SBG STUDY

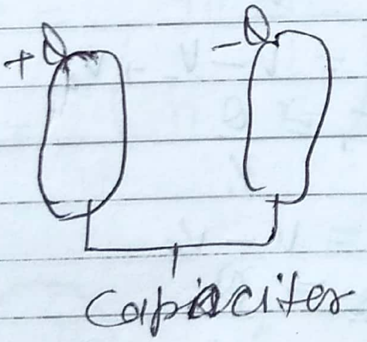
27/06/17

Capacitor or Condensor

* It is a device which store ~~electrod~~ electrostatic energy

* Generally It is a Combination of two Conductors both the Conductors are Called plates of Capacitor whatever be the shape of Conductor

* Generally both the plates have equal and opposite charge Hence net charge on Capister is zero.



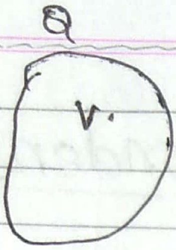
$Q_{net} = 0$

Charge on Capacitor =

= Charge on +ve plate
= Q.

* Capacitance of Capacitor: (C) :
  unit Farad (F)

It is the capacity of a capacitor to store electrostatic energy or electric charge



$Q \propto V$

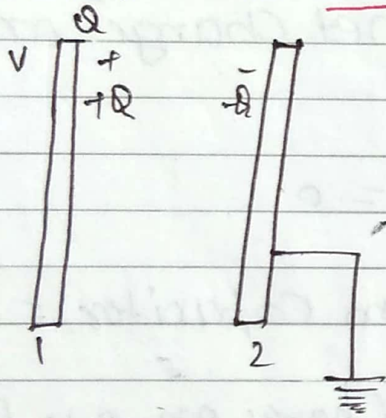
$Q = CV$

$C = \frac{Q}{V}$ C/volts = F

* It is independent of charge and potential.

* Principle of Capacitor:

Every Conductor have a maximum Capacity to store charge. To increase capacitance two Conductors are used and one of the Conductor is grounded.



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

$V_1 = V - V_- + V_2$

$C_1 = \frac{Q}{V_1}$

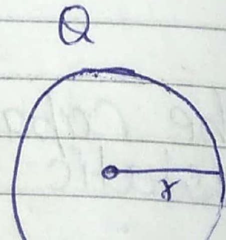
$V_2 = V - V_-$

$C_2 = \frac{Q}{V_2}$.

* Types of Capacitors:

1. Spherical capacitor:

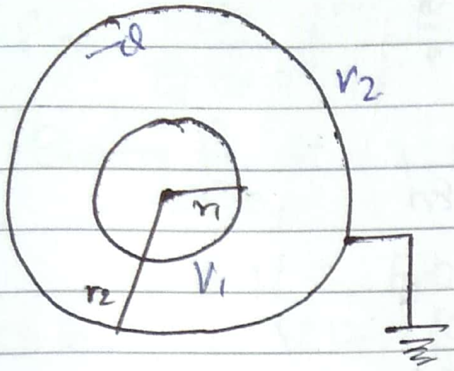
(i) Isolated Sphere:



$V = \frac{Q}{4\pi\varepsilon_0 r}$ $C = \frac{Q}{V}$

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

(ii)



$$V_1 = \frac{KQ}{r_1} - \frac{KQ}{r_2}$$

$$V_2 = 0$$

$$V = \frac{KQ}{r_1} - \frac{KQ}{r_2}$$

$$V = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$$

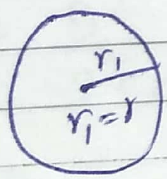
$$V = \frac{Q}{4\pi\varepsilon_0}\left(\frac{r_2 - r_1}{r_1 r_2}\right)$$

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

$$\boxed{C = 4\pi\varepsilon_0\left(\frac{r_1 r_2}{r_2 - r_1}\right)}$$

$$\boxed{C = \frac{4\pi\varepsilon_0}{\left(\frac{1}{r_1} - \frac{1}{r_2}\right)}}$$

*

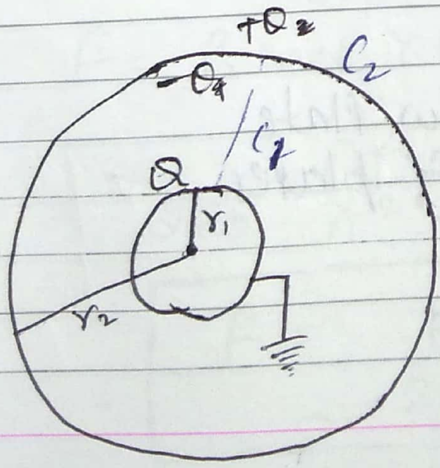


$r_2 = \infty$

$$C = \frac{4\pi\varepsilon_0}{\frac{1}{r} - \frac{1}{\infty}}$$

$$\boxed{C = 4\pi\varepsilon_0 r}$$

*

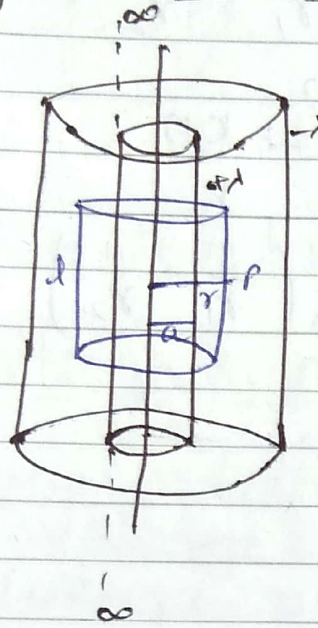


$$C_1 = 4\pi\varepsilon_0\left(\frac{r_1 r_2}{r_2 - r_1}\right)$$

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

$$C = C_1 + C_2$$

* Cylinderical Capistor:



$$E = \frac{\lambda}{2\pi\varepsilon_0}$$

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

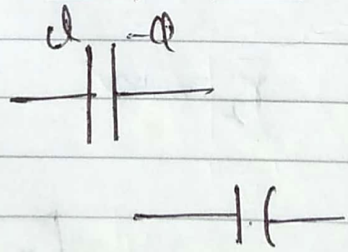
$$V = \int_a^b E\,dr$$

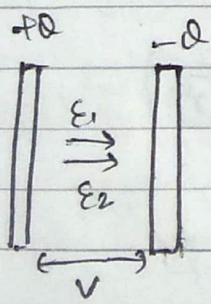
$$V = \frac{\lambda}{2\pi\varepsilon_0} \ln\left(\frac{b}{a}\right)$$

$$\frac{\lambda}{V} = \frac{2\pi\varepsilon_0}{\ln\left(\frac{b}{a}\right)}$$

$$\boxed{\text{Capacitance/length} = \frac{2\pi\varepsilon_0}{\ln\left(\frac{b}{a}\right)}}$$

* parallel plates Capaciter:





d → Sep. b/w plate
A → Area of plates

$$E_1 = \frac{Q}{2\varepsilon_0 A}$$

$$E_2 = \frac{Q}{2\varepsilon_0 A}$$

$$E = \frac{Q}{2\varepsilon_0 A} \qquad E = \frac{Q}{\varepsilon_0 A}$$

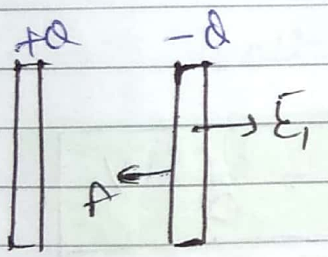
$$V = Ed$$

$$V = \frac{Qd}{\varepsilon_0 A}$$

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

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

* Force b/w the plates of capacitors :-



$$C = \frac{Q}{V}, \quad C = \frac{\varepsilon_0 A}{d}$$

$$F = QE_1$$

$$= Q \cdot \frac{Q}{2\varepsilon_0 A}$$

$$\boxed{F = \frac{Q^2}{2\varepsilon_0 A}}$$

$$P_{elect} = \frac{\sigma^2}{2\varepsilon_0}$$

$$F = P_{elect} \times A = \frac{\sigma^2}{2\varepsilon_0} A$$

$$= \frac{1}{2\varepsilon_0} \frac{Q^2}{A^2} \cdot A$$

$$\boxed{F = \frac{Q^2}{2\varepsilon_0 A}}$$

H.W: 21 – 31 – 8 – 1 complex
J – Advanced #16, 19

* Energy in Capaciter :

Capaciter stored Energy in the electric field b/w its plate

Energy density – Energy/vol. $= \frac{1}{2}\varepsilon_0 E^2$

total energy of capaciter = Potential Energy capaciter

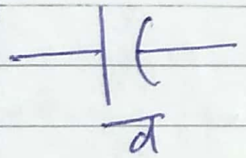
$$V = \frac{1}{2}\varepsilon_0 E^2 \times Ad$$

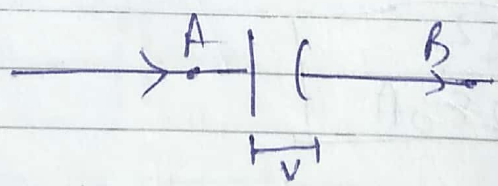
$$Q = CV$$

$$= \frac{1}{2}\varepsilon_0 \frac{Q^2}{\varepsilon_0^2 A^2} \times Ad$$

$$= \frac{Q^2 d}{2\varepsilon_0 A}$$

$$U = \frac{Q^2}{2C} = \frac{1}{2}CV^2 = \frac{1}{2}QV$$





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

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

$$E = \frac{Q}{\varepsilon_0 A}$$

$$V_A - \frac{Q}{C} = V_B$$

$$f = \frac{Q^2}{2\varepsilon_0 A}$$

$$V_A - V_B = \frac{Q}{C} = V$$

$$U = \frac{Q^2}{2C} = \frac{1}{2}CV^2$$

$$E = \frac{Q}{2\varepsilon_0 A}$$

* work done by battery $= W_b =$ charge given by battery $\times$ EMF

$= CV \times V$

$= CV^2.$

* Heat $= W_b - \Delta U$

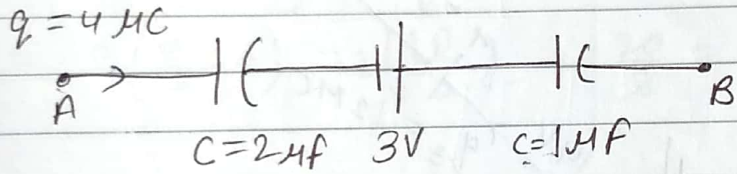
$= CV^2 - \frac{1}{2}CV^2$

Heat $= \frac{1}{2}CV^2$

$Q = CV$

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

Que:



If $V_A = 10$ volt then find V_B.

$Q = CV$

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

$Q = CV$

$V_A - 2 + 3 - 4 = V_B$

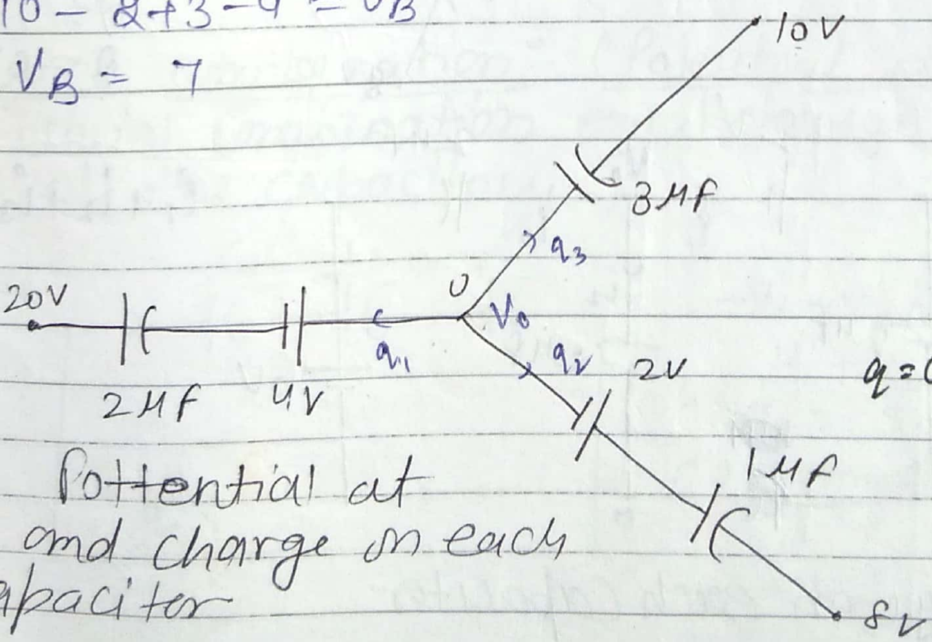
$10 - 2 + 3 - 4 = V_B$

$V_B = 7$

$Q = CV$

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

Que



$q_1 + q_2 + q_3 = 0$

$q = CV$

$Q = CV.$

$Q = CV.$

Find Potential at O and charge on each capacitor

$q_1 + q_2 + q_3 = 0$

$2(V_0 - 24) + 1(V_0 - 6) + 3(V_0 - 10) = 0$

$2V_0 - 48 + V_0 - 6 + 3V_0 - 30 = 0$

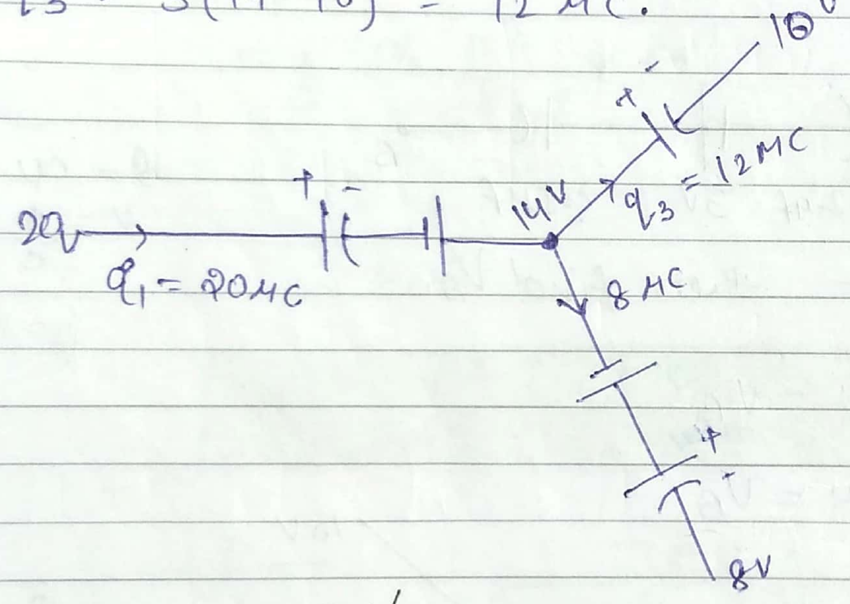
$6V_0 - 84 = 0$

$V_0 = \frac{84}{6} = 14$ Volt.

$q_1 = 2(14 - 24) = -20\ \mu C.$

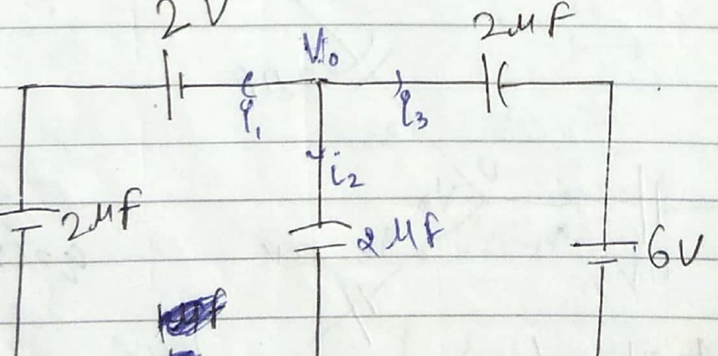
$q_2 = 1(14 - 6) = 8\ \mu C$

$q_3 = 3(14 - 10) = 12\ \mu C.$



$Q = CV$

Que:



$i_1 + i_2 + i_3 = 0$

$Q = c$

Find charge on each capacitor

~~$q_1 + q_2 + q_3 = 0$~~

~~$V_0 + 2 + 4 + 2 = 0$~~

~~$3(V_0 + 2) + 2(\ ) + 2(V_0 - 6)$~~

$$2(V_0 + 2) + 2V_0 + 2(V_0 - 6) = 0$$

$$6V_0 = 8$$

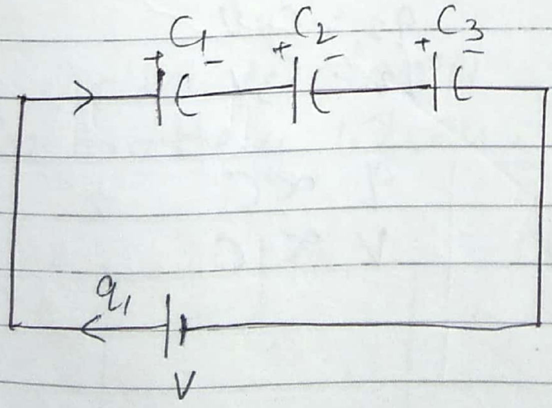
$$V_0 = \frac{8}{6} = \frac{4}{3}$$

$$V_0 = \frac{4}{3}$$

$$q_1 = 2\left(\frac{4}{3} + 2\right) = 2\left(\frac{10}{3}\right) = \frac{20}{3} = 6.6.$$

* Combination of capacitor :

(1) Series combination :- (Potential divider) :
In series combination equal charge flow throw all the capacitors.



$$-V_1 - V_2 - V_3 + V = 0$$

$$V_1 + V_2 + V_3 = V$$

$$C_1 V_1 = C_2 V_2 = C_3 V_3 = q$$

$$CV = \text{constant}$$

$$V \propto \frac{1}{C}$$

$$V \propto \frac{1}{C}$$

$$\frac{V_1}{V_2} = \frac{C_2}{C_1}$$ $Q = CV$

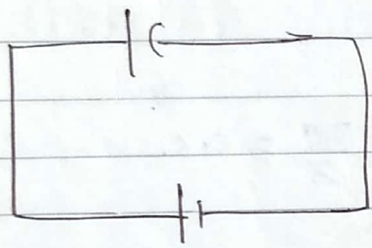
$$PE = U = \frac{q^2}{2C}$$

$$\text{Energy} = U \propto \frac{1}{C}$$

$$\frac{U_1}{U_2} = \frac{C_1}{C_2}$$

$\frac{C_2}{C_1}$

*



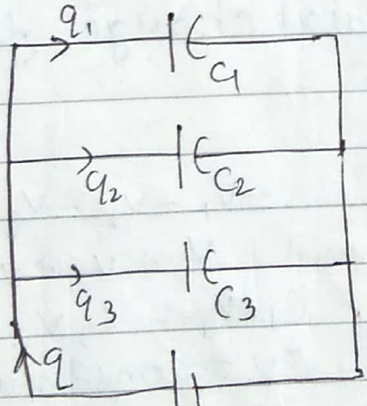
$$V_1 + V_2 + V_3 = V$$

$$\frac{q}{C_1} + \frac{q_2}{C_2} + \frac{q}{C_3} = \frac{q}{C_{eq}}$$

$$q = C_{eq} V$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} - - - -$$

* Parallel Combination: (Charge divider):



$$q = q_1 + q_2 + q_3 + - -$$

$$q_1 = C_1 V$$

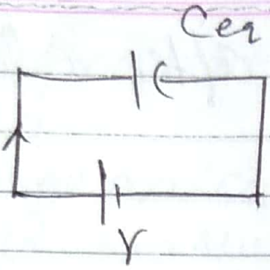
$$q_2 = C_2 V$$

$$q_3 = C_3 V$$

$$q \propto C$$

$$V \propto C$$

J-M
S-1

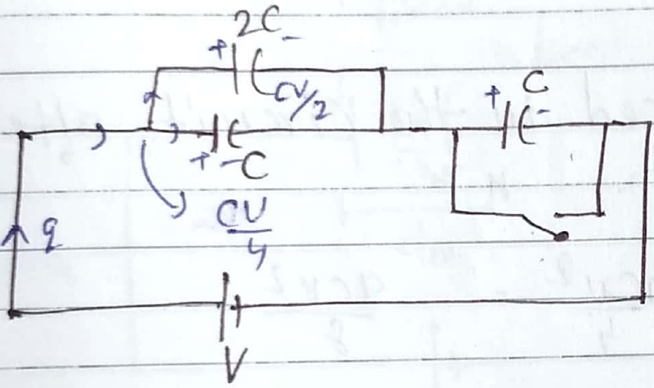


$q = C_{eq} V$

$C_{eq} = C_1 V + C_2 V + C_3 V_3 + \cdots$

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

Que



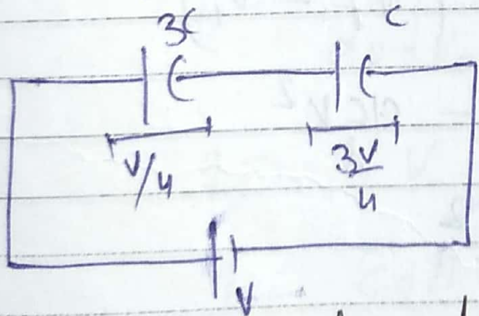
find charge on each Capacitor.

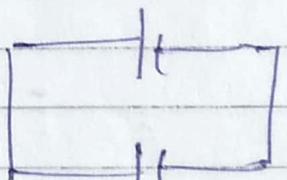
$\frac{1}{3C} + \frac{1}{1C} = \frac{1+3}{3} = \frac{4}{3}$

$\frac{3}{4} C$

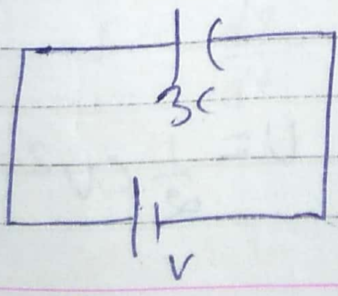
$Q = CV$

$= \frac{3CV}{4}$





(iii) Now Switch is closed find charge given by the battery when Switch is closed.



Charge given by battery $= q_f - q_i$

$3CV - \frac{3CV}{4}$

$= \frac{9CV}{4}$

(iii) find work done by the Battery after closing the switch.

$W_B \frac{9}{8} C V^2$

= Charge given by battery × EMF.

$= \frac{9CV}{4} \times V = \frac{9CV^2}{4}$

(iv) find heat produced in the circuit after closing the switch. $H =$

M-1

$= \frac{1}{2}\frac{9CV^2}{4} = \frac{9CV^2}{8}$

$U_f = \frac{1}{2} 3CV^2$

M-2 $H = W_b - \Delta U$

$U_i = \frac{1}{2}\frac{3CV^2}{4}$

$= \frac{9CV^2}{4} - (U_f - U_i)$

$= \frac{9CV^2}{4} - \frac{9CV^2}{8}$

$= \frac{9CV^2}{8}$

Que:-

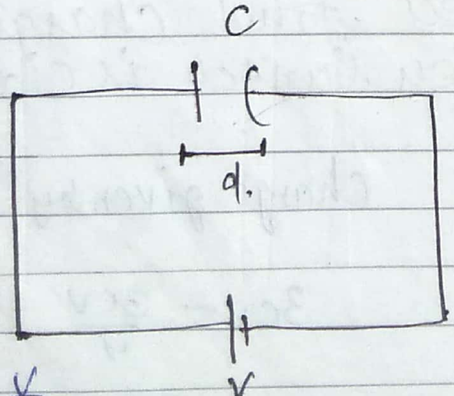


Plate Area = A

$U = \frac{1}{2} CV^2$

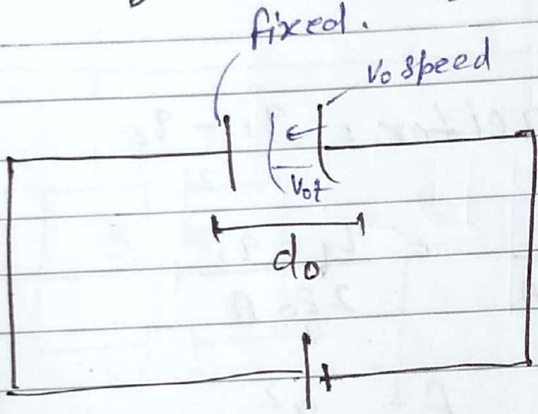
$E.F = \frac{Q}{\varepsilon_0 A} = \frac{V}{d}$

If sepration b/w the Plates is increased then

1. charge on capacitor $C = \frac{\varepsilon_0 A}{d}$ charge decrease,
2. E. field b/w the plates = decrease. $\frac{Q}{2\varepsilon_0 A}$
3. P.E b/w the plates = ~~increase~~ decrease
4. force of Attraction = Decrease. $F = \frac{Q^2}{2\varepsilon_0 A}$

5. Work done by the battery = Negative.

Que!



$Q = CV$

Plate Area A

Find charge on capacitor after time t.

$$C_t = \frac{\varepsilon_0 A}{d_0 - V_0 t}$$

$$q = C_t V$$

time ↑ charge ↑

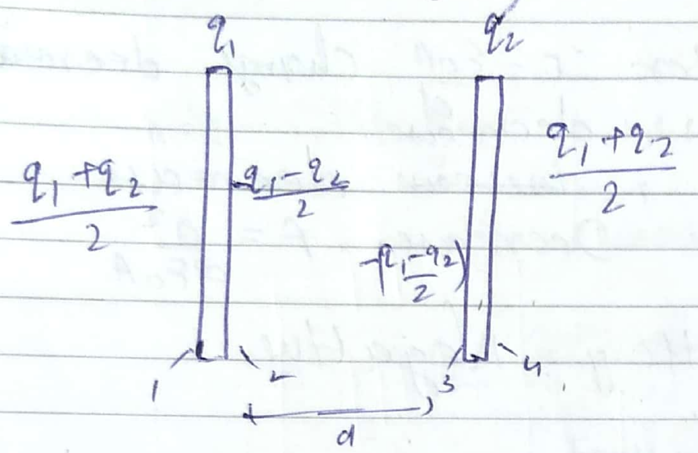
$$q = \frac{\varepsilon_0 A V}{d_0 - V_0 t}.$$

* find current in the Circit at any time t.

$$I = \frac{dq}{dt} = \frac{d}{dt}\left(\frac{\varepsilon_0 A V}{d_0 - V_0 t}\right)$$

H.W ⇒ S-1

(iii) Capacitor having unequal charge on its plates.



$$\text{charge on capacitor} = \frac{q_1 - q_2}{2}$$

$$E = \frac{q}{2\varepsilon_0 A} = \frac{q_1 - q_2}{2\varepsilon_0 A}$$

$$U = \frac{q^2}{2C} \qquad F = \frac{q^2}{2\varepsilon_0 A}$$

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

$$\frac{5Q}{2} - 1Q = \frac{3Q}{2}$$

Que:

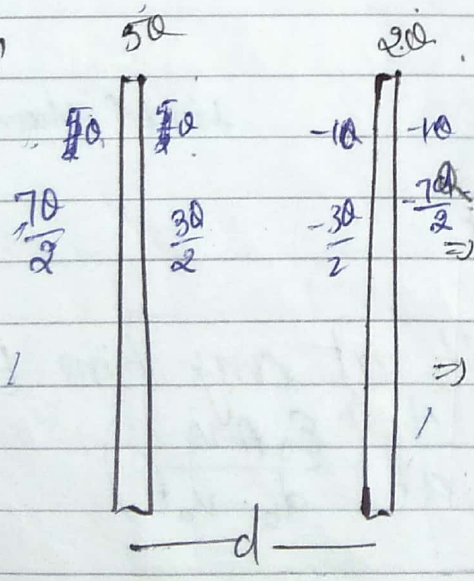


Plate Area A

⇒ find charge on capacitor $3Q/2$

⇒ E.f b/w the Plates.

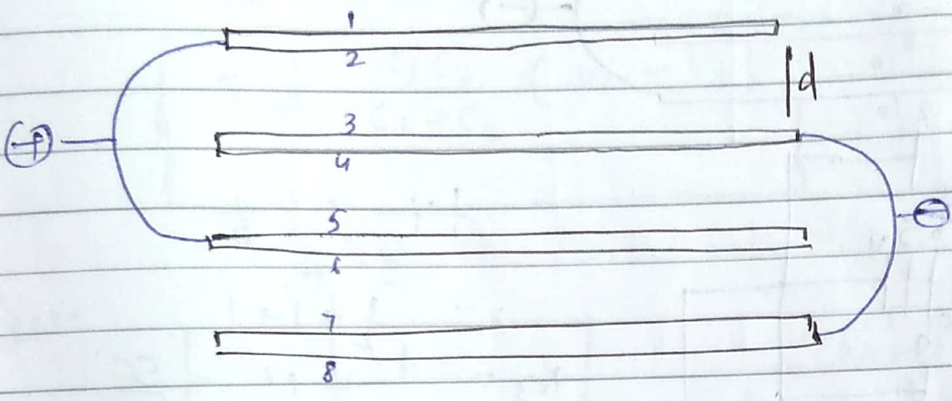
$$E = \frac{3Q}{2\varepsilon_0 A}$$

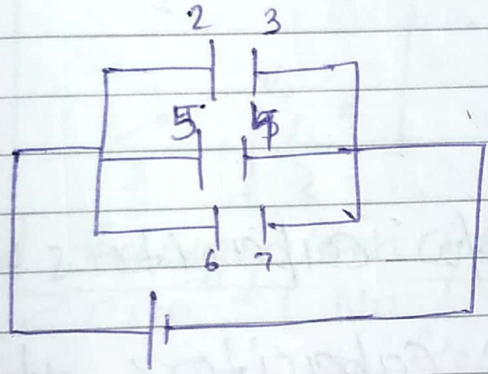
30/06/17

* Capacitance of combination of Parallel plates:

Ex! Find eq capacitance! $C_{eq} = ?$

Area = A

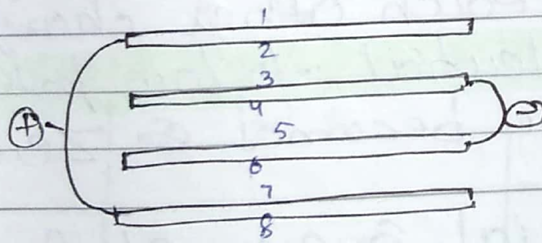


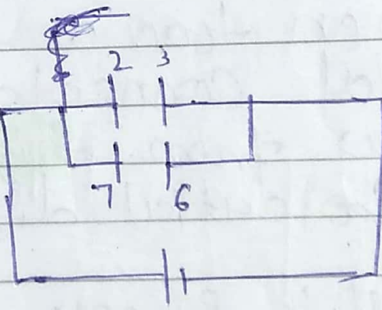


$$C = \frac{\varepsilon_0 A}{d}$$

$$C_{eq} = \frac{3\varepsilon_0 A}{d}$$

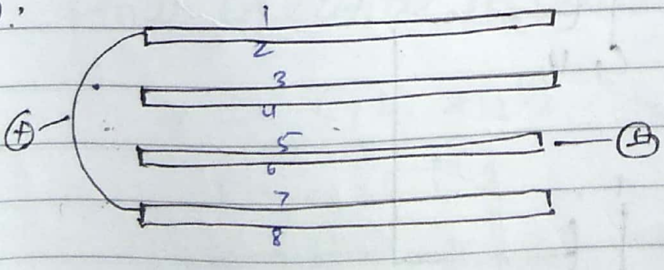
Que!

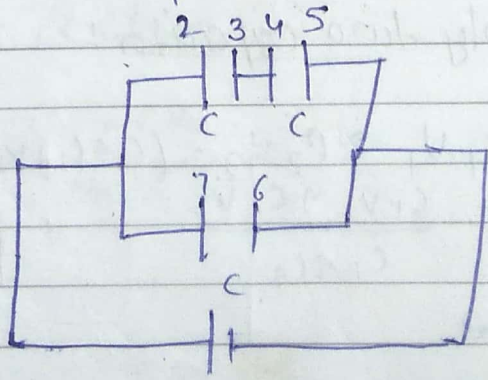




$$= \frac{2\varepsilon_0 A}{d}$$

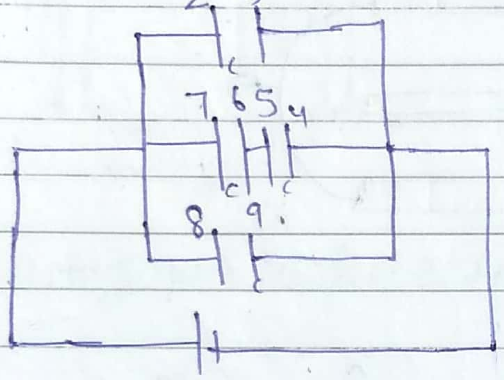
Que:





$$\frac{3C}{2} = \frac{3\varepsilon_0 A}{2d}$$

Que:



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

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

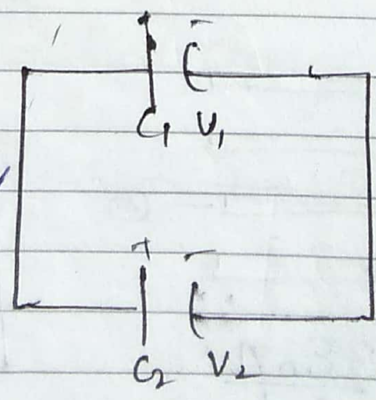
$R_{eq} = \frac{1}{2}+2 = \frac{5C}{2}$

* Charge sharing b/w capacitors :-

When two or more capacitors at different potential connected to each other charge flow from high potential to low potential till potential difference becomes zero

In this Process Potential energy of System decreases in the form of Heat.

only two capacitor :



$C_1V_1 + C_2V_2 = (C_1+C_2)V$

$V = \frac{C_1V_1 + C_2V_2}{C_1+C_2}$

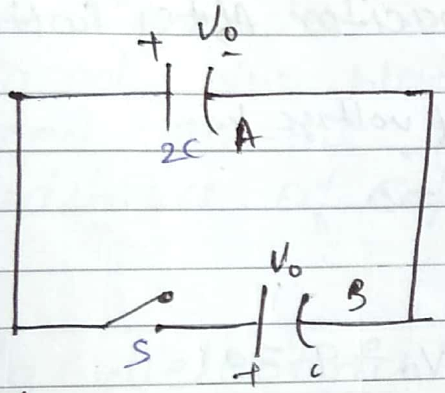
Heat

Heat producted = loss in PE = $U_i - U_f$

$= \frac{1}{2} C_1 V_1^2 + \frac{1}{2} C_2 V_2^2 - \frac{1}{2}(C_1 + C_2) V^2$

$$= \frac{1}{2} \frac{C_1 C_2}{C_1 + C_2} (V_1 - V_2)^2$$

Que:

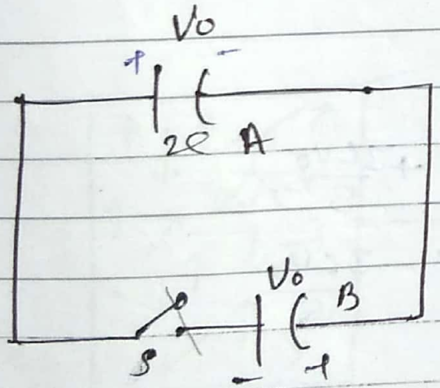


Charge is not flow because potential is same

find Energy loss After Switch the close.

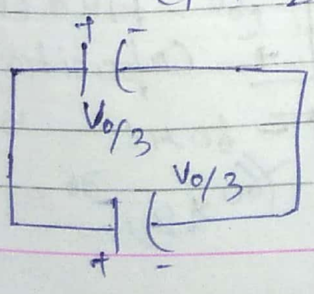
Ans => Zero (No loss energy because no flow of charge)

Q.



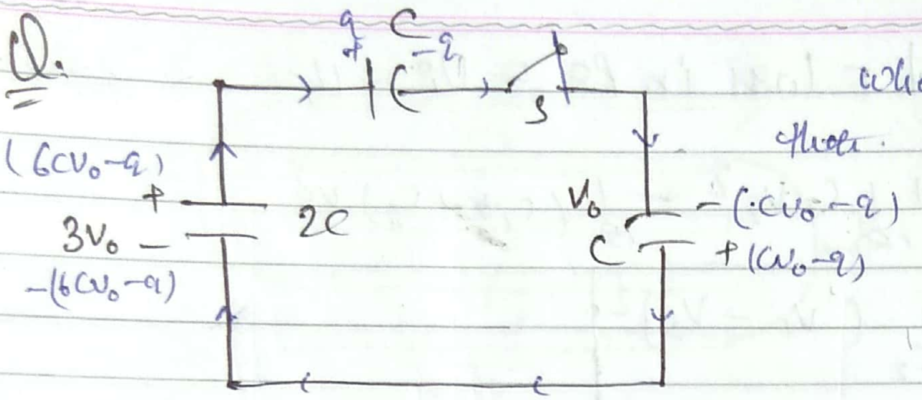
final potential After switch is closed

$V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2} = \frac{2CV_0 - CV_0}{3C} = \frac{V_0}{3}$



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

Q.



when switch is open then.

find charge on each Capacitor After switch is closed.

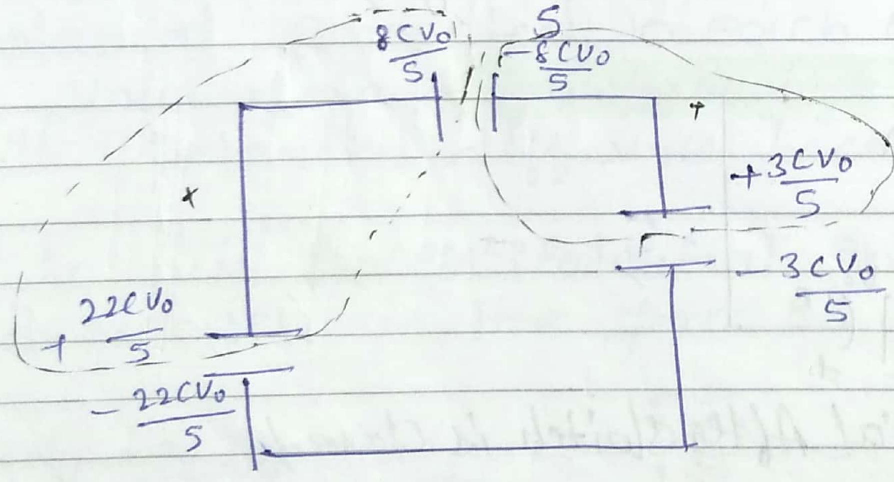
By using krichhof voltage law.

$$-\frac{q}{C} + \frac{CV_0 - q}{C} + \frac{6CV_0}{2C} = 0$$

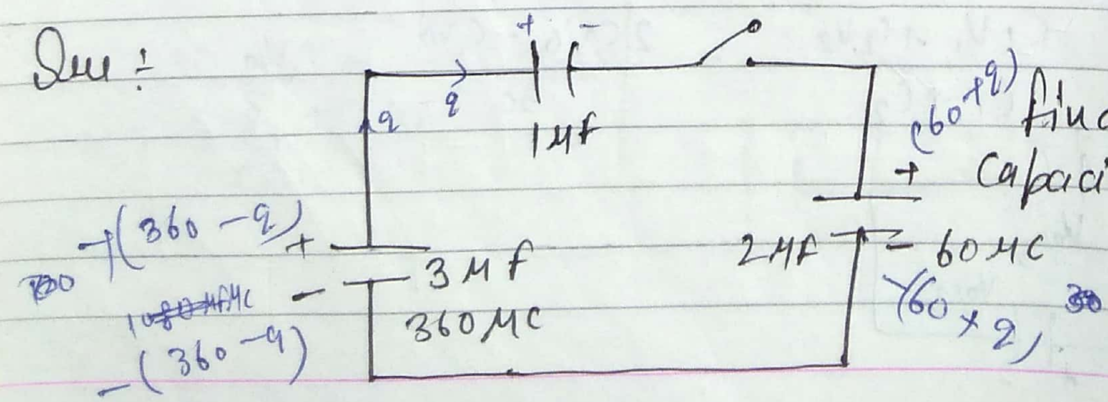
$$-2q + 2CV_0 - 2q + 6CV_0 - q = 0$$

$$8CV_0 = 5q$$

$$q = \frac{8CV_0}{5}$$



Que :-



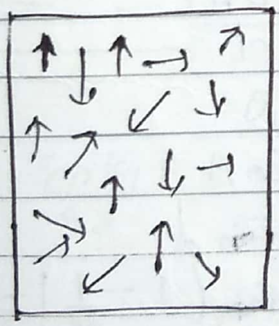
find charge on each capacitor after switch is closed.

Capa → S-1 → 1 to 6.
O-1 → 1 to 7.
elect. O-1, 2,3,5

$$-\frac{a}{T} - \frac{60+a}{2} + \frac{360-a}{3} = 0$$

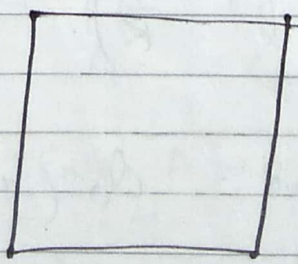
* **Dielectrics :-** Dielectrics are the materials having low conductivity Hence Basically these are non conductors. When a dielectric medium is placed b/w plates of Capacitor Charge Induced on the face of Dielectric and Capacitance of Capacitor increases.

(i) Polar dielectrics ! If Protones and electrons are not distributed uniformly than their centre of mass does not collide and atom behave as a dipole.



$P = 0$

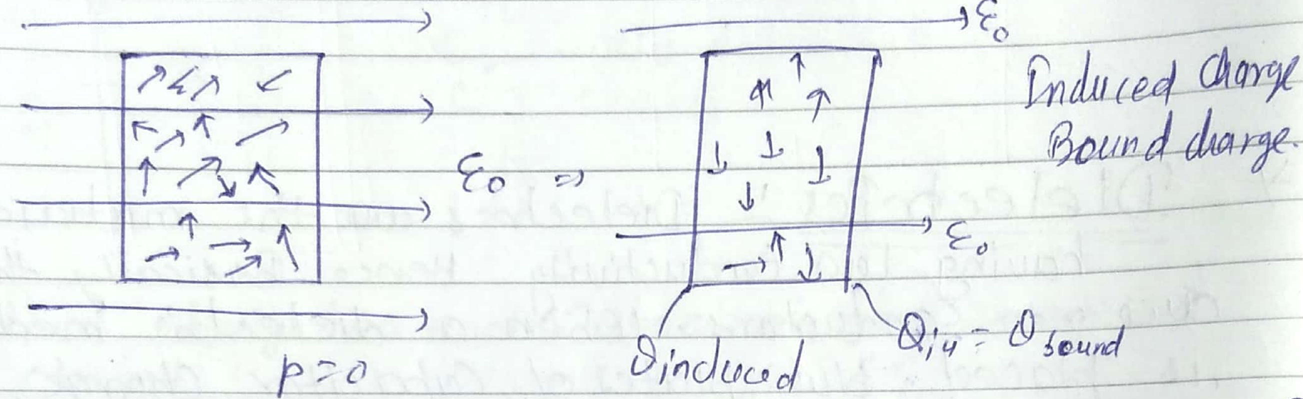
(ii) Non polar dielectric !

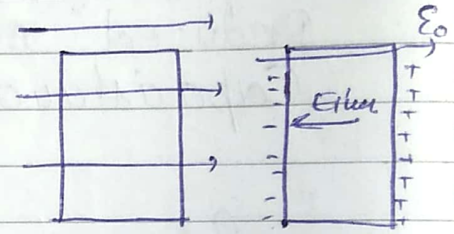


$P = 0$

1/07/17

* Dielectric in External feild:



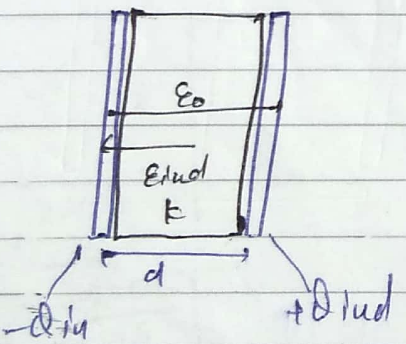


$$E_{net} = \mathcal{E}_0 - \mathcal{E}_i = \frac{E_0}{K}$$

$$\boxed{E_{ind} = \mathcal{E}_0\left(1 - \frac{1}{K}\right)}$$

Conductor $K = \infty$

* Capaciter having dielectric:



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

$$\mathcal{E}_0 = \frac{Q}{\varepsilon_0 A}$$

$$V_0 = E_0 d$$

$$E_{ind} = \mathcal{E}_0\left(1 - \frac{1}{K}\right) = \frac{Q_{ind}}{\varepsilon_0 A}$$

$$\frac{Q_0}{\varepsilon_0 A}\left(1 - \frac{1}{K}\right) = \frac{Q_{ind}}{\varepsilon_0 A}$$

$$\boxed{Q_{ind} = Q_0\left(1 - \frac{1}{K}\right)}$$

di... charge - each

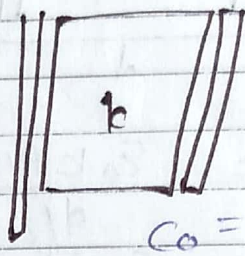
Net Electric field b/w the plates after dielectric is inserted

$$E_{net} = \frac{E_0}{k}$$

Pot. diff b/w the plates

$\Delta V = E_{net}\, d.$

$$\Delta V = \frac{E_0 d}{k}$$

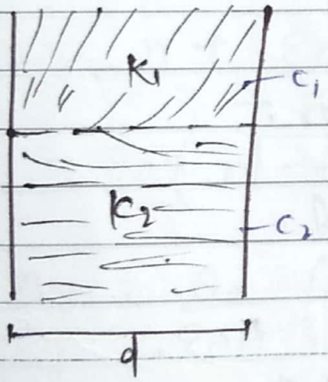


$$C_0 = \frac{\varepsilon_0 A}{d}$$

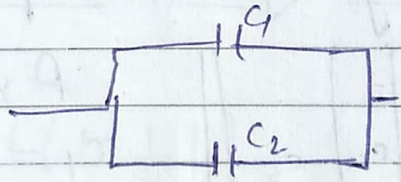
$$C = \frac{\varepsilon_0 k A}{d}$$

$$C = \frac{\varepsilon_0 k A}{d} = kC_0$$

Que:



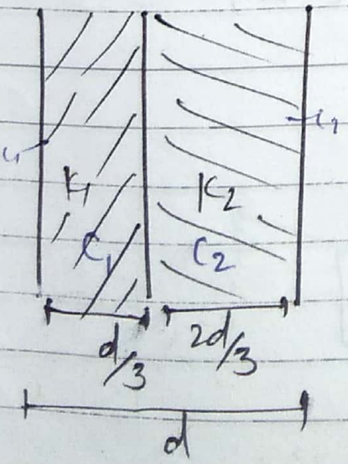
find Capacitance
plate Area - A

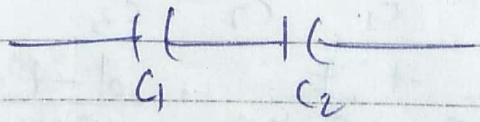


$C_{eq} = C_1 + C_2$

$$C_1 = \frac{\varepsilon_0 k_1 A}{2d}, \quad C_2 = \frac{\varepsilon_0 k_2 A}{2d}.$$

Q.:





$$C_1 = \frac{3\varepsilon_0 k_1 A}{d}$$

$$C_2 = \frac{3\varepsilon_0 k_2 A}{2d}$$

Que:

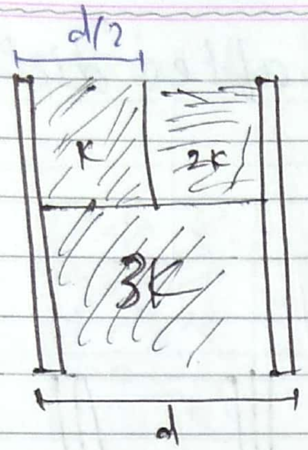
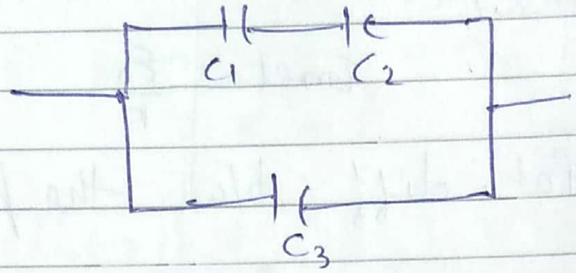


Plate Area = A

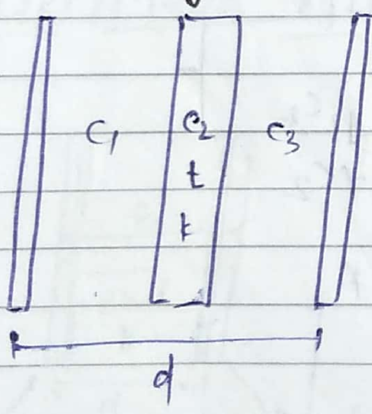


$$C_1 = \frac{\varepsilon_0 K A/2}{d/2} = \frac{\varepsilon_0 K A}{d}$$

$$C_2 = \frac{\varepsilon_0 2K\, A/2}{d/2} = \frac{2\varepsilon_0 K A}{d}$$

$$C_3 = \frac{\varepsilon_0 3K A/2}{d}$$

* Partially field Capacitor :-



Area A.

$$C_1 = \frac{\varepsilon_0 A}{x}$$

$$C_2 = \frac{\varepsilon_0 K A}{t}$$

$$C_3 = \frac{\varepsilon_0 A}{(d-t-x)}$$

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

$$\frac{x}{\varepsilon_0 A} + \frac{t}{\varepsilon_0 K A} + \frac{d-t-x}{\varepsilon_0 A}$$

$$= \frac{1}{\varepsilon_0 A}\left(x + \frac{t}{K} + d - t - x \right]$$

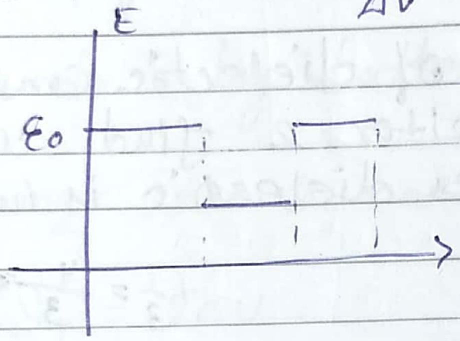
$$= \frac{1}{C} = \frac{d - t + t/K}{\varepsilon_0 A}$$

Cap → S-1 ⇒ 7, 8
O-1 ⇒ upto 15
→ 25, 26, 27
O-2 ⇒ 1 to 6. 10 and 11
J.M ⇒ 1, 10, 11, 12, 13, 14, 15

$$C = \frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{k}\right)}$$

IInd Method:

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



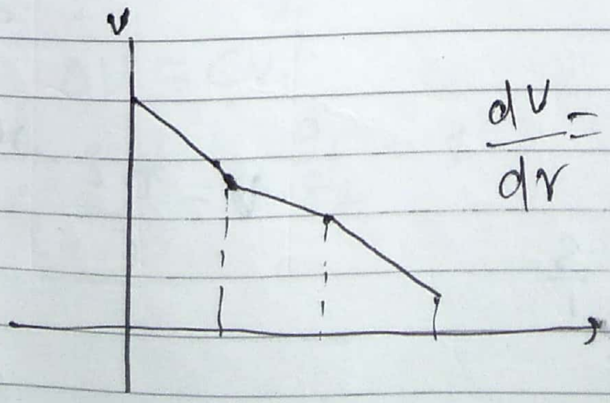
$\Delta V = E \Delta r$

$\Delta V = \varepsilon_0 x + \frac{\varepsilon_0}{k} t + \varepsilon_0 (d - t - x)$

$\Delta V = \varepsilon_0 \left(d - t + \frac{t}{k}\right)$

$\Delta V = \frac{Q_0}{\varepsilon_0 A} \left(d - t\left(1 - \frac{1}{k}\right)\right)$

$$C = \frac{\varepsilon_0 A}{\left(d - t\left(1 - \frac{1}{k}\right)\right)}$$



$\frac{dV}{dr} = -E$

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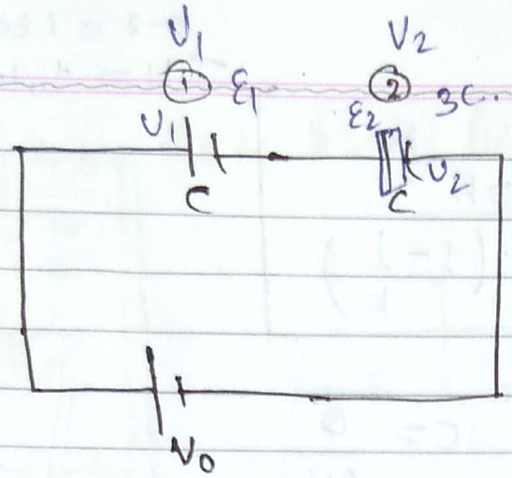
$\varepsilon = \frac{\varepsilon_0 A}{}$

Charge given by the battery ⇒ final − initial

$Q = CV$

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



$= Q = \frac{CV_0}{2}$

* Que:

A dielectric slab of dielectric constant 3 is incerted in capacitor 2. find work done by the battery after dielectric is incerted.

$C_{eq} = \frac{3C}{4}$

$1 + \frac{1}{3} = \frac{4}{3} \Rightarrow \frac{3C}{4}$

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

$Q = \frac{3CV}{4}$

$\frac{\varepsilon_0 k A}{d}$

Charge given by battery $\frac{3CV}{4} - \frac{CV}{2} = \frac{CV}{4}$

$\varepsilon = \frac{Q}{\varepsilon_0 k A}$

$W = QE$

$= \frac{CV^2}{4}$

* (ii) find $\frac{V_1}{V_2} = \frac{C_2}{C_1} = \frac{K}{1} = k$

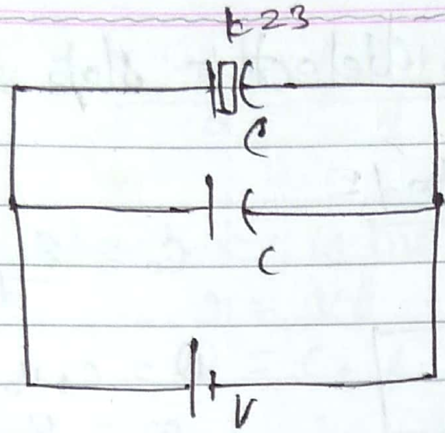
$E = \frac{V}{d}$

$\frac{E_1}{E_2} = \frac{3}{1}$

$V = \frac{Q}{C}$ → charge same on both

$\frac{V_1}{V_2} = \frac{C_2}{C_1} = \frac{3}{1}$

Que:



$Q = \frac{2C}{V}$

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

$C+C = 2C$

find work done by battery after insert dielectric

$\frac{\varepsilon_0 3A}{d}$

$\therefore W_b =$ Charge given by battery

$Q_i = 2CV$

$Q_f = 4CV$

$Q = 2CV$

$\text{work done} = 2CV^2$

ii) find heat produce in the circuit when dielectric in serted

$W_b = 2CV^2$

$4C$

$\frac{1}{2} \times 4C \times V^2$

$= 2CV^2$

$U_i = CV^2$

$U_f = \frac{1}{2}CV^2 + \frac{1}{2}3CV^2 = 2CV^2$

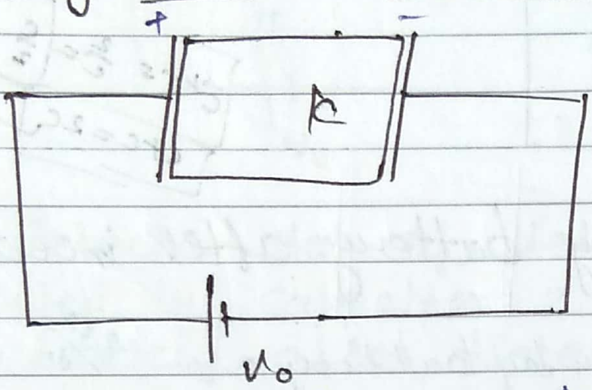
$\Delta U = CV^2$

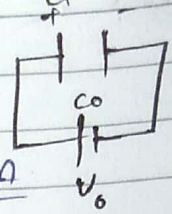
$\frac{V_1}{V_2} = 1 \qquad \frac{\varepsilon_1}{\varepsilon_2} = 1 \qquad C \text{ or } V = \frac{3}{1}$

$\varepsilon_0 = kA$

* Methods of Incerting dielectric slap :

(i) Battery Remains Connected :-





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

$Q = C_0 V_0$

$E_0 = \frac{V_0}{d}$

$U_0 = \frac{1}{2} C_0 V_0^2$

$C = kC_0 \qquad Q = kC_0V_0 = kQ_0$

$W_b = (k-1)\, C_0 V_0^2$

$E = E_0 \qquad U = kU_0$

When battery remains connected potential difference b/w the plates does not chang

Imp.

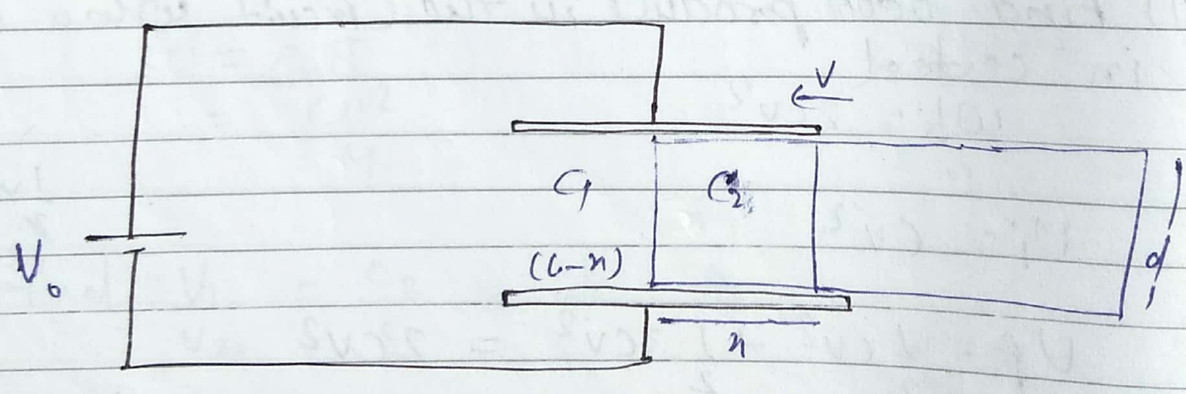


Plate $= l \times b$

$C_1 = \frac{\varepsilon_0 (l-x) b}{d} \qquad C_2 = \frac{\varepsilon_0 k\, x b}{d}$

$C = C_1 + C_2$

$C_K = \frac{\varepsilon_0 b}{d}(l - x + kx)$

$$C_x = \frac{\varepsilon_0 b}{d}(l + (k-1)x)$$

If dielectric is inserted with fast speed v.

$$x = vt$$

$$Q = C_t V.$$

* **force by External Agent to insert dielectric slowly into the capacitor:**

$$U = \frac{1}{2}\frac{\varepsilon_0 b V_0^2}{d}(l + (k-1)x)$$

$$f = \frac{dU}{dx} =$$

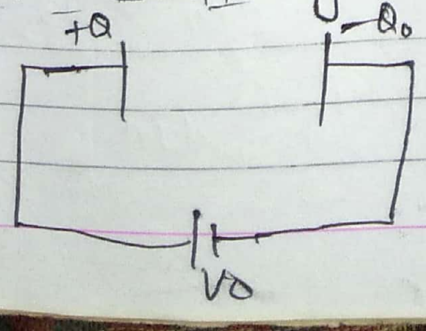
$$\boxed{f = \frac{\varepsilon_0 b V_0^2}{2d}(k-1)}$$

$$a = \frac{\varepsilon_0 b V_0^2 (k-1)}{2md}$$

$$l = \frac{1}{2}at^2$$

$$\boxed{t = \sqrt{\frac{2l}{a}}} \qquad T = 4t$$

* 2nd Method:
When Battery is disconnected:



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

$$Q_0 = C_0 V_0$$

$$E = \frac{V_0}{d}$$

H.W Race

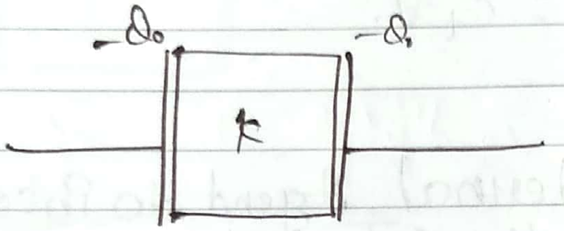
Q-1 ⇒ 16-20, 28-32, 36

B. Connected :

Not Con - Charge - Const.

$$U = \frac{Q_0^2}{2C_0} = \frac{1}{2} C_0 V_0^2$$

When Battery is not Connected charge on Capacitor does not change.



$C = KC_0$

$Q_0 = CV$

$V = \frac{V_0}{K}$

$E = \frac{E_0}{K}$

$U = \frac{V_0}{K}$

SBG STUDY