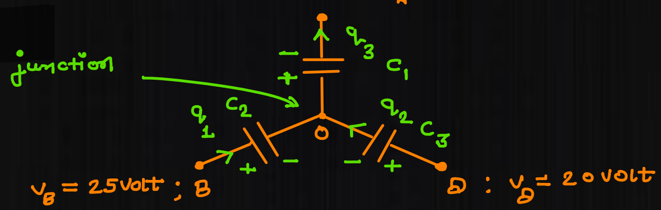
Q: 3 capacitors of capacitance $C_1 = 1\mu F$, $C_2 = 2\mu F$ & $C_3 = 3\mu F$ are connected as shown in the figure. Electric potentials at points A, B & D are 10 V, 25 V & 20 V respectively. find the potential at point P & charge on each capacitor.



Sol^n:→ at the junction O;

$$q_1 + q_2 = q_3$$

$$C_2 \cdot \Delta V_{BO} + C_3 \cdot \Delta V_{DO} = C_1 \cdot \Delta V_{OA}$$

$$\Rightarrow 2\times10^{-6} \times (V_B - V_O) + 3\times10^{-6} \times (V_D - V_O) = 1\times10^{-6} \times (V_O - V_A)$$

$$\Rightarrow 2\times(25 - V_O) + 3\times(20 - V_O) = (10 - V_O)$$

$$\Rightarrow 50 - 2V_O + 60 - 3V_O = 10 - V_O$$

$$\Rightarrow 120 = 6V_O$$

$$\therefore V_O = 20 \text{ Volt} \quad — (*)$$

Electric potential at junction O.

$\therefore$ charge on C_1 $(q_3) = C_1 \cdot \Delta V_{OA}$

$$= 1\times10^{-6} \times (V_O - V_A)$$

$$= 10^{-6} \times (20 - 10)$$

$$q_3 = 10 \mu C$$

charge on C_3 $(q_2) = C_3 \times \Delta V_{DO}$

$$= 3\times10^{-3} \times (20 - 20)$$

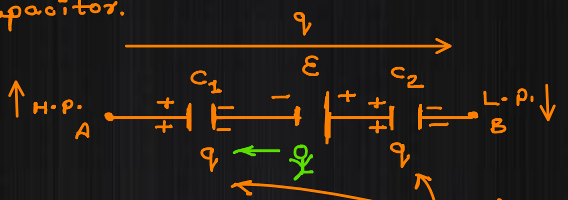
$$q_2 = 0 C$$

charge on C_2 $(q_1) = C_2 \times \Delta V_{BO}$

$$= 2\times10^{-6} \times (25 - 20)$$

$$= 10 \mu C$$

Q: for the following section of a capacitor circuit, Emf of the source is 10 volt. The capacitance of the capacitors are $C_1 = 1\mu F$ & $C_2 = 2\mu F$. The potential difference b/w points A & B is $V_A - V_B = 5V$. find the voltage across each capacitor.



as $V_A - V_B = 5$ i.e +ve
so $V_A > V_B$

charge is same due to series combination

Sol^n:→ Moving from Lower to higher potential;

$\Delta V_{AB} = V_A - V_B =$ Rise across C_2 + Drop across Battery + Rise across C_1

$$5 = \frac{q}{C_2} - \varepsilon + \frac{q}{C_1}$$

$$\Rightarrow 5 = q \cdot \left\{ \frac{1}{1\times10^{-6}} + \frac{1}{2\times10^{-6}} \right\} - 10$$

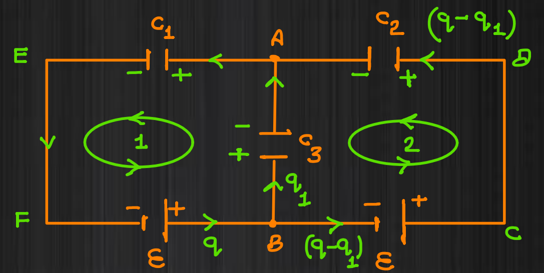
$$\Rightarrow 15\times10^{-6} = q \times \frac{3}{2}$$

$$\Rightarrow q = 10 \mu C \quad — (1) \text{ ; charge on each capacitor.}$$

so P.D. across C_1 $(\Delta V_1) = \frac{q}{C_1} = \frac{10\times10^{-6}}{1\times10^{-6}} = 10$ volt so P.D. across C_1 $(\Delta V_1) = \frac{q}{C_1} = \frac{10\times10^{-6}}{1\times10^{-6}} = 10$ volt

" " C_2 $(\Delta V_2) = \frac{q}{C_2} = \frac{10\times10^{-6}}{2\times10^{-6}} = 5$ volt

Q: find the P.D. b/w points A & B.



*) In case of multiple batteries present in the circuit, consider any of them as the major battery & consider charge is driven by it only.

*) In case of multiple close loops apply KVL in all loops in the same sense.

Applying KVL in Loop 1; AEFB

$$-\frac{q_1}{C_3} - \frac{q}{C_1} + \varepsilon = 0$$

$$\Rightarrow \frac{q}{C_1} + \frac{q_1}{C_3} = \varepsilon \text{ — (1)} \quad \longrightarrow \quad q = C_1\cdot\left\{\varepsilon - \frac{q_1}{C_3}\right\}$$

Applying KVL in Loop 2; ABCD

$$\frac{q_1}{C_3} + \varepsilon - \frac{(q-q_1)}{C_2} = 0$$

$$\frac{q}{C_2} = \varepsilon + q_1\cdot\left(\frac{1}{C_2} + \frac{1}{C_3}\right)$$

$$q = C_2\cdot\left\{\varepsilon + q_1\cdot\frac{(C_2+C_3)}{C_2C_3}\right\} \text{ — (2)}$$

from (1) & (2);

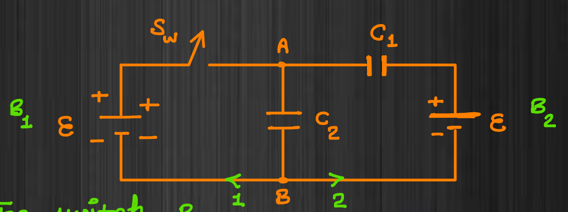
$$C_2\cdot\left\{\varepsilon + q_1\cdot\frac{(C_2+C_3)}{C_2C_3}\right\} = C_1\cdot\left\{\varepsilon - \frac{q_1}{C_3}\right\}$$

$$\Rightarrow C_2\cdot\varepsilon + q_1\cdot\frac{(C_2+C_3)}{C_3} = C_1\cdot\varepsilon - \frac{q_1}{C_3}$$

$$\Rightarrow \frac{q_1}{C_3}\cdot\left\{C_1+C_2+C_3\right\} = (C_1-C_2)\cdot\varepsilon$$

P.D. b/w points A & B $\Rightarrow \frac{q_1}{C_3}$ or $\Delta V_{AB} = \frac{(C_1-C_2)\cdot\varepsilon}{(C_1+C_2+C_3)}$ volt

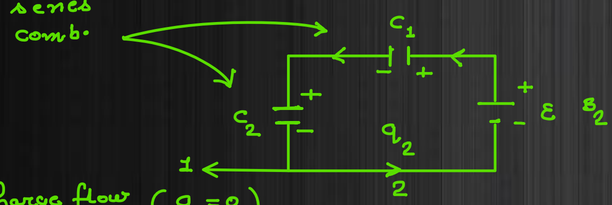
Q: what amount of charge will flow after shorting the switch through sections 1 & 2 in the shown directions indicated by the arrows?



Sol^n:→ Before closing the switch B_1 is open circuit
ie not a part of circuit

series

is open circuit
ie not a part of circuit



no charge flow ($q_1 = 0$) along arrow 1 —①

as $C_{eq} = \frac{C_1 \cdot C_2}{C_1 + C_2}$

so initial charge flow along arrow 2

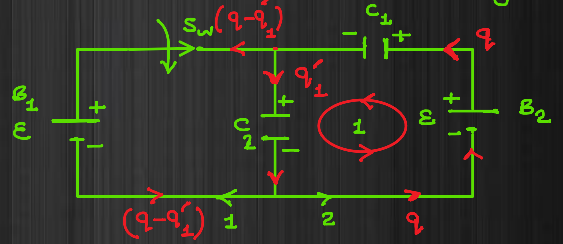
$q_2 = C_{eq} \cdot V = \frac{C_1 \cdot C_2 \cdot \varepsilon}{(C_1 + C_2)}$ —②

on shorting (closing) the switch:

C_2 comes in parallel combination of the Battery B_1 directly.

so charge on the plates of C_2

$q_1' = C_2 \cdot \varepsilon$ —③



Applying; KVL in loop 1

$$-\frac{q}{C_1} - \frac{q_1'}{C_2} + \varepsilon = 0$$

from ③ $\Rightarrow -\frac{q}{C_1} - \frac{C_2 \cdot \varepsilon}{C_2} + \varepsilon = 0$

$\Rightarrow q = 0$ —④ : charge flown along direction 2 after shorting the switch

so $(q - q_1') = 0 - C_2\varepsilon = -C_2\varepsilon$; charge flown opposite to Direction 1 after shorting the switch.

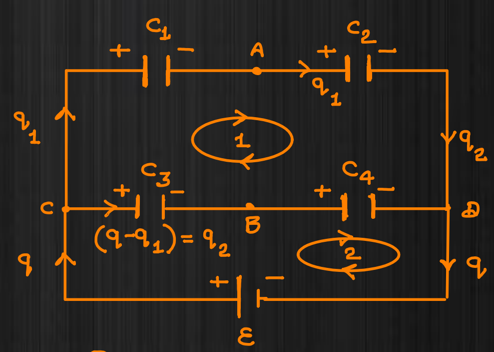
$\therefore$ charge flown opposite to Direction 1 $= C_2\varepsilon$

$\therefore$ flow of additional charge along 1 after S_w is closed $(\Delta q_1) = C_2\varepsilon - 0 = C_2\varepsilon$

" " " " " 2 " " " " $(\Delta q_2) = 0 - \frac{C_1 C_2 \varepsilon}{C_1 + C_2}$

$= \frac{-C_1 C_2 \varepsilon}{(C_1 + C_2)}$

Q: find the potential difference b/w points A & B. under which condition the P.D. b/w points A & B will become zero.



Applying KVL in loop ① :

$$-\frac{q_1}{C_1} - \frac{q_1}{C_2} + \frac{q_2}{C_4} + \frac{q_2}{C_3} = 0$$

$$q_1 \cdot \left(\frac{1}{C_1} + \frac{1}{C_2}\right) = q_2 \cdot \left(\frac{1}{C_3} + \frac{1}{C_4}\right) \text{ —①}$$

Applying KVL in Loop②

Applying KVL in Loop 2

$$\frac{-q_2}{C_3} - \frac{q_2}{C_4} + \varepsilon = 0$$

$$\varepsilon = q_2 \cdot \left(\frac{1}{C_3} + \frac{1}{C_4}\right) \text{ --- } (2)$$

$$\therefore\ q_2 = \frac{C_3 \cdot C_4 \cdot \varepsilon}{(C_3 + C_4)}$$; charge on C_3 & C_4

from 1 & 2

$$q_1 \cdot \left(\frac{C_1 + C_2}{C_1 \cdot C_2}\right) = \varepsilon$$

$$\therefore\ q_1 = \frac{C_1 \cdot C_2 \cdot \varepsilon}{(C_1 + C_2)} \text{ --- } (3)$$; charge on C_1 & C_2

P.D. b/w points A & B

$$\Delta V_{AB} = (V_A - V_B) = (V_A - V_C) + (V_C - V_B)$$

$$= -\frac{q_1}{C_1} + \frac{q_2}{C_3}$$

$$= \frac{-C_2 \varepsilon}{(C_1 + C_2)} + \frac{C_4 \varepsilon}{(C_3 + C_4)}$$

$$= \left\{ \frac{C_4}{(C_3 + C_4)} - \frac{C_2}{(C_1 + C_2)} \right\} \cdot \varepsilon$$

$$= \frac{(C_1 \cdot C_4 + C_2 \cdot C_4 - C_2 C_3 - C_2 C_4) \cdot \varepsilon}{(C_1 + C_2) \cdot (C_3 + C_4)}$$

$$\Delta V_{AB} = \frac{(C_1 C_4 - C_2 C_3) \cdot \varepsilon}{(C_1 + C_2) \cdot (C_3 + C_4)}$$

if $\Delta V_{AB} = 0$

then ; $\frac{(C_1 C_4 - C_2 \cdot C_3) \cdot \varepsilon}{(C_1 + C_2)(C_3 + C_4)} = 0$

$\therefore\ C_1 C_4 - C_2 C_3 = 0$

$\Rightarrow\ C_1 \cdot C_4 = C_2 \cdot C_3$

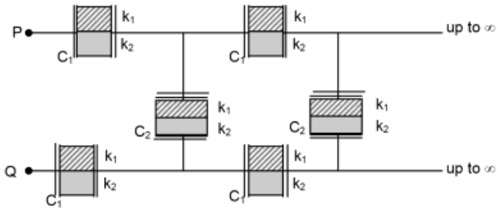
$$\boxed{\frac{C_1}{C_2} = \frac{C_3}{C_4} \quad \text{or} \quad \frac{C_1}{C_3} = \frac{C_2}{C_4}}$$

condition for Balanced wheat-stone Bridge.

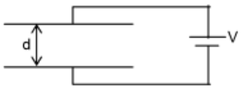
Assignment (Subjective Problems)

LEVEL – I

1. Find the equivalent capacitance between the ends P and Q. The plates are of area A, and the distance between them is d. The dielectric of material $k_1 = 2$, and the dielectric constant of material $k_2 = 4$,



2. The plates of a parallel plate capacitor, having area 'A', are maintained at constant potential difference 'V'. If the initial separation between the plates is 'd', find the work done in increasing the separation of plates to '2d'.



3. A 1 μF and a 2μF capacitor are connected in series across a 1200 V supply.
(a) Find the charge on each capacitor and the voltage across each capacitor.
(b) The charged capacitors are disconnected from the line and from each other, and are now reconnected with terminals of like charge connected together. Find the final charge on each capacitor and the voltage across each capacitor.

4. A capacitor of 20μF and charged to 500 Volts is connected in parallel with another capacitor of 10μF charged to 200 Volts. Find the common potential.

5. A battery of 10 V is connected to a capacitor of capacity 0.1F. The battery is now removed and this capacitor is connected to a second uncharged capacitor. If the charge is equally distributed on these two capacitors, find the total energy stored in the two capacitors. Find the ratio of final energy to the initial energy.

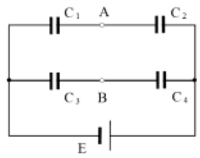
6. The distance between the plates of a parallel plate capacitor is 0.05m. A field of 3×10^4 V/m is established between the plates and an uncharged metal plate of thickness 0.01 m is inserted into the capacitor parallel to its plate. Find potential difference
(a) Before the introduction of the metal plate.

(b) After its introduction.
(c) What would be the potential difference if a plate of dielectric constant K = 2 is introduced in place of metal plate?

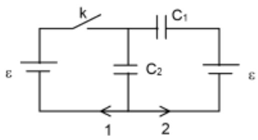
7. Two parallel plate capacitors A and B having capacitance 1 μF and 5μF are charged separately to the same potential of 100 volt.
Now the positive plate of A is connected to the negative plate of B and negative plate of A to the positive plate of B.
Find the final charge on each capacitors and total loss of electrical energy in the given system.

8. A capacitor of capacitance 0.1 μ F is charged until the difference in potential between its plates is 25 V. Then the charge is shared with a second capacitor which has air as dielectric. The potential difference falls to 15 V. If the experiment is repeated with dielectric introduced between the plates of the second capacitor, the potential difference is 8 V. What is the dielectric constant of the material introduced?

9. Determine the potential difference ϕ_A - ϕ_B between points A and B of the circuit shown in figure. Under what condition is it equal to zero?

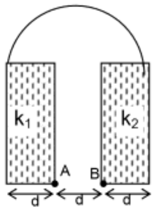


10. In the given circuit diagram, find the charge which will flow through direction 1 and 2 when the key is closed.



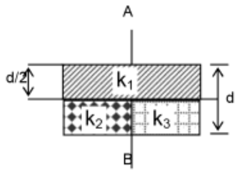
LEVEL – II

1. If the area of parallel plates shown in the figure is 'A' and they are placed at distance 'd' apart form each other, then find the equivalent capacitance between A and B. (The two outer plates are connected with a conductivity wire)

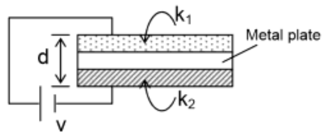


2. Two spherical conductors of radius R and 2R, having potential 4V, and 2V are kept isolated. Find the loss in electrostatic energy if they are connected by a conducting wire.

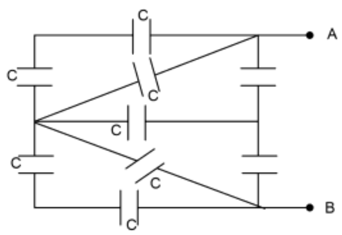
3. Find the equivalent capacitance between A and B, if the plates have equal area 'A'.



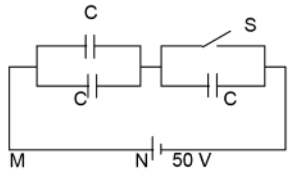
4. Two metal plates form a parallel plate capacitor. The distance between the plates is given as 'd'. A metal plate of thickness (d/2), and two dielectric slabs of thickness (d/4) is introduced between the plates as shown in the figure. If the metal plate is removed find the work done in slowly removing it. (The plates of capacitor is connected to a battery having potential difference 'v')



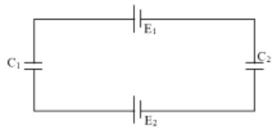
5. Find the equivalent capacitance between A and B in the circuit shown below. If the ends 'A' and 'B' are connected across a 12 V cell, find the electrostatic potential energy of the system. (the capacitance of each capacitor is 100 μF)



6. Each capacitor has a capacitance of 5 μF. Find the charge that will flow through MN when the switch S is closed.



7. In the figure shown, determine the potential differences on the plates of capacitors C_1 = 3μF, C_2 = 7μF, if value of E_1 = 12kV, E_2 = 13kV.

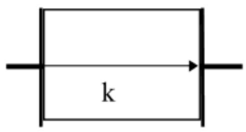


8. An electron flies with an initial velocity v_o into a parallel plate capacitor in a direction making an angle α to the plates and leaves the capacitor at an angle β to the plates. The length of the capacitor plates is L. Find the intensity E of the field between the plates and the kinetic energy of the electron as it leaves the capacitor. Take the mass and charge of electron as m and e respectively.

9. A uniform electric field E exists between the plates of a capacitor. The plate length is ℓ and the separation of the plates is d.

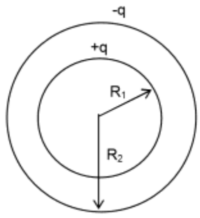
(a) An electron and a proton start from the negative plate and positive plate respectively and go to the opposite plates. Which of them wins this race?
(b) An electron and a proton start from the midpoint of the separation of plates at one end of the plates. Which of the two will have greater deviation when they start with the
(i) same initial velocity
(ii) same initial kinetic energy, and
(iii) same initial momentum?

10. Figure shows a parallel plate capacitor having square plates of edge a and plate separation d. The gap between the plate is filled with a dielectric of dielectric constant k which varies from the left plate to the right plate as $k = k_o + \alpha x$, where k_o and α are positive constants and x is the distance from the left end. Calculate the capacitance.

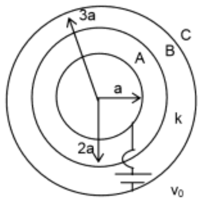


LEVEL - III

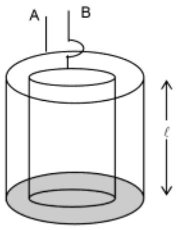
1. The space between the two coaxial cylindrical shells of radius R_1 and R_2 ($R_1 < R_2$) is filled by a dielectric substance, whose dielectric constant varies with the distance from the axis as **$k = A/r^3$**. If the length of the cylindrical shells is 'ℓ' then find the capacitance of the system.



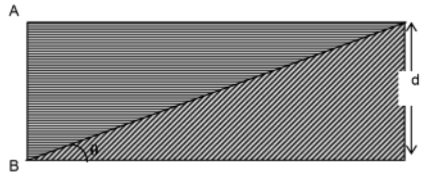
2. In the arrangement of spherical shells shown, find the capacitance of the sphere 'B'. i.e. between B and infinity. (The space between the shells B and C is filled with a material having dielectric constant k).



3. A cylindrical capacitor is made of two cylindrical shells of radius 'a' and '2a' as shown in the figure. If the bottom surface of the capacitor is sealed and liquid of dielectric constant 'k' is introduced between the shells at the rate of πa^3 per second, then find the equivalent capacitance C_{AB} as a function of time (t) assuming that there is no liquid in the capacitor at t = 0 ($\ell >> a$).

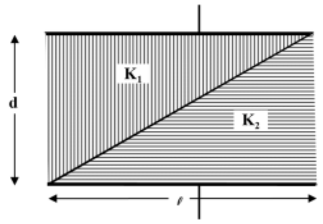


4. The capacitance of a parallel plate capacitor with plate area 'A' and separation 'd' is C. The space between the plates is filled with two edges of dielectric constant k and 2k respectively (**as shown in the figure**). Find the equivalent capacitance of the arrangement.

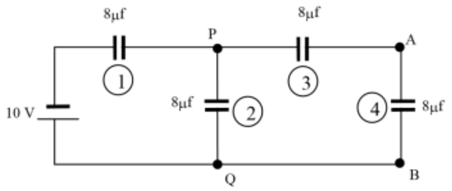


5. A 3μF and 4μF capacitor are charged to 6V. After being disconnected from the battery, they are reconnected in such a manner that plates of opposite polarities are connected. What is the potential difference V finally, and charges? What is the energy loss.

6. A capacitor is formed by two square metal plates of edge 'ℓ', separated by a distance d. Dielectrics of dielectric constant K_1 and K_2 are filled in the gap as shown in the figure. Find the capacitance.

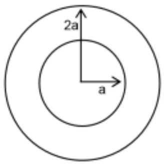


7.

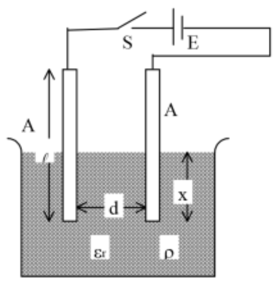


(a) In the above circuit, find the potential difference across AB.
(b) Find the ratio of potential energy stored in the capacitors 1 & 4.

8. A metallic sphere of radius a is covered with a dielectric substance of varying dielectric the dielectric constant as a function of the radial distance from the centre of the sphere ($a \le r \le 2a$). Find the capacitance of the metallic sphere. The dielectric extends upto a radial distance r = 2a.



9. A parallel plate capacitor with square plate of side ℓ and separation between the plates d is placed on the surface of the liquid of density ρ and relative permitivity ε_r. If a cell of emf E is connected across the capacitor, find the height of the liquid between the plates in equilibrium.

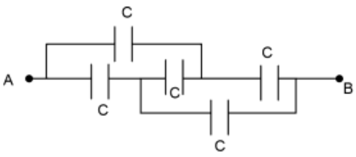


10. Inside a ball, charged uniformly with volume density ρ, there is a spherical cavity. The centre of cavity is displaced with respect to the centre of the ball by a distance 'a'. Find the field strength $\vec{E}$ inside the cavity, assuming the permittivity to be equal to unity.

Assignment (Objective Problems)

LEVEL - I

1. The equivalent capacitance between A and B is
(A) C
(B) 2C
(C) 1.5 C
(D) none of the above



2. The capacitance of a capacitor increases three times, when we introduce a dielectric material between the plates in such a way that it fill the entire plate area, the dielectric constant of material is
(A) 3 (B) 1.5
(C) 0.33 (D) none of the above

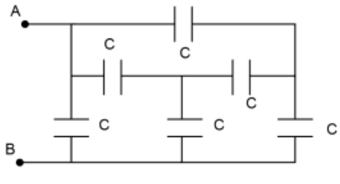
3. The plates of a parallel plate capacitor are not parallel, the interface charge density is
(A) is higher at the closer end (B) is non-uniform
(C) is higher at inclined plate. (D) none of the above

4. There are 'n' identical capacitors, which are connected in parallel to a potential difference V. These capacitance are then reconnected, in series. The potential difference between the extreme ends is :
(A) zero (B) nV
(C) (n – 1) V (D) none of the above

5. The force with which the plates of a parallel plate capacitor having a charge Q and area of each plate A, attract each other is
(A) directly proportional to Q^2 and inversely to A.
(B) inversely proportional to Q^2 and directly to A.
(C) does not depend upon Q^2 and is inversely proportional to A.
(D) none of the above

6. If an insulated metal slab of small thickness is introduced between the plates of a parallel plate capacitor, the capacitance of the capacitor
(A) increases (B) decreases
(C) remains constant (D) none of these above

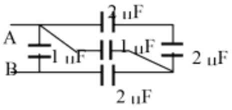
7. The equivalent capacitance between A and B is
(A) 6 C
(B) 4C
(C) 2C
(D) none of the above



8. A dielectric slab of thickness 4 mm is placed between the plates of a parallel plate capacitor. If the distance between plates is reduced by 3.5 mm, the capacity of the capacitor remains same. Find the dielectric constant of the medium.

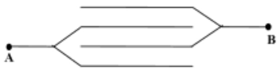
(A) 2 (B) 4
(C) 6 (D) 8

9. The effective capacitance between A and B will be



(A) 0.5 μF
(B) 1.5 μF
(C) 2 μF
(D) 2.5 μF

10. If the capacitance between two successive plates is C, then the capacitance of the equivalent system between A and B is

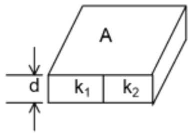


(A) $\frac{C}{3}$ (B) 3C
(C) $\frac{2}{3}C$ (D) $\frac{3}{2}C$

LEVEL – II

1. Two capacitors are once connected in parallel and then in series. If the equivalent capacitance in two cases are 16 F and 3F respectively, then capacitance of each capacitor is
(A) 16 F, 3F (B) 12 F, 4 F
(C) 6F, 8F (D) none of these

2. Two dielectrics of equal size are inserted inside a parallel plate capacitor as shown. With what factor the effective capacitance increases ?



(A) $\frac{k_1k_2}{k_1+k_2}$ (B) $\frac{k_1+k_2}{2}$
(C) $\frac{2k_1k_2}{k_1+k_2}$ (D) none of above

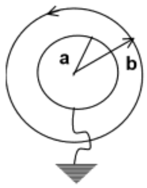
3. If a dielectric slab is introduced between the plates of an isolated charged parallel plate capacitor
(A) force of attraction between the plates increases
(B) force of attraction between the plates decreases
(C) force of attraction between the plates remains same
(D) nothing can be said

4. The capacitance of two capacitors in parallel is four times their capacitance when they are connected in series. The ratio of the individual capacitances will be
(A) 1:2 (B) 1:1
(C) 2:1 (D) 4:1

5. Two identical parallel plate capacitors of same dimensions are connected to a DC source in series. When one of the plates of one capacitor is brought closer to other plate
(A) the voltage on the capacitor whose plates came closer is greater than the voltage on the capacitor whose plates are not moved.
(B) the voltage on the capacitor whose plates came closer is smaller than the voltage on the capacitor whose plates are not moved.
(C) the voltage on the two capacitors remain equal.
(D) the applied voltage is divided among the two inversely as the capacitance.

6. You are given 32 capacitors of 4μF capacitance each. How do you connect all of them so that the effective capacitance becomes 8 μF?
(A) 4 capacitors in series and 8 such groups in parallel.
(B) 2 capacitors in series and 16 such groups in parallel.
(C) 8 capacitors in series and 4 such groups in parallel.
(D) All of them in series.

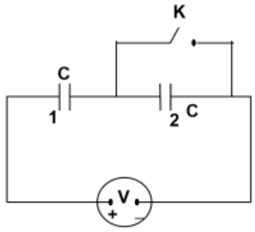
7. Figure shows a spherical capacitor with inner sphere earthed. The capacitance of the system is



A) $\frac{4\pi\varepsilon_0 ab}{b-a}$ (B) $\frac{4\pi\varepsilon_0 b^2}{b-a}$

(C) $4\pi\varepsilon_0$ (b + a) (D) none of these

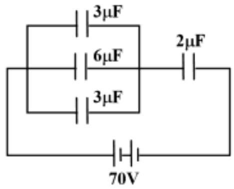
8. The charge flowing across the circuit on closing the key K is equal to



(A) CV (B) $\frac{C}{2}$ V

(C) 2CV (D) zero

9. The potential difference across the capacitor of $2\mu F$ is



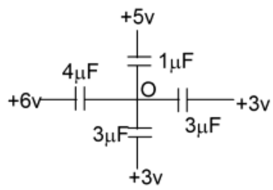
(A) 10 V

(B) 60 V

(C) 28 V

(D) 56 V

10. What is the potential at point O,



(A) 4.27 V (B) 17 V

(C) zero (D) 34V

Answers to the subjective Assignment

LEVEL – I

1. $C_{eq} = 1.07\ \varepsilon_0 A / d$

2. $W = \frac{1}{4}\frac{\varepsilon_0 AV^2}{d}$

3. **(a)** 800 μC, 800V, 800μC, 400V. **(b)** 1600/3V,1600/3μC, $\frac{3200}{3}\mu C$

4. 400V

5. 2.5J, $\frac{1}{2}$

6. (a) 1500 Volt (b) 1200 Volt (c) 1350 Volt

7. 0.6×10^{-4}C; 0.33×10^{-4}C; $\frac{5}{3}\times 10^{-2}$ J

8. 3.2

9. $\varphi_A - \varphi_B = E\frac{C_2C_3 - C_1C_4}{(C_1+C_2)(C_3+C_4)}$, when $C_1/C_2 = C_3/C_4$.

10. Charge flown through path 2= $-\frac{\in c_1c_2}{c_1+c_2}$

Charge flown through path 1= $\varepsilon\ c_2$

LEVEL – II

1. $\frac{A\varepsilon_0}{d}\left[\frac{k_1k_2 + k_1 + k_2}{(k_1+k_2)}\right]$

2. $\frac{16\pi\varepsilon_0 Rv^2}{3}$

3. $\frac{2A\varepsilon_0}{d}\left[\frac{(k_2+k_3)(k_1)}{2k_1+k_2+k_3}\right]$

4. $\frac{4A\varepsilon_0 v^2 k_1^2 k_2^2}{d(k_1+k_2)(k_1+k_2+2k_1k_2)}$

5. 125 μF, 750 μJ.

6. 333.3 μC

7. 700 V, 300V

8. $\frac{mv_0^2\cos^2\alpha(\tan\beta - \tan\alpha)}{eL}$, $\frac{mv_0^2\cos^2\alpha}{2\cos^2\beta}$

9. (a) Electron (b) (i) Electron (ii) Both equal deviation (iii) Proton

10. $\frac{\varepsilon_0 a^2\alpha}{\ln\left(1+\frac{\alpha d}{K_0}\right)}$

LEVEL – III

1. $\frac{q}{V} = \frac{6\pi\varepsilon_0 A\ell}{(R_2^3 - R_1^3)}$

3. $C_{AB} = \frac{2\pi\varepsilon_0}{\ln 2}\left[\ell + \frac{(k-1)at}{3}\right]$ for $0 \le t \le 3\ \ell/a$ secs

and $C_{AB} = \frac{2\pi\varepsilon_0}{\ln 2}\left[\ell + (k-1)a\right]$ for $t > 3\ \ell/a$ secs

4. 2ck ln2.

5. (6/7) V

6. $C = \left[\frac{\varepsilon_0 \ell^2 k_1 k_2}{(k_2 - k_1)d}\right] \ln\frac{k_2}{k_1}$

7. (a) 2V (b) 9 : 1

8. $4\pi\varepsilon_0\ a\ k_0\ [1+\ln 2]^{-1}$.

9. $h = \frac{\varepsilon_0(\varepsilon_r - 1)E^2}{\ell \rho g d}$

10. $E = \frac{\rho\vec{a}}{3\varepsilon_0}$

Answers to the Objective Assignment

LEVEL - I

1.	A	2.	A
3.	D	4.	B
5.	A	6.	B
7.	C	8.	D
9.	C	10.	B

LEVEL - II

1.	B	2.	B
3.	C	4.	B
5.	B, D	6.	A
7.	B	8.	B
9.	B	10.	A