \text{--- (1)}$$

$$C_2 = \frac{K_2 \varepsilon_0 A/2}{d/2} = \frac{K_2 \varepsilon_0 A}{d} \quad \text{--- (2)}$$

$$C_3 = \frac{K_3 \varepsilon_0 A/2}{d} = \frac{K_3 \varepsilon_0 A}{2d} \quad \text{--- (3)}$$

$$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_S = \frac{C_1 C_2}{C_1 + C_2}$$

C_S and C_3 are parallel

$$C_N = C_S + C_3$$

$$C_N = \frac{C_1 C_2}{C_1 + C_2} + C_3$$

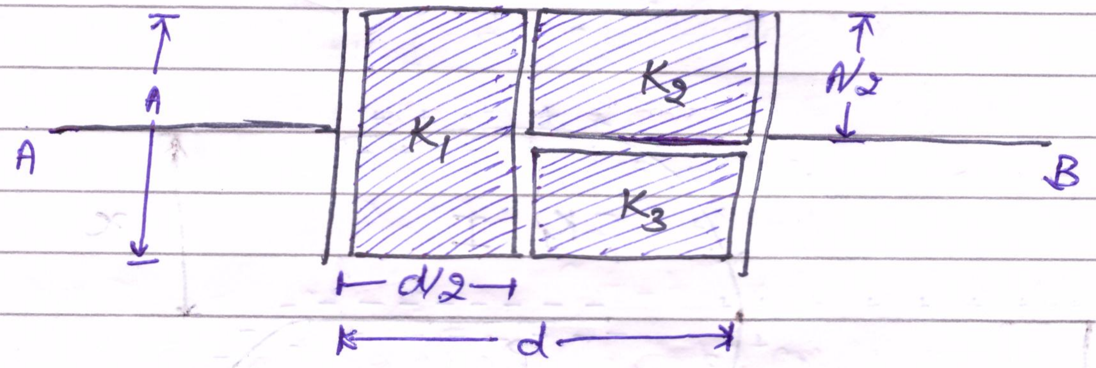
$$= \left[\frac{\frac{K_1 \varepsilon_0 A}{d} \times \frac{K_2 \varepsilon_0 A}{d}}{\frac{K_1 \varepsilon_0 A}{d} + \frac{K_2 \varepsilon_0 A}{d}}\right] + \frac{K_3 \varepsilon_0 A}{2d}$$

$$= \left[\left(\frac{K_1 K_2}{K_1 + K_2}\right) \frac{\varepsilon_0 A}{d} + K_3 \frac{\varepsilon_0 A}{2d}\right]$$

$$= \frac{\varepsilon_0 A}{d}\left[\frac{K_1 K_2}{K_1 + K_2} + \frac{K_3}{2}\right]$$

$$C_N = C_0\left[\frac{K_1 K_2}{K_1 + K_2} + \frac{K_3}{2}\right]$$

Ans



$$C_1 = \frac{K_1 \varepsilon_0 A}{d/2} = \frac{2K_1 \varepsilon_0 A}{d} \quad \text{------ (1)}$$

$$C_2 = \frac{K_2 \varepsilon_0 A/2}{d/2} = \frac{K_2 \varepsilon_0 A}{d} \quad \text{------ (2)}$$

$$C_3 = \frac{K_3 \varepsilon_0 A/2}{d/2} = \frac{K_3 \varepsilon_0 A}{d} \quad \text{------ (3)}$$

$$C_p = C_2 + C_3 \quad \text{------ (4)}$$

NOW, $$\frac{1}{C_N} = \frac{1}{C_p} + \frac{1}{C_1}$$

$$\frac{1}{C_N} = \frac{1}{C_2 + C_3} + \frac{1}{C_1}$$

$$\frac{1}{C_N} = \frac{1}{\frac{K_2 \varepsilon_0 A}{d} + \frac{K_3 \varepsilon_0 A}{d}} + \frac{1}{\frac{2K_1 \varepsilon_0 A}{d}}$$

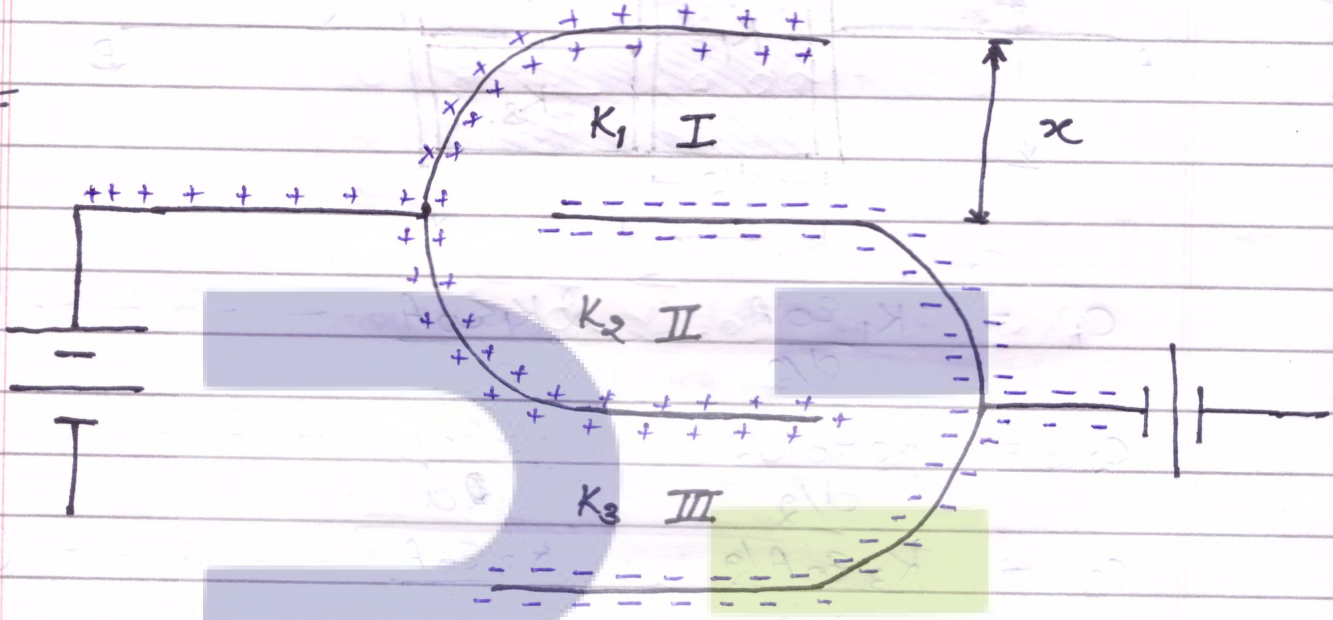
$$= \frac{d}{\varepsilon_0 A (K_2 + K_3)} + \frac{d}{2K_1 \varepsilon_0 A}$$

$$= \frac{d}{\varepsilon_0 A}\left(\frac{1}{K_2 + K_3} + \frac{1}{2K_1}\right)$$

$$= \frac{d}{\varepsilon_0 A}\left(\frac{2K_1 + K_2 + K_3}{2K_1 (K_2 + K_3)}\right)$$

$$C_N = \frac{2K_1(K_2+K_3)}{2K_1+K_2+K_3}$$

Ans



$$C_1 = \frac{K_1 \varepsilon_0 A}{x} \quad \text{------- (1)}$$

$$C_2 = \frac{K_2 \varepsilon_0 A}{x} \quad \text{------- (2)}$$

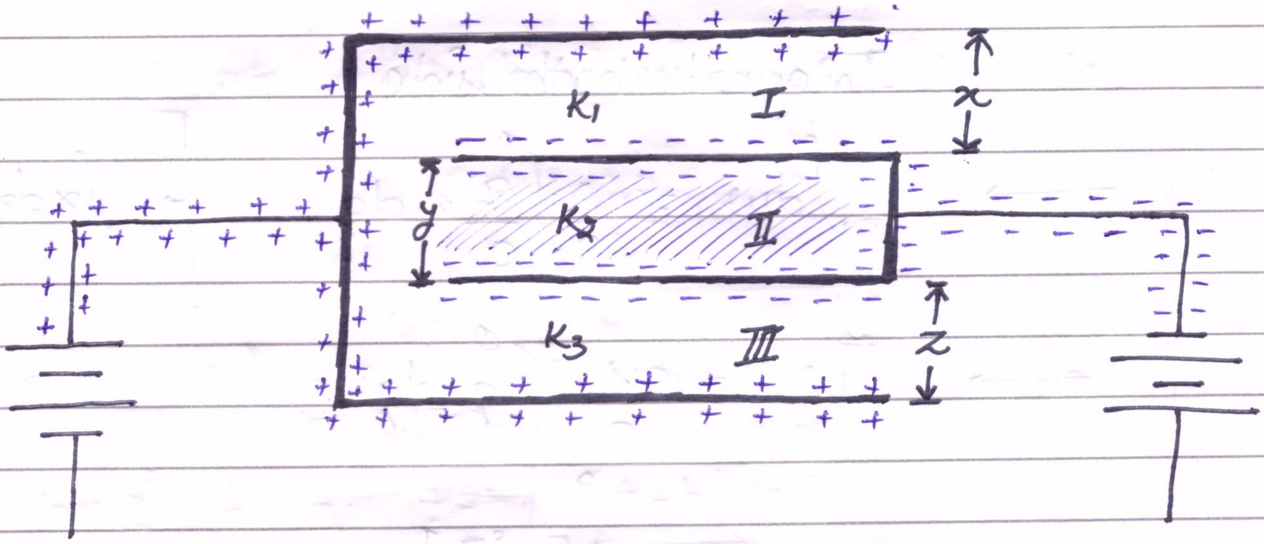
$$C_3 = \frac{K_3 \varepsilon_0 A}{x} \quad \text{------- (3)}$$

$$C_p = C_1 + C_2 + C_3$$

$$= \frac{\varepsilon_0 A}{d}\left[K_1 + K_2 + K_3\right]$$

$$C_p = \frac{\varepsilon_0 A}{d}(K_1 + K_2 + K_3)$$

Ques



Ans

$$C_1 = \frac{K_1 \varepsilon_0 A}{x} \quad \text{------} (1)$$

$$C_3 = \frac{K_3 \varepsilon_0 A}{z} \quad \text{------} (2)$$

$$C_p = \left[\frac{K_1 \varepsilon_0 A}{x} + \frac{K_3 \varepsilon_0 A}{z}\right]$$

$$\boxed{C_p = \varepsilon_0 A \left[\frac{K_1}{x} + \frac{K_3}{z}\right]}$$

* Energy Stored in Capacitor

Let 'dw' is small work done when (dq) charge move with potential (V)

$$\longrightarrow \quad dw = V \times dq$$

we know that,

$$q = CV \Rightarrow V = \frac{q}{C}$$

$$\longrightarrow \quad dw = \frac{q}{C} \times dq$$

Integrade both side

$$\int dw = \int_0^Q \frac{q}{c} \times dq$$

$$\int x\,dx = \frac{x^2}{2}$$

$$w = \frac{1}{c}\int_0^Q q\,dq$$

$$w = \frac{1}{c}\left[\frac{q^2}{2}\right]_0^Q$$

$$w = \frac{1}{c}\left[\frac{Q^2}{2} - \frac{0^2}{2}\right]$$

$$\boxed{w = \frac{Q^2}{2c}}$$

Special case

$$Q = CV \quad , \quad C = Q/V$$

$$w = \frac{1}{2}\frac{Q^2}{C} \Rightarrow \frac{1}{2}\frac{C^2V^2}{C} = \frac{1}{2}CV^2$$

$$w = \frac{1}{2}\frac{Q^2}{C} \Rightarrow \frac{1}{2}\frac{Q^2}{Q/V} = \frac{1}{2}QV$$

Note

① $\boxed{w = V \times q}$

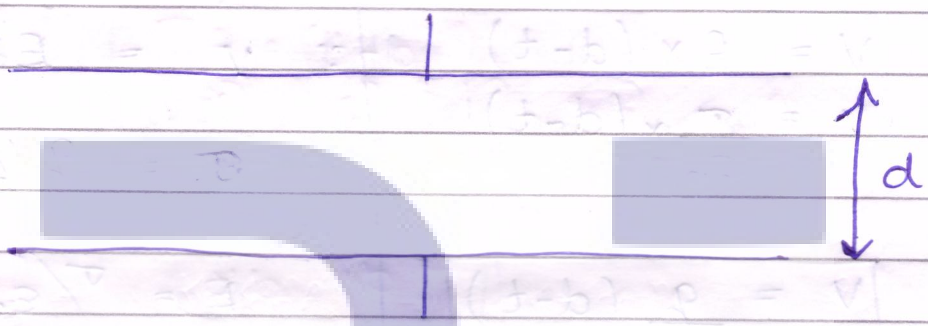
② $\boxed{q = CV}$

③ $E = w = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C}$

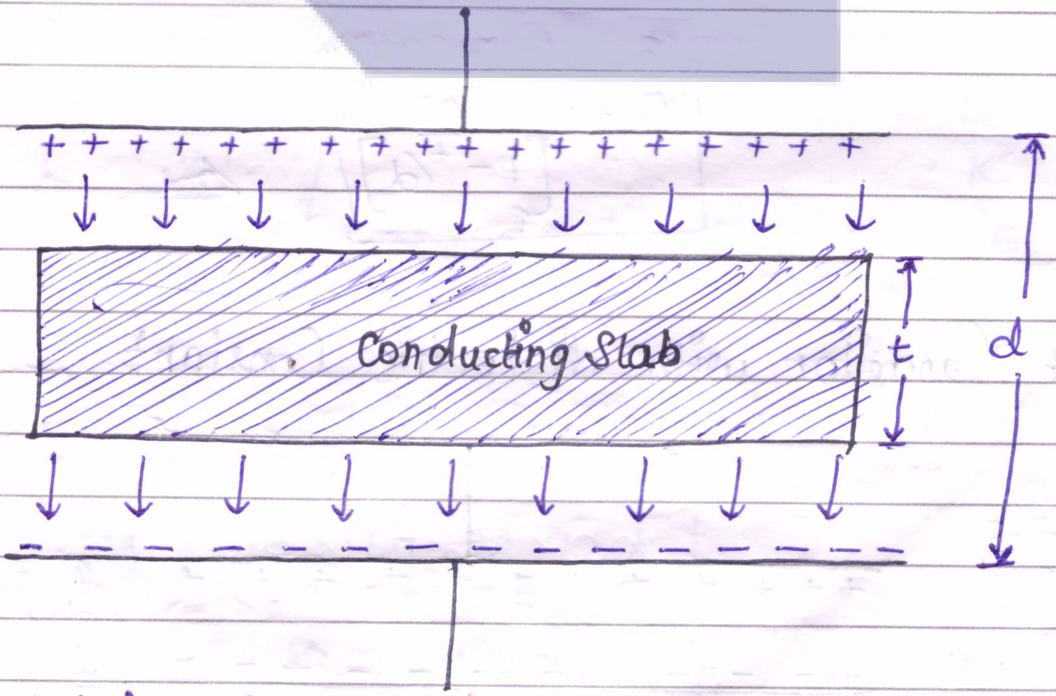
* Capacitor with Conducting Slab

* Capacitor with Dielectric Slab

* Capacitor with Conducting Slab



$$C_0 = \frac{\varepsilon_0 A}{d}$$ ⇒ Capacitor with free air



Let 't' is Thickness of Slab.
Let 'd' is distance b/w plates.
Let 'A' is Area of Capacitor

Let 'E' is Electric field.

$$C_0 = \frac{\varepsilon_0 A}{d}$$

We know,

$Q = CV$, $C = Q/V$

$\because V = E \times d$

$\because \sigma = q/A$

$E = \sigma/\varepsilon_0$

$\longrightarrow$ $V = E \times (d-t)$

$V = \frac{\sigma}{\varepsilon_0} \times (d-t)$

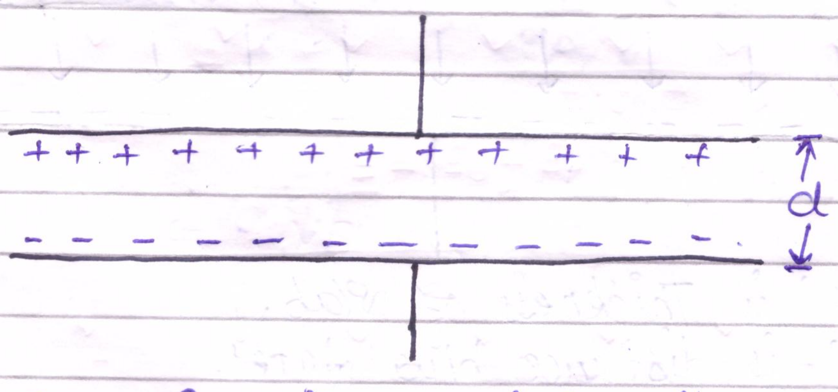
$$V = \frac{q}{A \times \varepsilon_0}(d-t)$$

$\longrightarrow$ $C = \frac{q}{\frac{q}{A\varepsilon_0}(d-t)} = \frac{A \times \varepsilon_0}{(d-t)} = \frac{A\varepsilon_0}{d\left[1-\frac{t}{d}\right]}$

$$C = \frac{C_0}{\left[1 - t/d\right]}$$

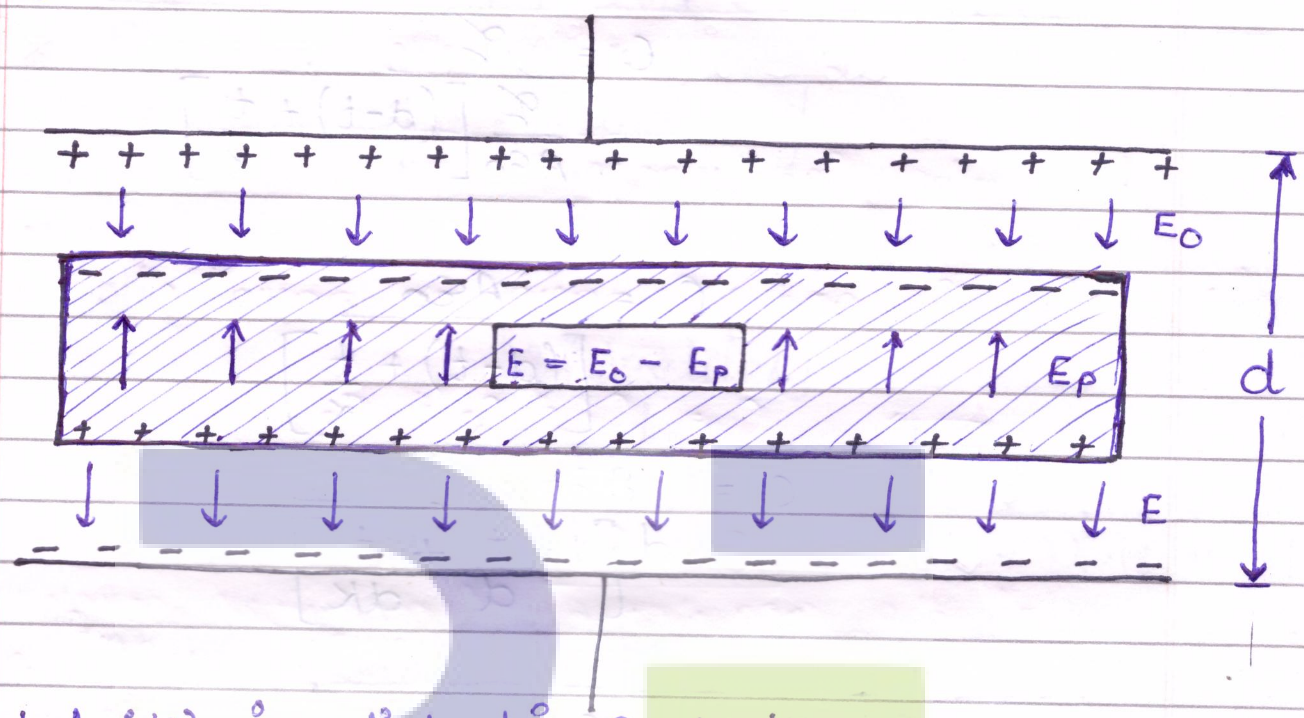
Ans

* Capacitor with dielectric Constant



C_0 = Capacitance of Capacitor $= \frac{\varepsilon_0 A}{d}$

After putting dielectric constant



Let 'K' is dielectric Constant
Let 'd' is distance B/w plates
Let 't' is thickness of dielectric Slab

$\longrightarrow Q = CV$

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

$\longrightarrow V = E_0(d-t) + E(t)$

$\longrightarrow V = E_0(d-t) + \frac{E_0}{K}(t)$

$\longrightarrow V = E_0\left[(d-t) + \frac{t}{K}\right]$

$$E_0 = \frac{\sigma}{\varepsilon_0} = \frac{q}{A \times \varepsilon_0}$$

$\longrightarrow V = E_0\left[(d-t) + \frac{t}{K}\right]$

$\longrightarrow V = \frac{q}{A\varepsilon_0}\left[(d-t) + \frac{t}{K}\right]$

we know that, $c = \frac{Q}{V}$

Put the value of V in equation

$$C = \frac{q}{\frac{q}{A\varepsilon_0}\left[(d-t) + \frac{t}{K}\right]}$$

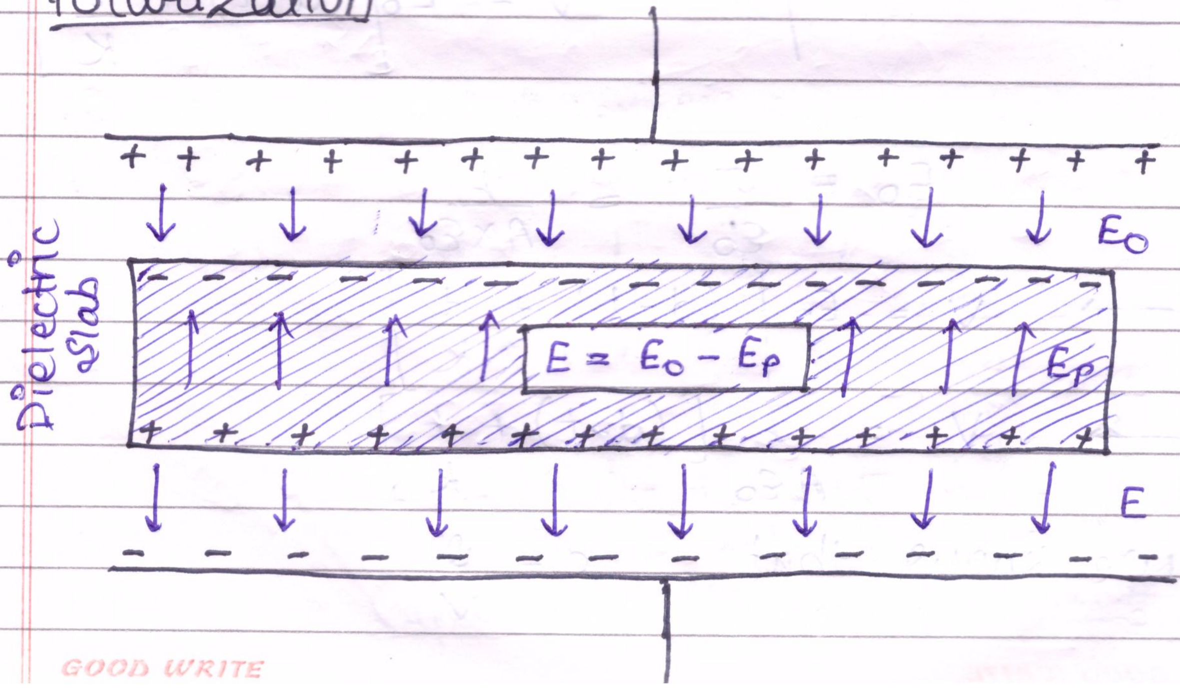
$$C = \frac{A\varepsilon_0}{\left[(d-t) + \frac{t}{K}\right]}$$

$$C = \frac{A\varepsilon_0}{d\left[1 - \frac{t}{d} + \frac{t}{dK}\right]}$$

$$\boxed{C = \frac{C_0}{\left[1 - \frac{t}{d} + \frac{t}{dK}\right]}}$$

∴ Capacitance Increases when dielectric slab is putted.

Polarization



E_0 = applied electric field
E_p = polarized electric field

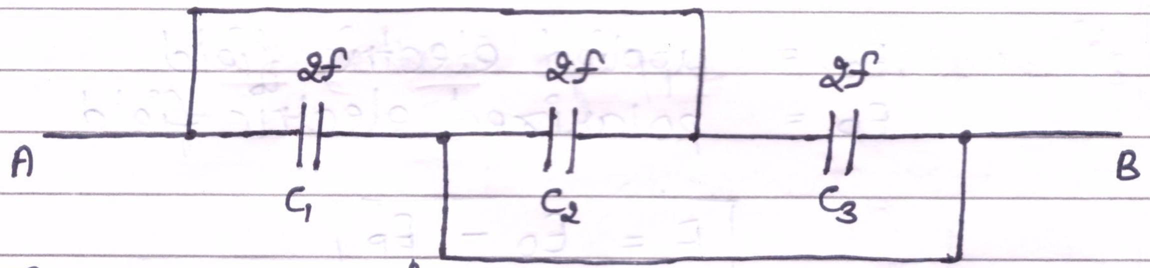
$$\boxed{E = E_0 - E_p}$$

Dielectrics

Dielectrics
- Polar Dielectrics
- Non-Polar Dielectrics

Polar Dielectrics	Non-Polar Dielectrics
① Centre of positive & negative charge one coincide each other called "Polar Dielectrics"	① Centre of positive & negative doesn't coincide each other called "Non - Polar Dielectric"
	
Ex- CO_2 , H_2	Ex – HCl , H_2O
② $\boxed{p = q \times 2a}$, distance in polar dielectric is zero. $\rightarrow$ $2a = 0$ so, $\boxed{p = 0}$ There is no dipole moment	② There is dipole moment.

Que



Find the Capacitance ?

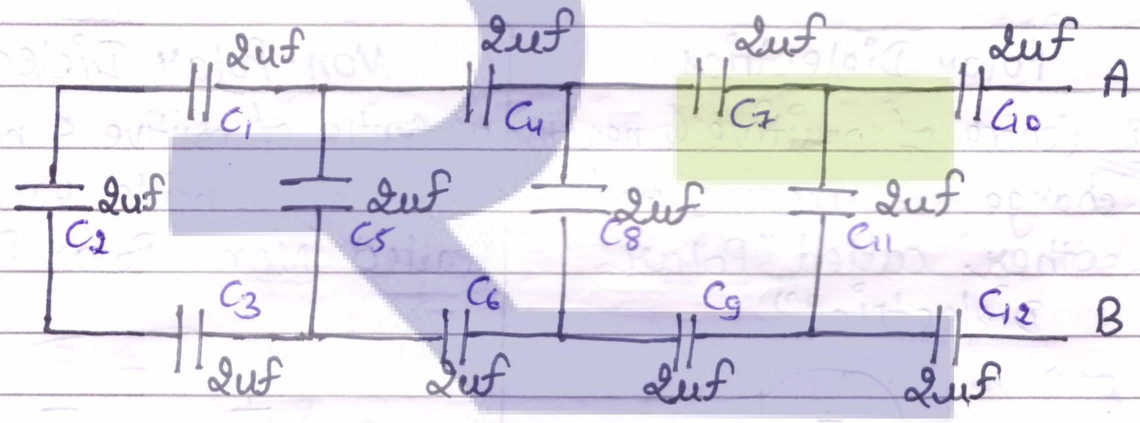
Ans C_1, C_2 and C_3 are in parallel

$\longrightarrow$ $C = C_1 + C_2 + C_3$

$C = 2 + 2 + 2$

$\boxed{C = 6f}$

Que



$\longrightarrow$ $\frac{1}{C_{S_1}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \Rightarrow \frac{1}{2} + \frac{1}{2} + \frac{1}{2} \Rightarrow \frac{3}{2}$

$C_{S_1} = 2/3$ — — — — (1)

$\longrightarrow$

$C_{P_1} = C_{S_1} + C_5 \Rightarrow \frac{2}{3} + 2 \Rightarrow \frac{8}{3}$

$C_{P_1} = \frac{8}{3}$ — — — — (2)

$\longrightarrow$ $\frac{1}{C_{S_2}} = \frac{1}{C_{P_1}} + \frac{1}{C_7} + \frac{1}{C_9} \Rightarrow \frac{3}{8} + \frac{1}{2} + \frac{1}{2} = \frac{11}{8}$

$C_{S_2} = 8/11$

$$\rightarrow C_{P_2} = C_{S_2} + C_{11} = \frac{8}{11} + 2$$

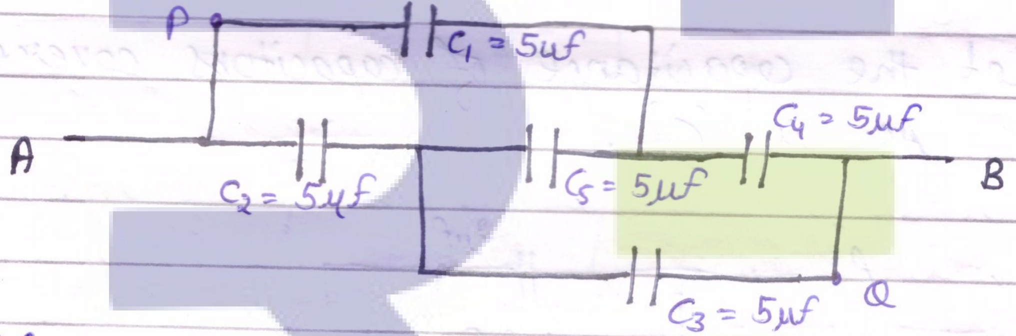
$$C_{P_2} = \frac{30}{11}$$

$$\rightarrow \frac{1}{C_{S_3}} = \frac{1}{C_{P_2}} + \frac{1}{C_{10}} + \frac{1}{C_{12}} = \frac{11}{30} + \frac{1}{2} + \frac{1}{2}$$

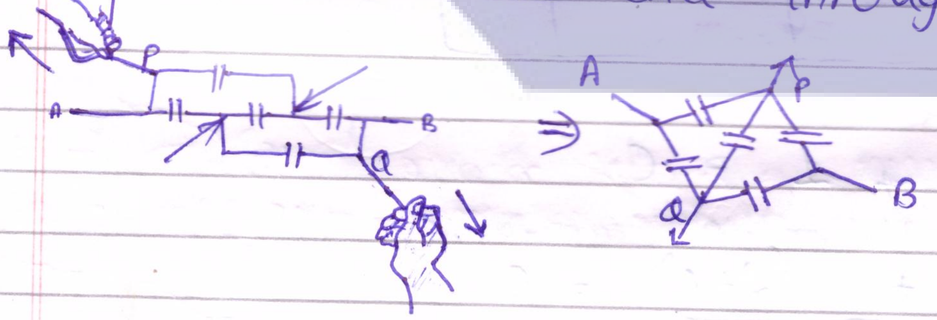
$$\frac{1}{C_{S_3}} = \frac{41}{30}$$

$$\boxed{C_{S_3} = \frac{30}{41} \mu f}$$

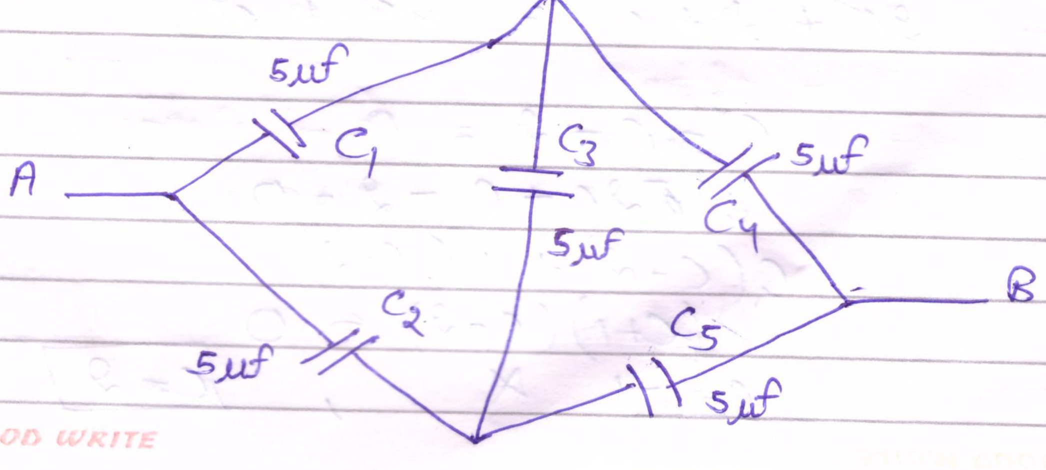
Ques



If we stretch its end through point 'P' & 'Q'

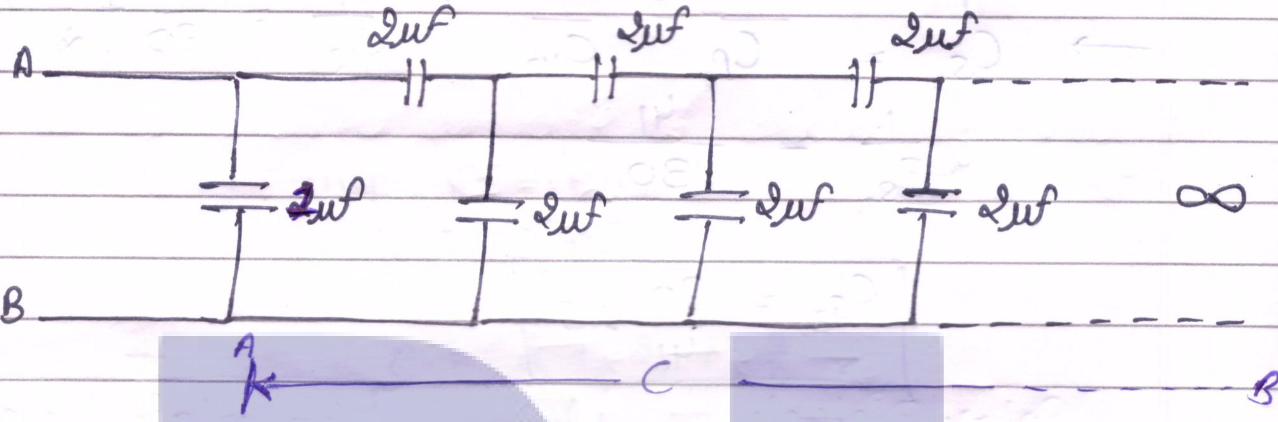


Hence It will form Wheatstone Bridge.



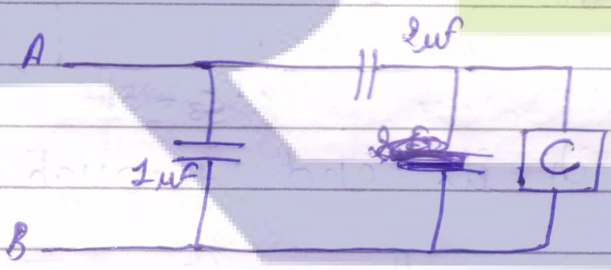
If $\boxed{\frac{C_1}{C_2} = \frac{C_4}{C_5}}$ then neglect (C_3)

Ans



Let the capacitance of capacitors covered in AB is 'C'.

So,



$\longrightarrow \frac{2 \times C}{2+C} + 1 = C$

$\longrightarrow \frac{2C + 1(2+C)}{2+C} = C$

$= 2C + 2 + C = C[2+C]$

$= \cancel{2C} + 2 + C = \cancel{2C} + C^2$

$C^2 - C - 2 = 0$

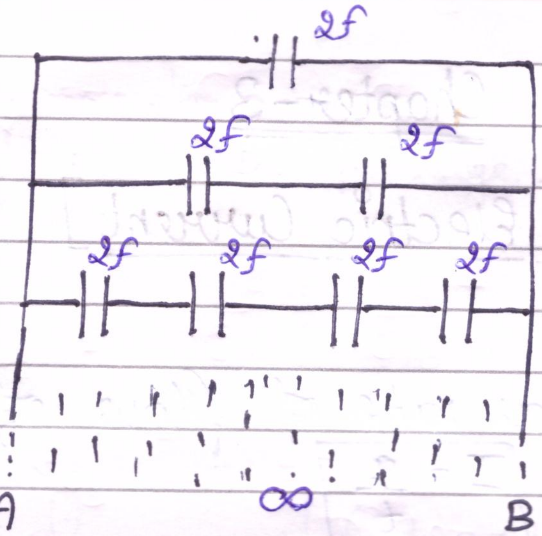
$C^2 - 2C + C - 2 = 0$

$C(C-2) + 1(C-2)$

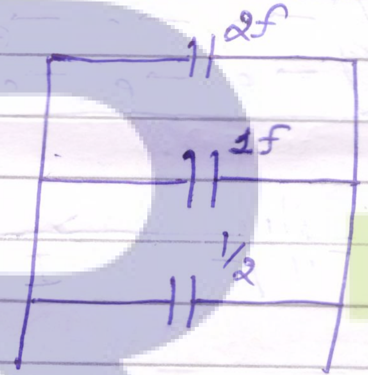
$(C+1)(C-2) = 0$

$C = -1$ ✗ , $\boxed{C = 2}$

Que



Ans Solve first row wise capacitors



$$C = 2 + \left[1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} \dots \infty\right]$$

$$C = 2 + \left[1 + \frac{1}{2} + \frac{1}{4} \dots \infty\right]$$

G.P

• r = common ration = $\frac{1}{2}$

$\Rightarrow a = 1$

$$S_n = \left[\frac{a}{1-r}\right]$$

$$S_n = \frac{1}{(1 - 1/2)} = \frac{1}{1/2} = 2$$

$C = 2 + 2 \Rightarrow 4f$, $\boxed{C = 4f}$