PHYSICS

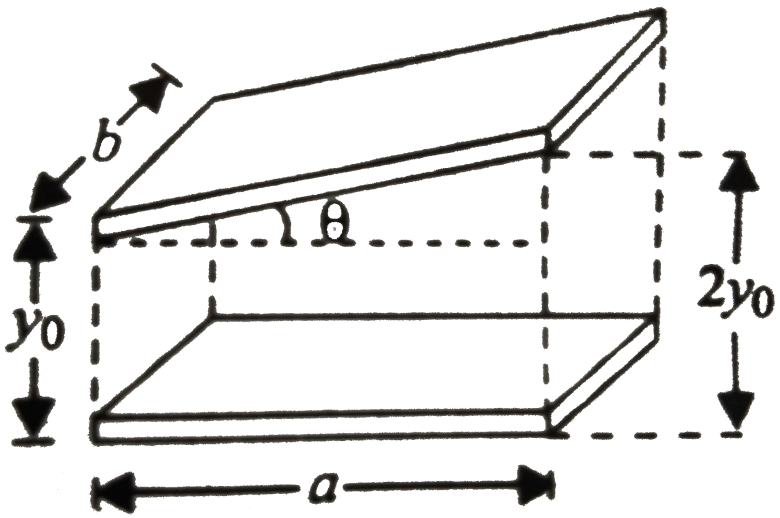
BOOKS - CENGAGE PHYSICS (ENGLISH)

CAPACITOR AND CAPACITANCE

Illustration

1. A capacitor has rectangular plates of length a and width b. The top plate is inclined at a small angle as shown in. The plate separation varies from $d = y_0$ at the left to $d = 2y_0$ at the right, where y_0 is much less

than a or b. system.



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2. A capacitor of capacitance C, which is initially uncharged , is connected with a battery of emf ε. Find the heat dissipated in the circuit during the process of charging .

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3. A capacitor of capacitance C, which is initially charged up to a potential differnce ε, is connected with a battery of emf $\varepsilon/2$ such that the positive terminal of the battery is connected with the positive plate of the capacitor. After a long time.

i. find the total charge flow through the battery

ii. find the total work done by the battery

iii. Find the heat dissipated in the circuit during the process of charging.

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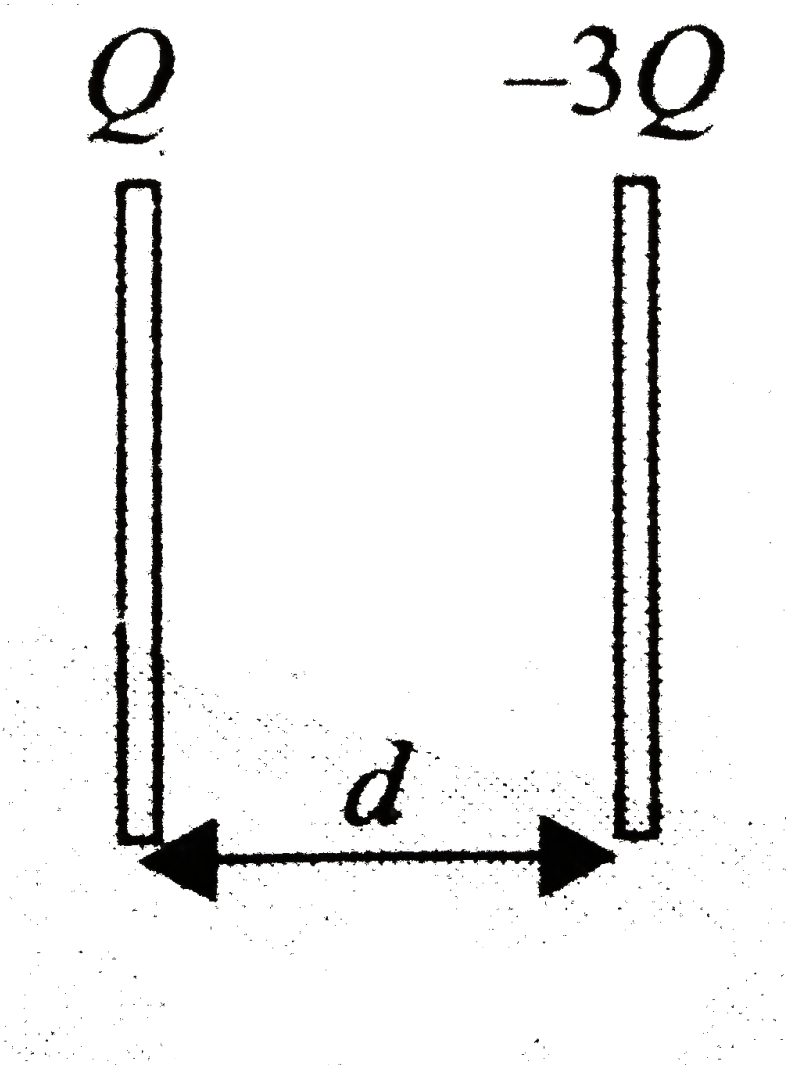
4. A parallel plate capacitor has capacitance C. If the charges of the plates are Q and $-3Q$, find of the



i. charges at the inner surfaces of the plates

ii. Potential difference between the plates

iii. charge flown if the plates are connected

iv. energy lost by the capacitor in (iii.)

v. charge flown if any plate is earthed.

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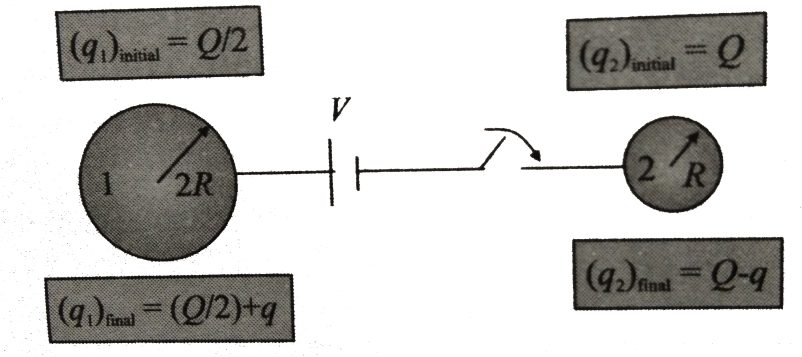
5. There are two spheres of radii R and $2R$ having charges Q and $Q/2$, respectively. These two spheres are connected with a cell of emf V volts as show in. When the switch is closed, find the final charge on each sphere.



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6. Two conducting spheres of radii $6km$ and $12km$ each, having the same charge $3 \times 10^{-8}C$, are kept very far apart. If the spheres are connected to each other by a conductiong wire, find

i. the direction and amount of charge transferred and

ii. final potential each sphere.

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7. A solid conducting sphere of radius 10 cm is enclosed by a thin metallic shell of radius 20 cm. A charge $q = 20\mu C$ is given to the inner sphere. Find the heat generated in the process, the inner sphere is connected to the shell by a conducting wire.

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8. An isolated coductor, initially free from charge, is charge by repeated conacts with a plate, which afrer each contact has a charge Q due to some mechanism.If q is the charge on the conductor after the first operation, prove that the maximum charge that can be give to the conductor in this way is $Qq/Q - q$.

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9. Two capacitors C_1 and C_2 are charged 2uF AND 3uF seperately to potentials $20V$ and $10V$, respectively. The terminals of capacitors C_1 and C_2 are marked as (A-B) and (C-D), respectvely. A is connected with C and B is connected with D.

i. Find the final potential dsifference across each eapacitors.

ii. Find the final charge in both capacitors

iii. How much heat is produced in the circuit.

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10. If A is connerted with D and B is connected with C find the potential difference a across each capacitor and the final charge in each capacitor.

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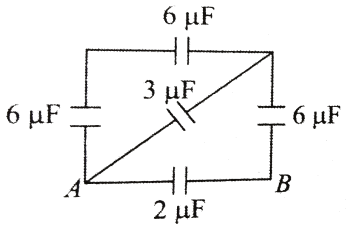
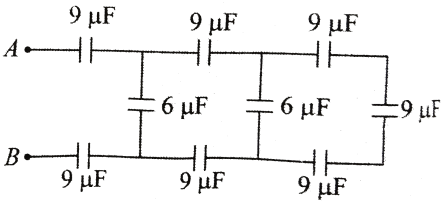
11. In , different capacitors are arranged. Find the equivalent capacity across the poinsts (A) and (B)



(i)



(ii)

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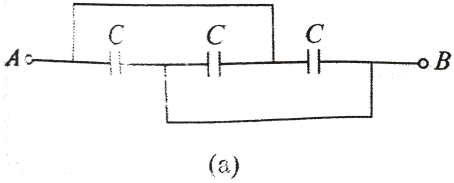
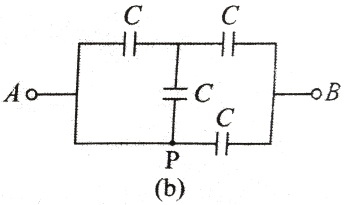
12. Different capacitors are arranged as shown in Fig. 4.42 Final the equivalent capacity across the points (A) and (B).



(a)



(b)

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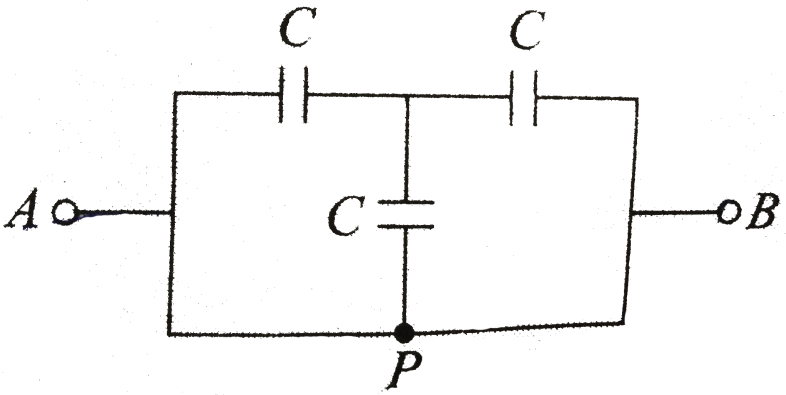
13. Three capacitors are arranged as shown in. Find the equivalent capactiy across the points A and B.



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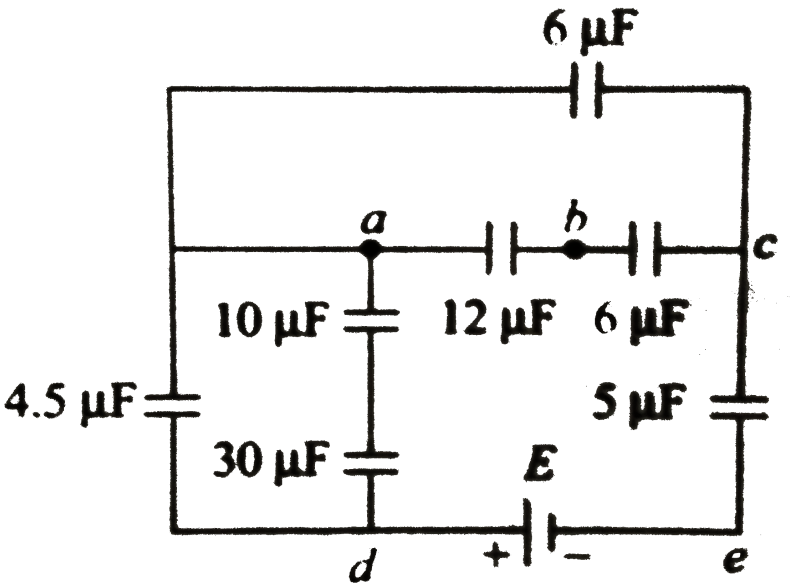
14. In the circuit shown in the potential difference between the point a and b is $4V$, Find the emf ε of the battery. Assume that before connecting

the battery in the circuit, all the capacitors were uncharged.



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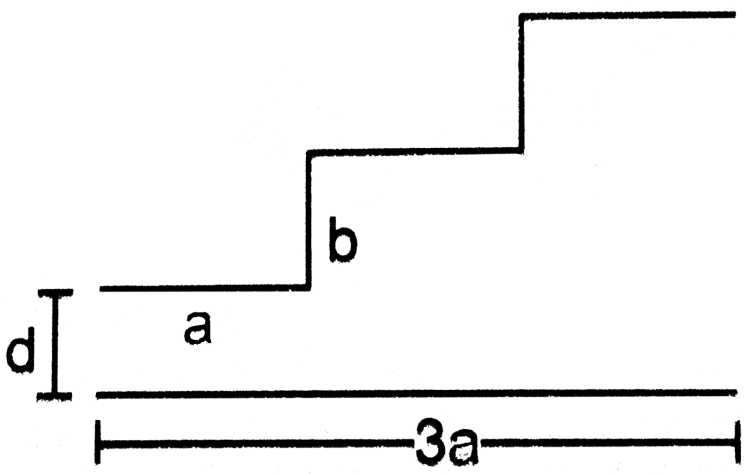
15. A capacitor is made of a flat plate of area A and a second plate having a stair -like structure as shown in figure. The width of each stair is a and

the height is b . Find the capacitance of the assembly.



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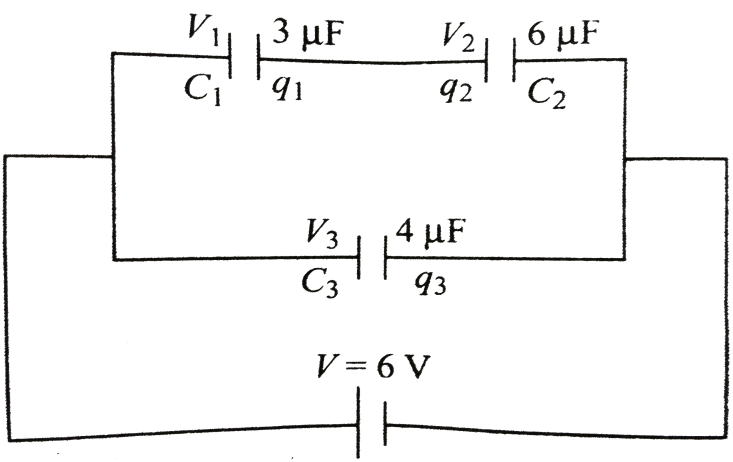
16. Three capacitors of capacitances $3\mu F, 6\mu F$, and $4\mu F$ are connected as shown across a battery of emf $6V$.



i. Find the equivalent capacitance,

ii. Find the potential difference and charge on each capacitor.

iii. Find the energy stored in the system of capacitors and total energy stored in the system of capacitor.

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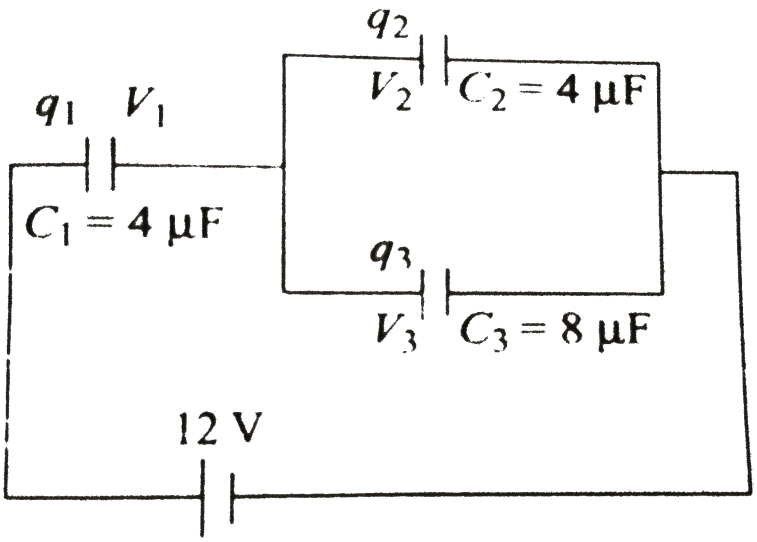
17. Three capcitors of capacitances $4\mu F$,



$4\mu F$, and $8\mu F$, are connected as show across a battery of emf $12V$.

i. Find the equivalent capacitane.

ii. Find the potential difference and charge on each capacitor.

iii. Find the energy stored in each capacitor and the total energy stored in the system of capacitors.

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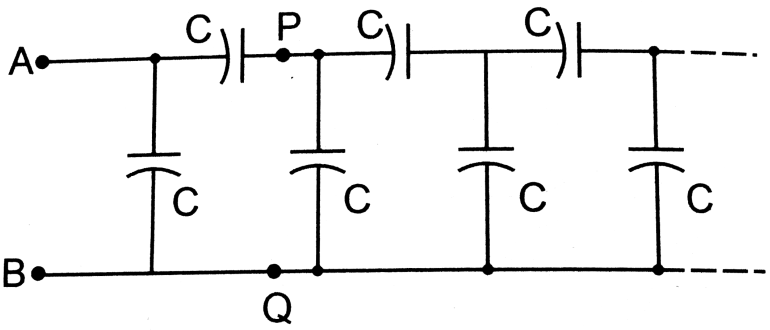
18. Find the capacitance of the infinite ladder shown in figure.



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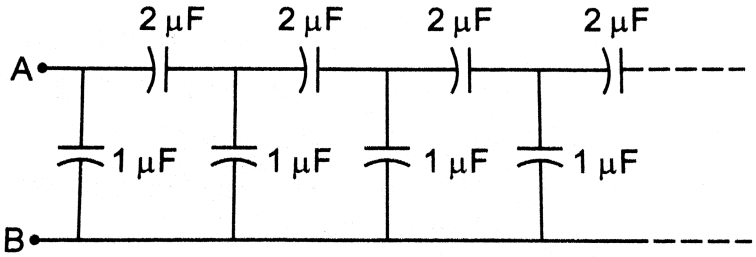
19. A finit ladder is constructed by connecting several sections of $2\mu F, 1\mu F$ capacitor combinations as shown in figure . It is terminated by a capacitor of capacitance C . What value should be chosen for C, such that the equivalent capacitance of ladder between the points A and B becomes independent of the number of sections in between ?



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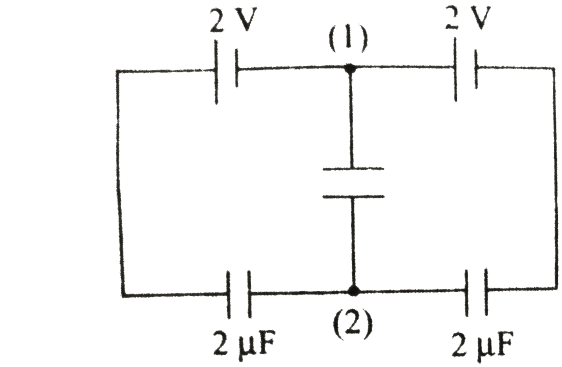
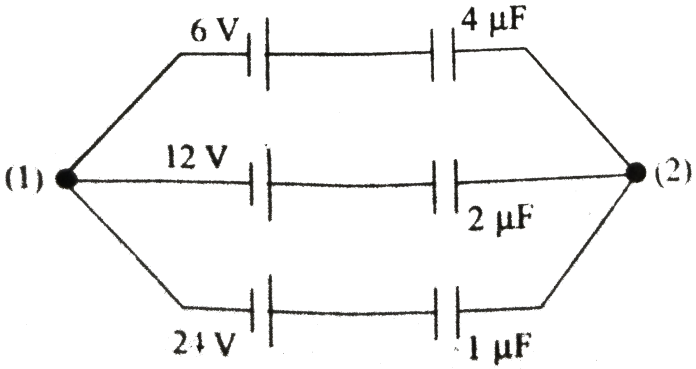
20. Find the potential difference $V_a - V_b$ between the points (1) and (2) shown in each part of Fig.



(a)



(b)

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21. What is $V_A - V_B$ in the arrangement shown in.What is the condition such that $V_A - V_B = 0$

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22. Six capacitors $C_1 = C_2 = C_3 = C_4 = C_5 = C_6 = C$ are arranged as shown in. Determine the equivalent capacitance between A and B.

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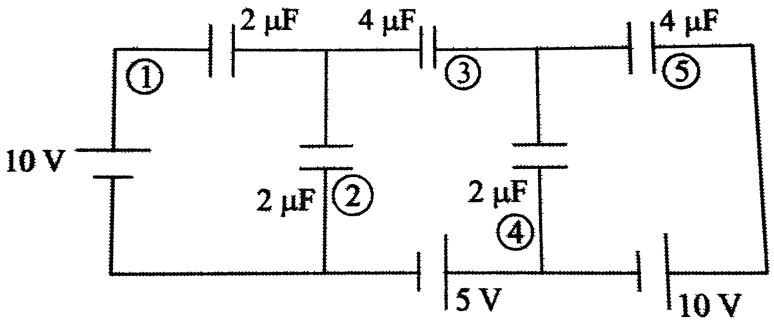
23. In what are the charger on all the four capacitors?



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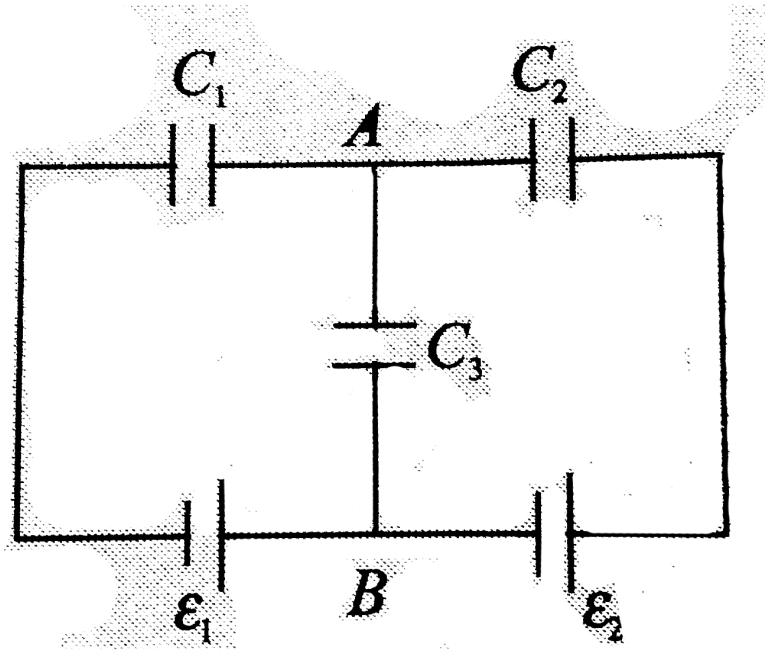
24. Find the potential differnce $V_A - V_B$ between points A and B of the circuit shown in.



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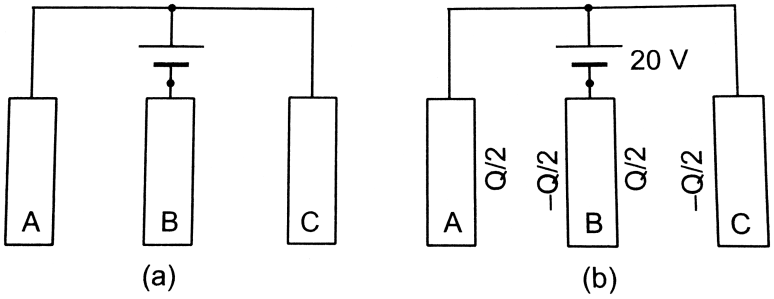
25. Each of the three plates shown in figure has an area of 200 cm^2 on one side and the gap between the adjacent plates is 0.2 mm. The emf of the battery is 20V. Find the distribution of charge on various surfaces of the plates. What is the equivalent capacitance of the system between the

terminal points?



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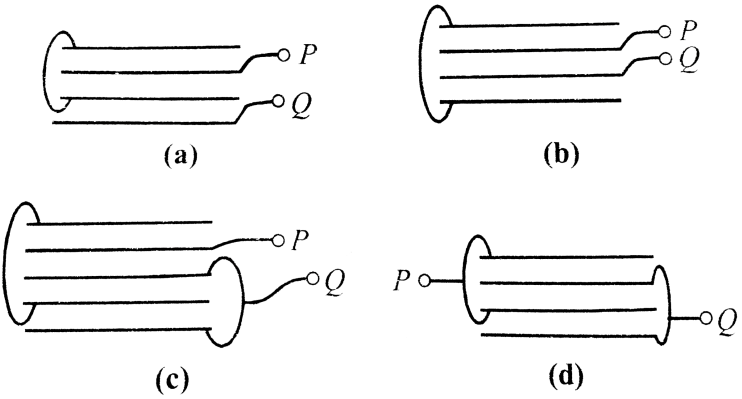
26. Identical metal plates are located in air at equal distance d from one another. The area of each plate is equl to A Evaluate the capacitance of the system between P and Q if the plates are interconnected as shown in.



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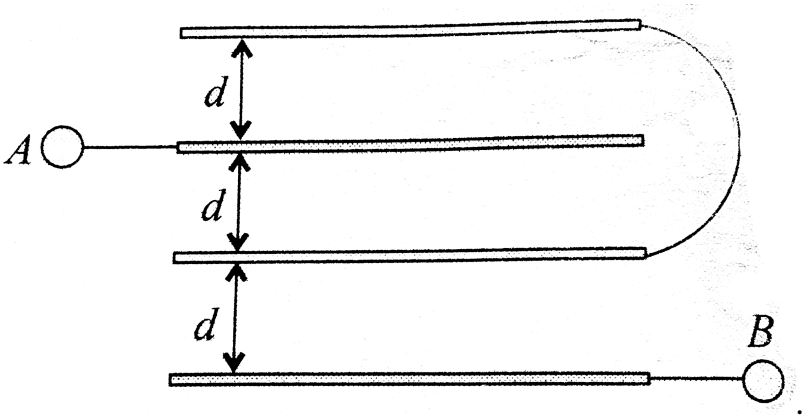
27. Four identical plates, each having area A, are arranged as shown in Fig.

Find the equicalent capacity of the structure between (A) and (B).



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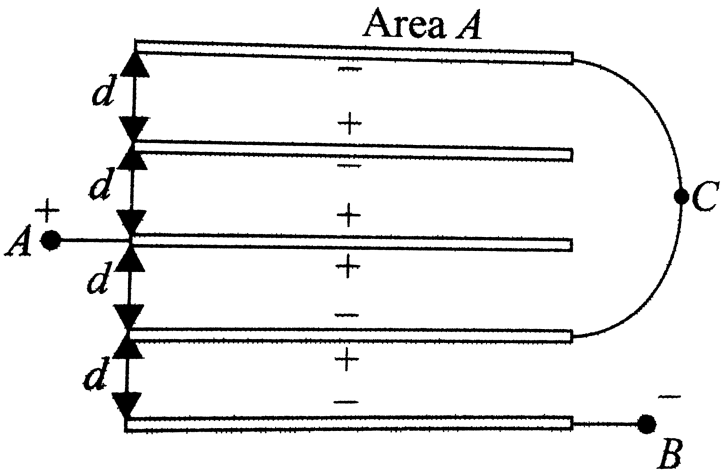
28. Five identical plates, each having area A are arranged as shown in Fig.

Find the equivalennt capacity of the strusture between A and B?



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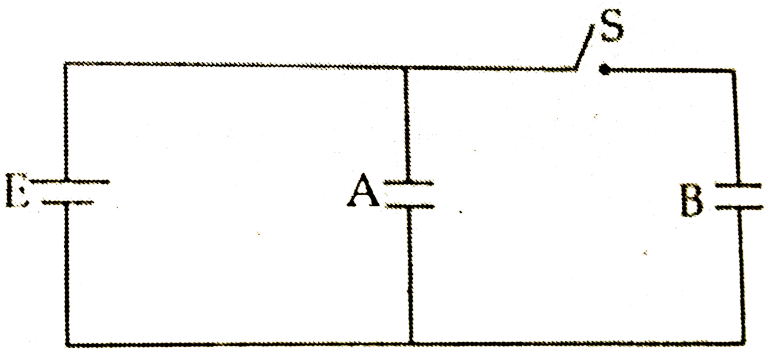
Solved Examples

1. Two identical parallel plate capacitors A and B are connected to a battery of V volts with the switch S closed . The switch is now opend and the free space between the plantes of the capacitors is filled with a dielectric of dielectric constant K. Find the rario of the total electrostatic energy stored in both

capacitors before and after the introduction of the dielectric.



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2. Two parallel plate capacitors of capacitance C each are connected in series with a battery of emf ε. Then, one of the capacitors is filled with a dielectric of dielectric constane K.

i. Find the change in electric field in the two capacitors, if any

ii. What amount of charge flows through the battery?

iii Find the change in the energy stored in the circuit, if any.

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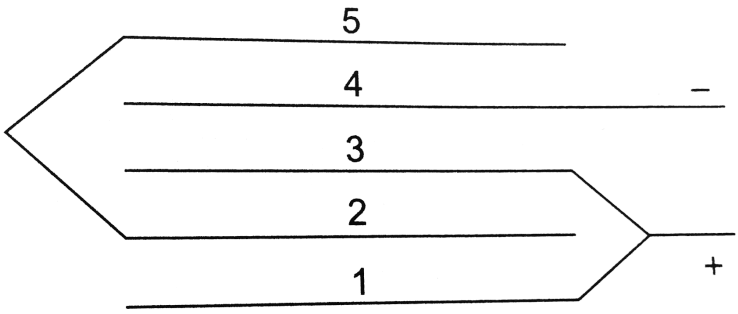
3. Five identical conducting plates, $1, 2, 3, 4$ and 5 are fixed parallel pltes equidistant from each other (see figure). A conductor connects plates 2 and 5 while another conductor joins 1 and 3. The junction of 1 and 3 and the plate 4 are connected to a source of constant emf V_0. Find



(a) the effective capacity of the system between the terminals of source.

(b) the charges on the plates 3 and 5. Given, $d =$ distance between any two successive plates and $A =$ area of either face of each plate.

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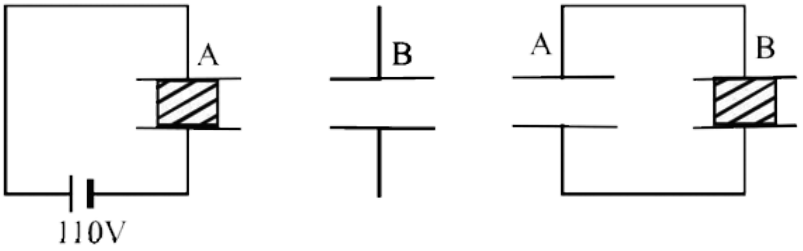
4. Two parallel plate capacitors A and B have the same separation $d = 8.85 \times 10^{-4} m$ between the plates. The plate area of A and B are $0.04m^2$ and $0.02m^2$ respectively. A slab of dielectric constant (relative

permittivity) $K = 9$ has dimensions such that it can exactly fill the space between the plates of capacitor B.



(i) The dielectric slab is placed inside. A as shown in figure (a). A is then charged to a potential difference of 110V. Calculate the capacitance of A and the energy stored in it.

The battery is disconnected and then the dielectric slab is moved from A. Find the work done by the external agency in removing the slab from A.

(iii) The same dielectric slab is now placed inside B, filling it completely, The two capacitors A and B are then connected as shown in figure(c). Calculate the energy stored in the system.

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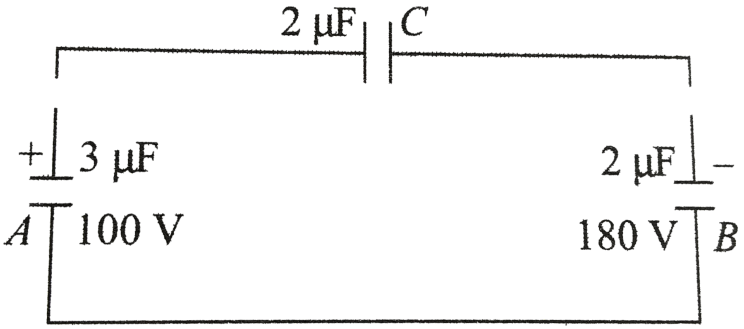
5. Two capacitors A and B with capacities $3\mu F$ and $2\mu F$ are charged to a potential differece of $100V$ and $180V$, respectively. The plates ot the capacitors are connected as shown in, with one wire free from each capacitor. The upper plate of A is positive and that of B is negative An uncharged $2\mu F$ capacitor C with lead wires falls on the free ends to complete the circuit.

i. Calculate the final charge on the three capacitors,

ii. Find the amount of electrostatic energy stored in the system before and after the completion of the circuit.



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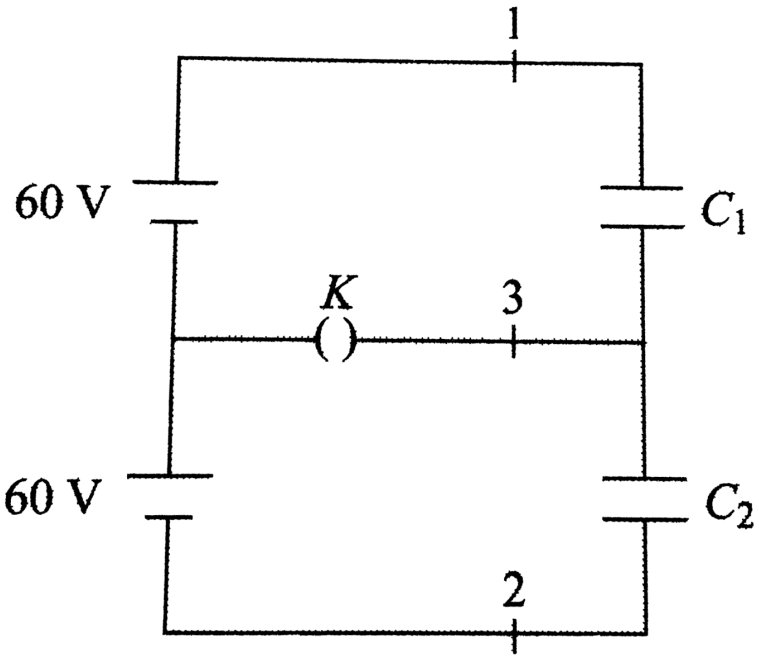
6. In the circuit shown , the emf of each battery is $60V$ and $C_1 = 2\mu F$ and $C_2 = 3\mu F$. Find the charges that will flow through the sections $1, 2$ and 3 after the Key is closed.



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7. Find the capacitance between the terminals A and C_3 If $\varepsilon_r = 2$

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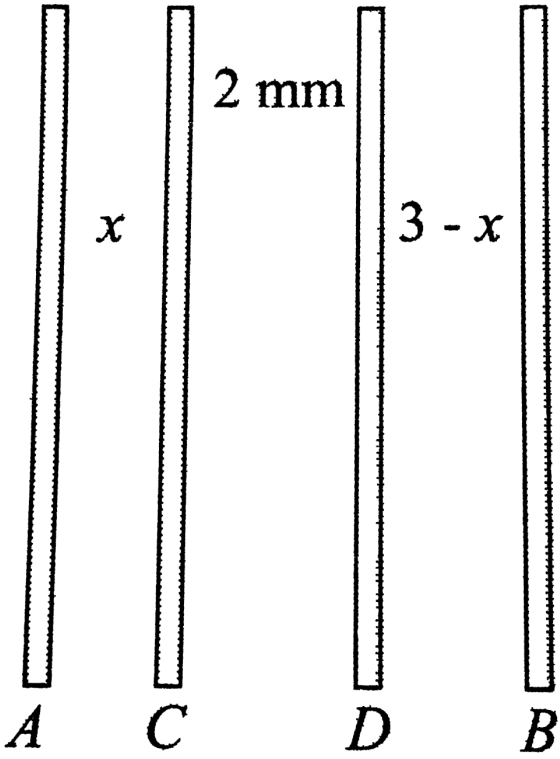
8. Two parallel plate capacitors differ only in the spacing between their (very thin) plates , AB has a spacing of 5 mm and a capacitance of $20pF$, while CD has a spacing of $2mm$. Plates A and C carry charges of $+1nC$, while B and D each carry $-1nC$, What are the potential diffences V_{AB} and V_{CD} after the capacitor CD is slid centrally between and parallel ot the plates of AB without touching them ? Would it make any difference if CD was not centrally paced between A and B ?



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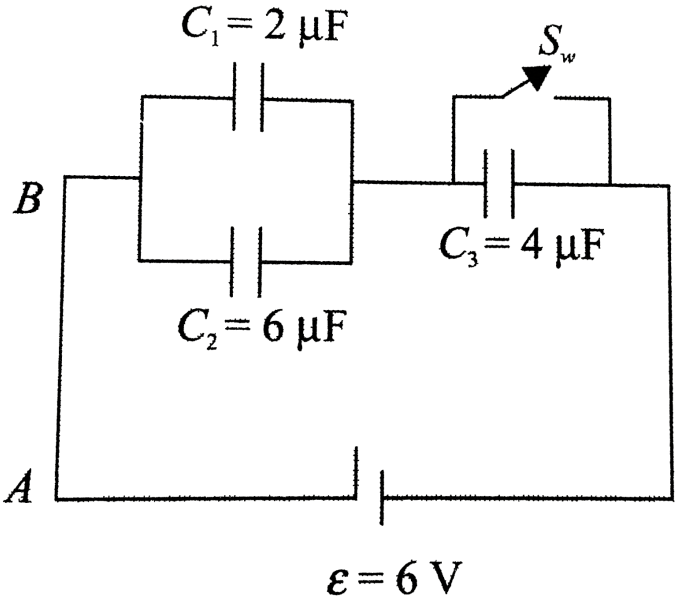
9. In, all the capacitors are in steady state initially.

i. What is the charge flowing through the switch when it is closed?

ii. What is the charge flowing section AB?

iii. What is the work done by the battery?

iv. What is the heat produced when (S) is closed?



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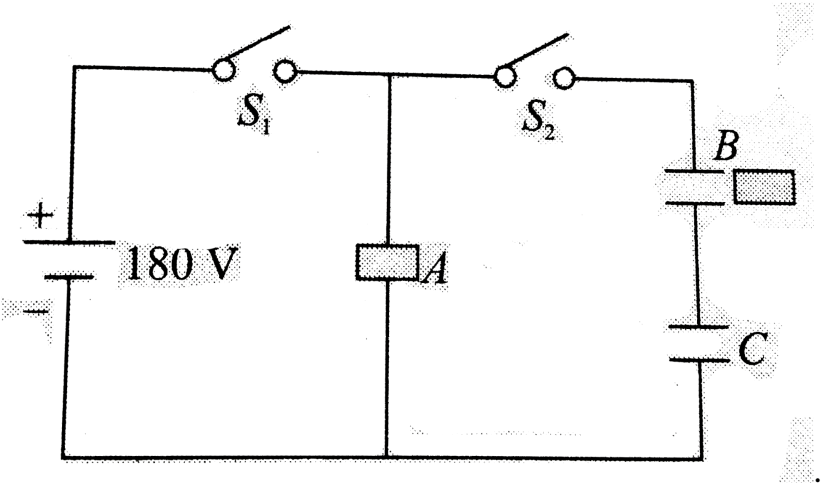
10. In the circuit shown in , capacitor A has capacitance $C_1 = 2\mu F$ when filled with a dielectric slab $(k = 2)$. Capacitors B and C are air capacitors and have capacitaces $C_2 = 3\mu F$ and $C_3 = 6\mu F$, respectively.



A is charged by closing the switch S_1 alone.

i. Calculate the energy supplied by the battery during the process of charging.

Switch $S_1$is now opened and is closed.

ii. Calculate the charge on B and the energy stored in the system when an electrical equilinrium is atained.

Now switch S_2 is also opened, and the slab of A is removed. Another dielectric slab of $K = 2$, which can just fill the space in B, is inserted into it and then switch S_2 alone is closed.

iii. Calculate by how many time the electric field in B is increased. Calculate also the loss of energy during the redistribution of charge.

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Exercise 4.1

1. Suppose the two plates of a capacitor have different areas. When the capacitor is charged by connecting it to a battery, do the charges on the two plates have equal magnitued, or can they be differet? Explain you reasoning.

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2. The charged plates of a capacitor attract each other. So work by some external force is required to pull the plates farther apart. What happens to the energy added by this work.

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3. Two metal plates having charges $Q \text{ and } -Q$ face each other at some separation and are dipped into an oil tank .If the oil is pumped out, the eletric field between the plates will

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4. a. How many excess electrons must be added to one plate and removed from the other to give a $5.000nF$ parallel plate capacitor $25.0J$ of stored energy ?

b. How could you modify the geometry of this capacitor so that can store $50.0J$ of energy without changing the charge on its plates?

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5. A capacitor of capacitance C is charged to a potential difference V from a cell and then disconncted from it. A charge $+Q$ is now given to its positive plate. The potential difference across the capacitor is now

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6. A capacitor is connected across a battery .

a. Why done each plate receive a charge of exactly the same magnitude?

b. Is this true even if the plates are of different size?

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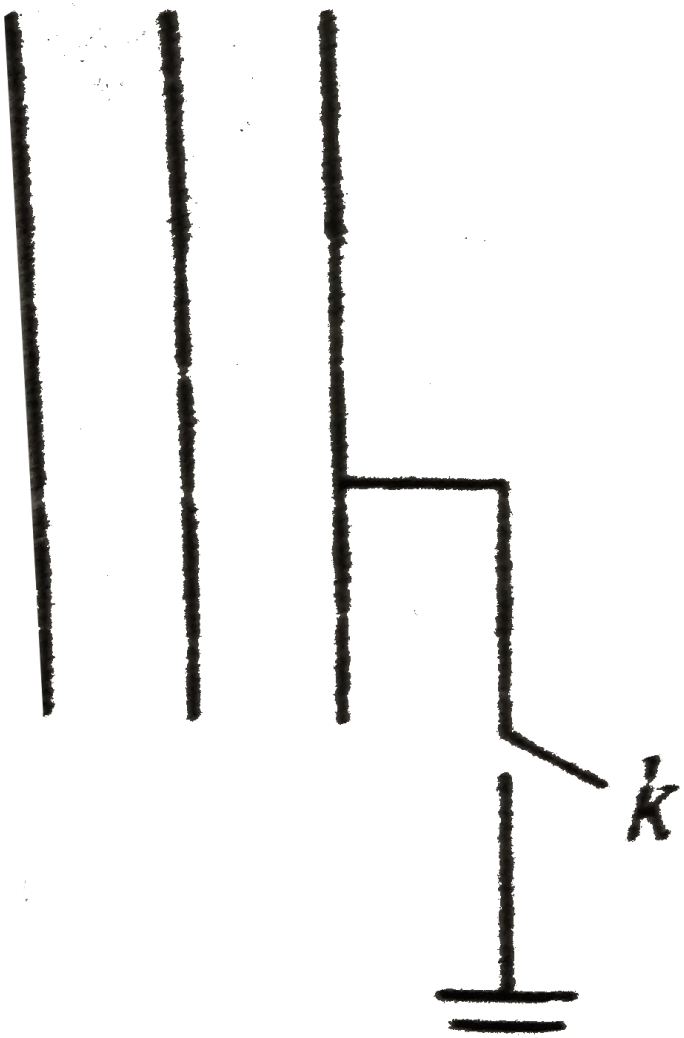
7. Three identical large metallic plates are placed parallel to each other at a very small separation as shown in. The central plate is give a charge Q.

What amount of charge will flow to earth when the key is pressid?



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8. The plates of a plane capacitor are drawn apart keeping them connected to a bettery. Next, the same plates are drawn apart from the same initial condition keeping the battery disconnected, In which case is more work done?

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9. If a small charge q is moved along a closed path in the field between the plates of a parallel plate capacitor, will any work be done by the agent that moves the charge?

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10. At which of the two points, 1 or 2, of a charged capacitor with nonparallel plates is the surface charge density greater?

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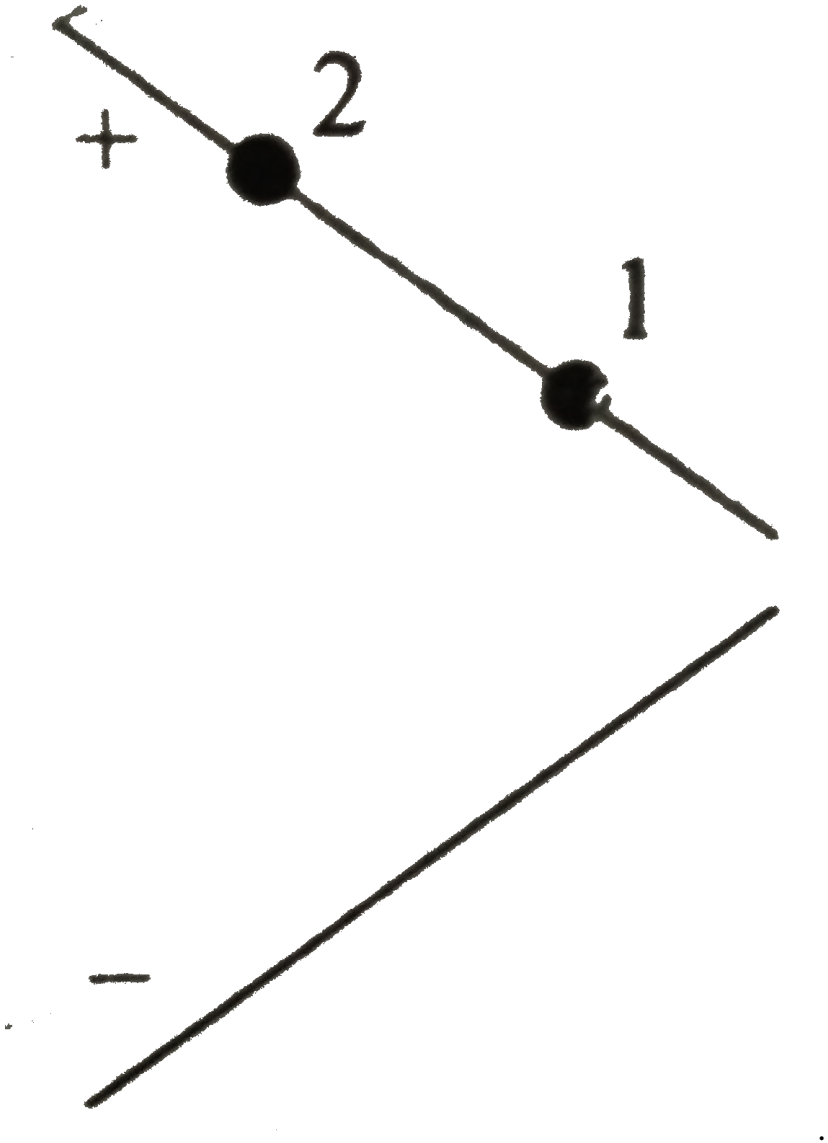
11. A parallel plate air capacitor is connected to a battery. If the plates of the capacitor are pulled farther apart, then state whether the following statements are true or false.

a. Strength of the electric field inside the capacitor remains unchanged, if the battery is disconnected before pulling the plates.

b. During the process, work is done by the external force applied to pull the plates irrespective of whether the battery is disconnected or not.

c. Strain energy in the capacitor decreases if the battery remains

connected.



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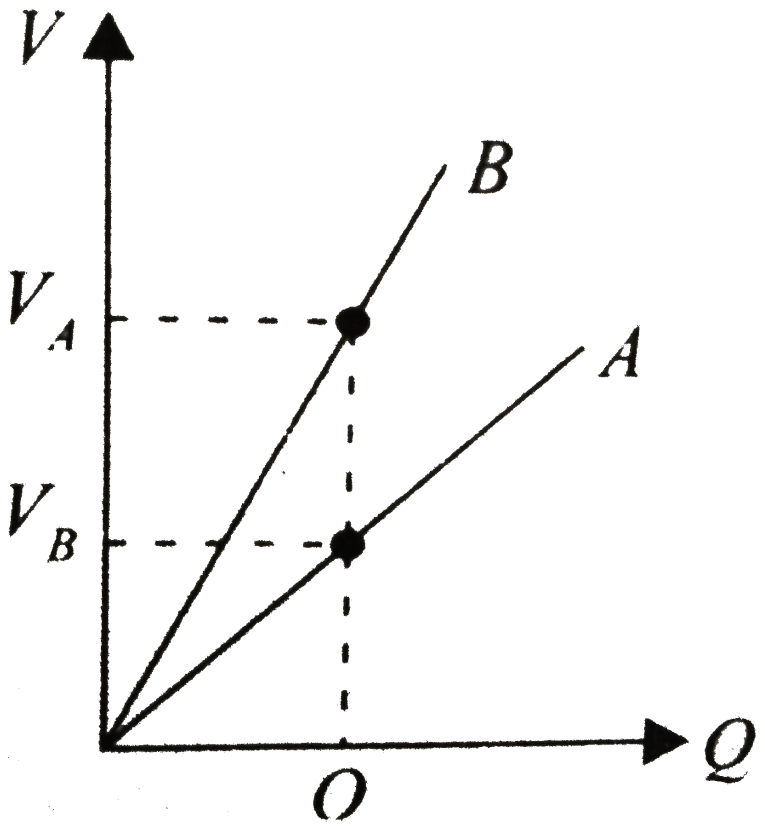
12. Shows the variation of voltage V across the plates of two capacitors A and B versus incease in charge Q stored in them. Which of the capacitors has higher capacitance? Give reason for your answer.



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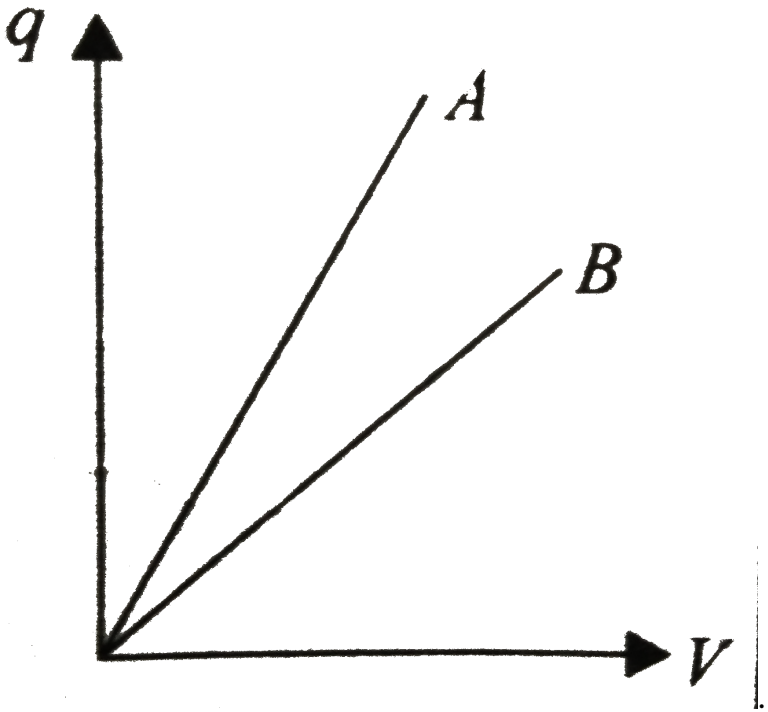
13. Shows these variation of charge q for two capacitors C_1 and C_2 The two capacitors have the same plate separation. But the plate area of C_2 is double than that of C_1. Which of the lines in the figure corresponds to C_1 and C_2 and why?



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Exercise 4.2

1. A conductor is an extreme case of a dielectric, because if an electric field is applied to a conductor, charges are free to move within the conductor to set up "induced charges". What is the dielectric constant of a perfect conductor? Is it $K = 0$, $K \to \infty$, or something in between ? Explain your reasoning.

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2. A capacitor of capacitance C is charged to a potential differece V_0. The terminals of the charged capacitor are then connected to those of an uncharged capacitor of capacitance $C/2$.

a. Compute the original charge of the system.

b. Find the final potential differce across each capacitor.

c. Find the final energy of the system.

d. Calculate the decrease in energy when the capacitors are connected.

e. Where did the "lost" energy go?

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3. A parallel plate vacuum capacitor eith plate area A and separation x has charges $+Q$ and $-Q$ on its plates. The capacitor is disconnected from the source of charge, so the charge on each plate remains fixed.

a. What is the total energy stored in the capacitor?

b. The plates are pulled apart an additional distance each case.

c. If F is the force with which the plates attract each other, the change in the stored energy must equal the work $dW = Fdx$ done in pulling the plates apart. Find an expression for F

d. Energy storage in a capacitor can be limited by the maximum electric field between the plates. What is the ratio of the electric field for the series for parallel combinations?

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4. You have two identical capacitors and an external potential source.

a. Compare the total energy stored in capacitor when they are connected to the applied potential in series and in parallel.

b. Compare the maximum amount of charge stored in each case.

c. Energy storage in a capacitor can be limited by the maximum electric

field between the plates. What is the ratio of the electric field for the series for parallel combinations?

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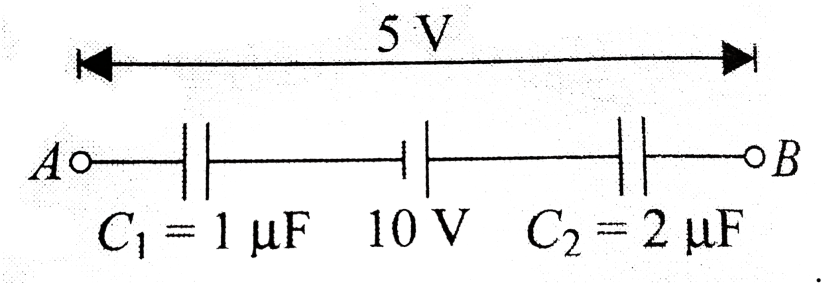
5. A circuit has section AB as shown in The emf of the cell is $10V$, and the capacitors have capacitances $C_1 = 1\mu F$ and $C_2 = 2\mu F$. Find the voltage across each capacitor.



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6. While a capacitor remains connected to a battery a dielectic slab is slipped between the plates. Describe qualitatively what happens to the

charge, the capcitance, the stored energy. Is work required to insert the slab?

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7. If you have several $2.0\mu F$ capacitrors, each capable of withstanding $200V$ without breakdown, how would you assemble a combination that has an equivalent capacitance of

a. $0.4\mu F$

b. $1.2\mu F$ each with standing $1000V$?

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8. n identical capacitors are connected in parallel to a potential difference V. These capacitors are then reconnected in series, their charges being left undisturbed. The potential difference obtained is

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9. In the arrangement shwn in Fig.4.96, plate (B) given a charge equal to

60

μC, The ratio d_1 / d_2 is 2. Then

$q_1 =$ ___

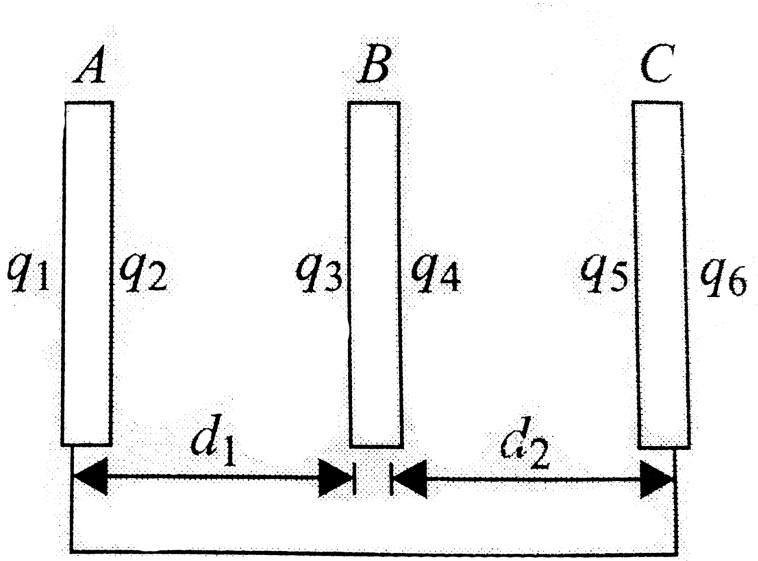
$q_2 =$ _____

$q_3 =$ _____

$q_4 =$ _____

$q_5 =$ _____

$q_6 =$ _____



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10. In plate A has $100\mu C$

charge, while plate B has $60\mu C$ charge.

a. When both switches are open, then

$q_1 =$ _____

$q_2 =$ _____

$q_3 =$ _____

$q_4 =$ _____

b. When switch S_1 is closed,

the

$q_1 =$ _____ , $q_2 =$ _____

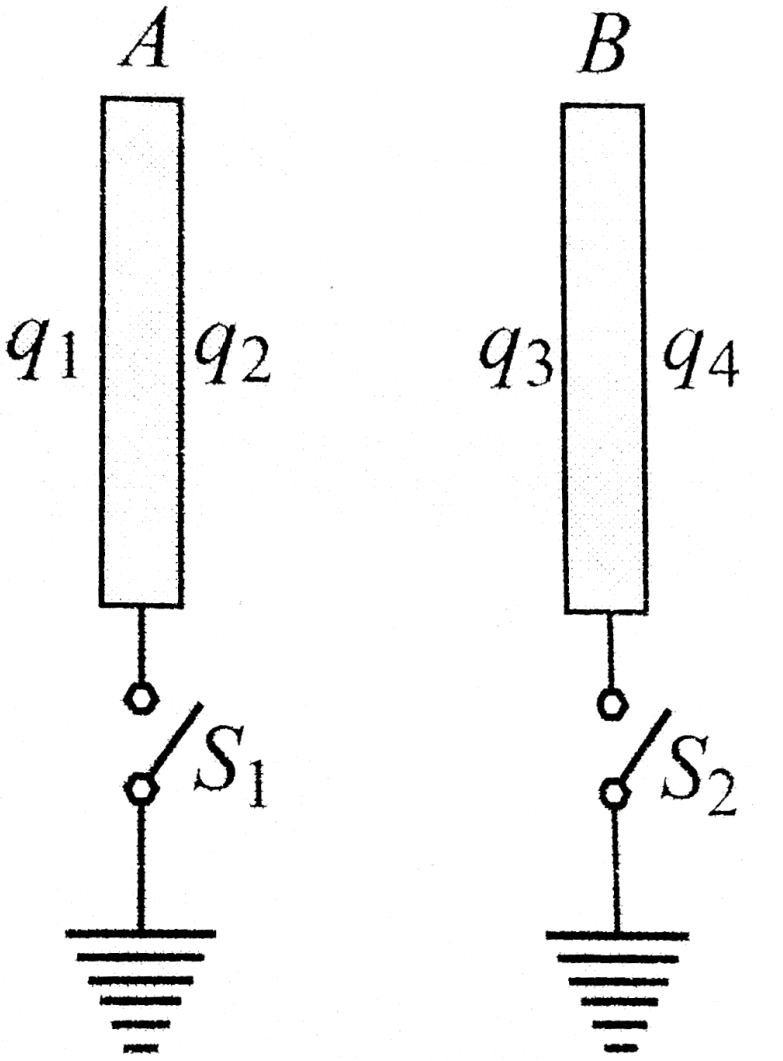
$q_3 =$ _____ , $q_4 =$ _____

c. When switch S_1 is also closed, then

$q_1 =$ _____

$q_2 =$ _____

$q_3 =$ _____ ltbrlt $q_4 =$ _____ .



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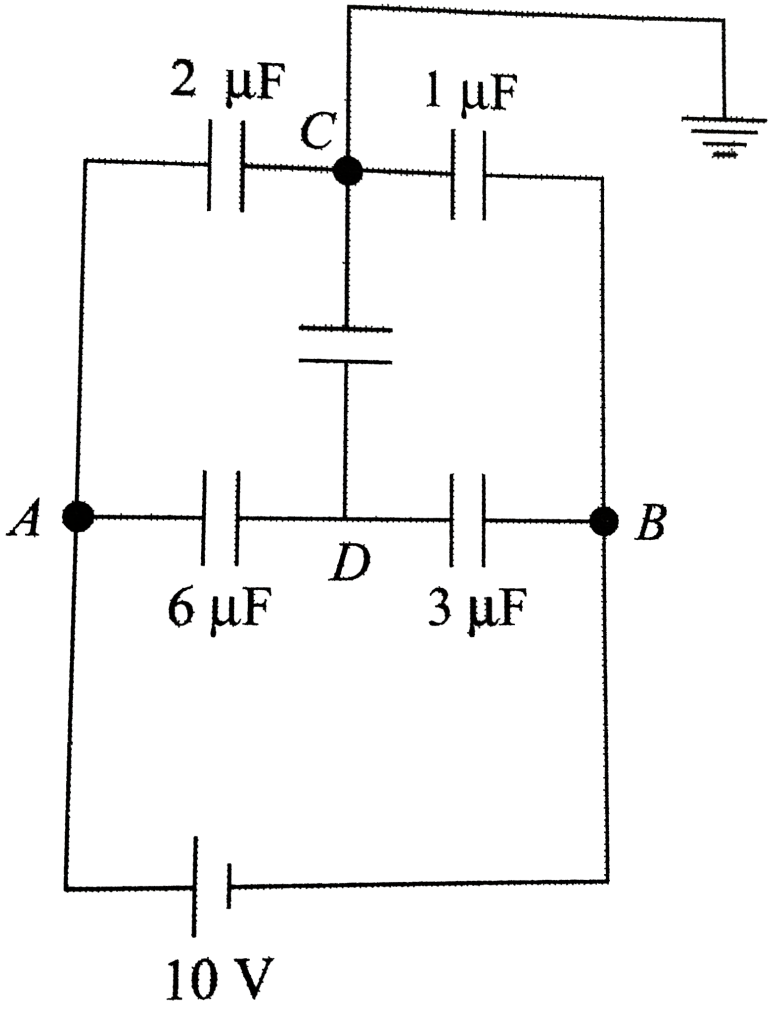
11. For the network of capacirors as shown in figure.



a. Find the potential of junction B.

b. Find the potential of function D,

c. Find the charge on $2\mu F$ capacitor.

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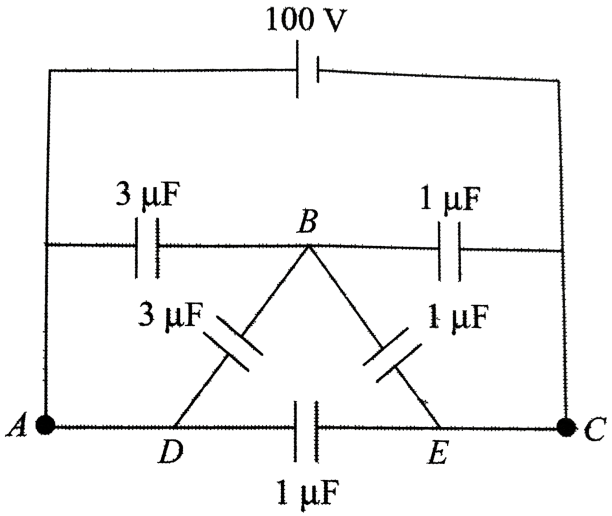
12. In the system is in steady state. Then

a. $V_A - V_B =$ _____

b. $V_B - V_C =$ _____

c. $V_D - V_e =$ _____

d. The energy stored in the circuit is "_____"`



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13. Find whether the following statements are true or false.

a. If a battery is connected across a circuit consisting of two identical

capacitors, it is found that, in steady state, the two capacitors must be in series with each other.

b. If a battry is connected across a ciruit consisting of two capacitors having differnt capacitances, it is found that, in steady state, the two capacitors has equal charge, then two capacitors must be in seties with each other.

c. If a battery is connected across a circuit cansisting of two identical capacitors, it is found that, in steady state, the two capacitors have equal charge, then the two capacitors may be in series with each other.

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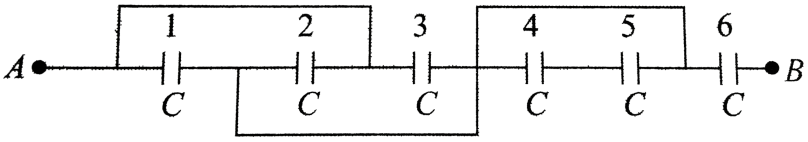
14. Find the equicalent capacitance between points A and B as show in



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15. Three capacitors C_1, C_2 and C_3 are connected as shown in, The potentials of P, Q, and R are $V_1, V_2,$ and V_3, respectively. Find the potential V_0 at the function$O$.

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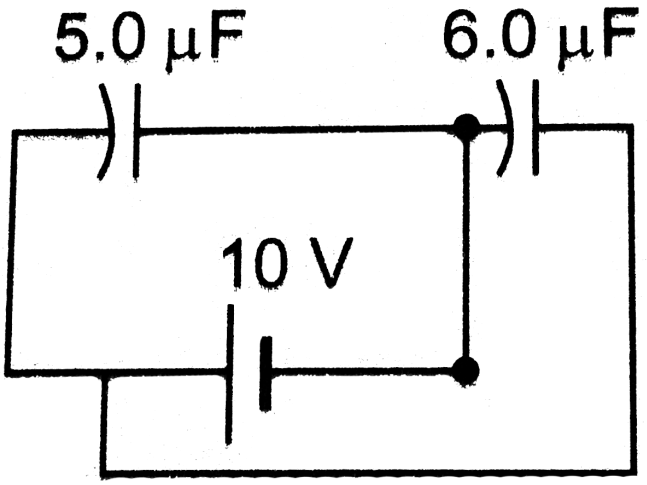
16. Find charge supplied by the bettery in the arrangement shown in figure.



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17. Two large parallel metal plates, each having area A , are or $ientedh$ or $izontally$ and $separatedbyadis$ tan ce3d . $Agroundedconduct \in gwirejo \in sthem,$ and $\in itiallyeachplatecarrie$ Q` is inserted between the two plates, parallel to them and lacated a distance (d) from the upper plate, as shown in. What induced charge appears on each of the two original plates?

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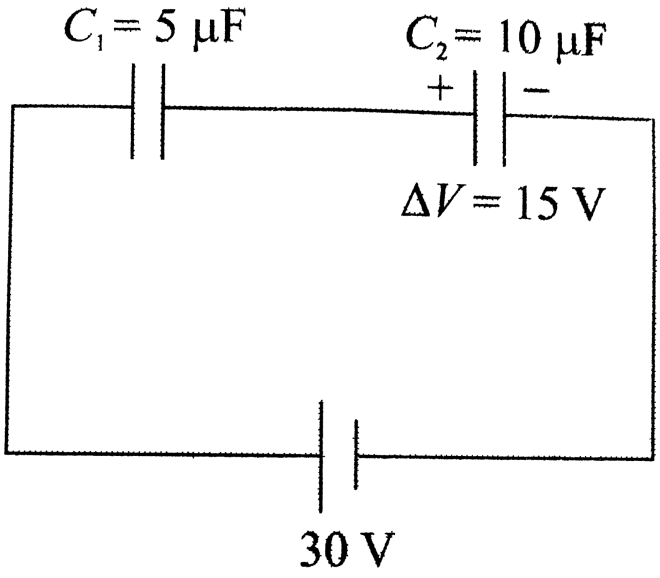
18. A $10\mu F$ capacitor is charged to $15V$. It is next connected in seties with an uncharged $5\mu f$ capacitor. The series cambination is finally connected across a $30V$ battery, as shown in. Find the new potential differnce across

the $5\mu F$ and $10\mu F$ capacitors.



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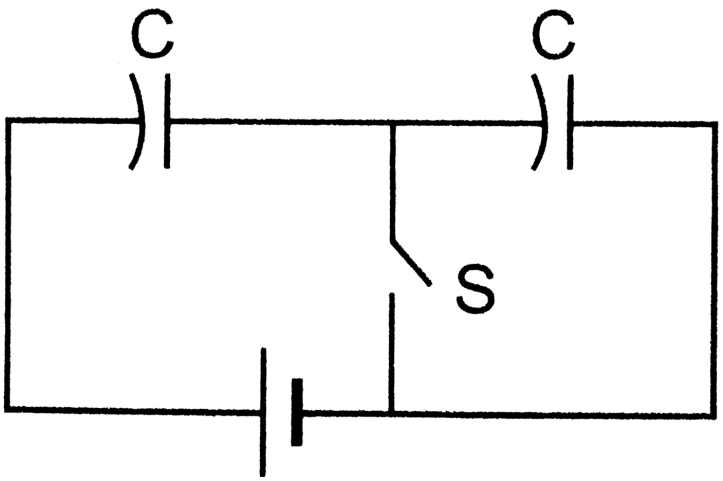
19. Consider the situation shown in figure (31-E23) . The switch S is open for a long time and then closed . (a) Find the charge flown through the

battery when the switch S is closed (b)Find the work done by the battery .



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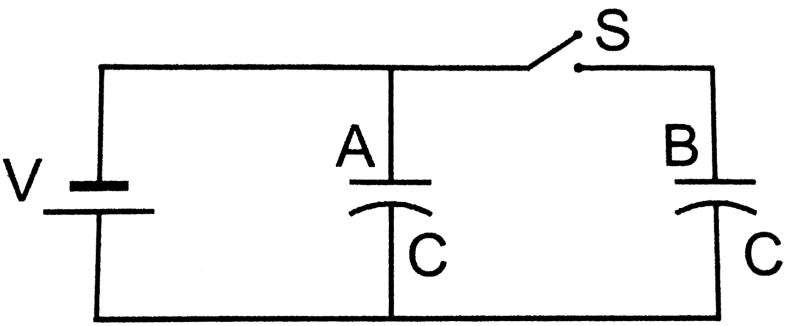
20. Figure shows two identical parallel plate capacitors connected to a switch S. Initially ,the switch is closed so that the capacitors are completely charged .The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant 3. Find the ratio of the initial total energy stored in the

capacitors to the final total energy stored.



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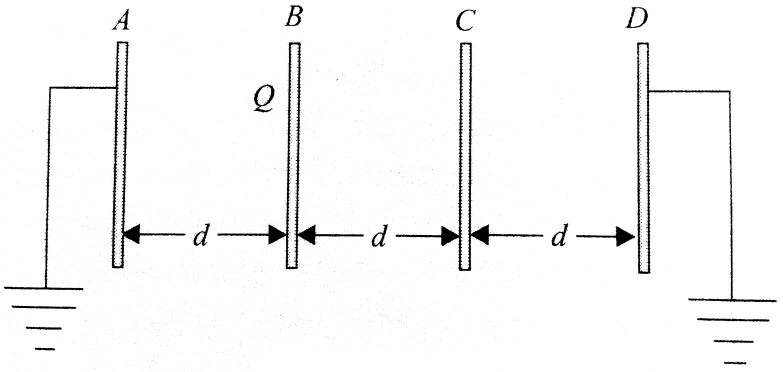
21. Four parallel large plates separated by equal distance d are arranged as shown in. The area of the plates is S Find the potential differnce between plats B and C if plate B is given a charge Q.



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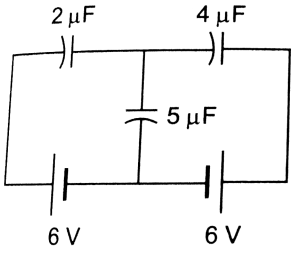
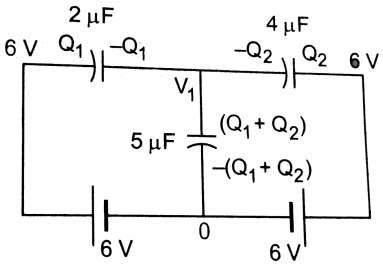
22. Find the charges on the three capacitors shown in figure



(a)



(b)

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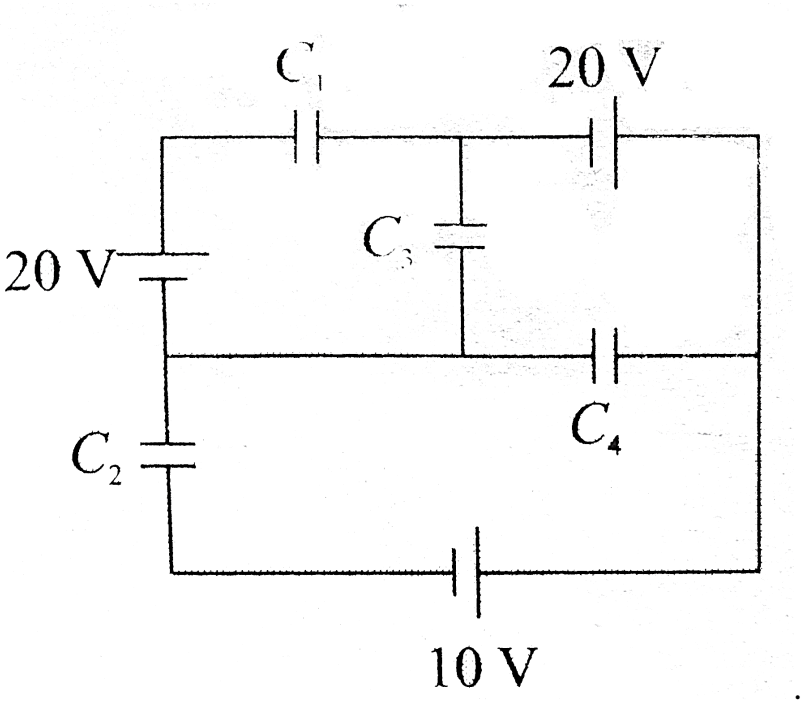
23. Four capacitors $C_1 = 8\mu F$,

$C_2 = 2\mu f$, $C_3 = 6\mu F$, and $C_4 = 6, \mu F$ are arranged as shown in. Find

the charge on all the capacitors in the circuit.



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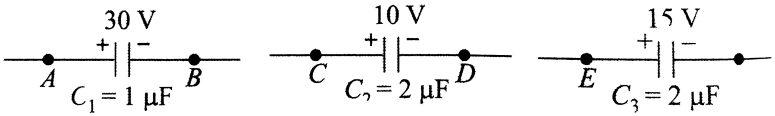
24. Three capacitors of capacitances $1\mu F$, $2\mu F$, and $2\mu F$, are cahrged up to the potential difference $30V$, $10V$, and $15V$, respectivly. If terminal A is connected with DC is connected with E and F is connected eith B, the

find the charge flow in the ciruit and the final charge on the capacitors.



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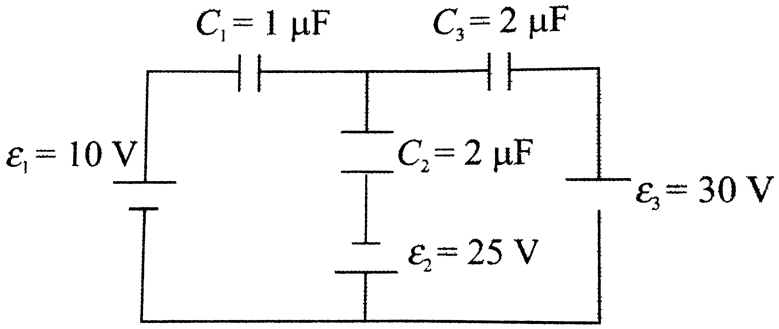
25. Three initially uncharged capacitors are arranged with batteries as shown in. Find the charge on each capacitor.



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26. A capacitor of capacitance C which is initially charged up to a potential differnce ε is connected with a battery of emf $\frac{\varepsilon}{2}$ such that the

positive terminal of the battery is connected with the positive plate of the capacitor. Find the heat loss in the circuit the process of charging.

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27. A $5.0\mu F$ capacitor is charged to $12V$. The positive plate of this capacitor is now connected to the negative terminal of a $12V$battery and vise versa . Calculate the heat developed in the connecting wires.

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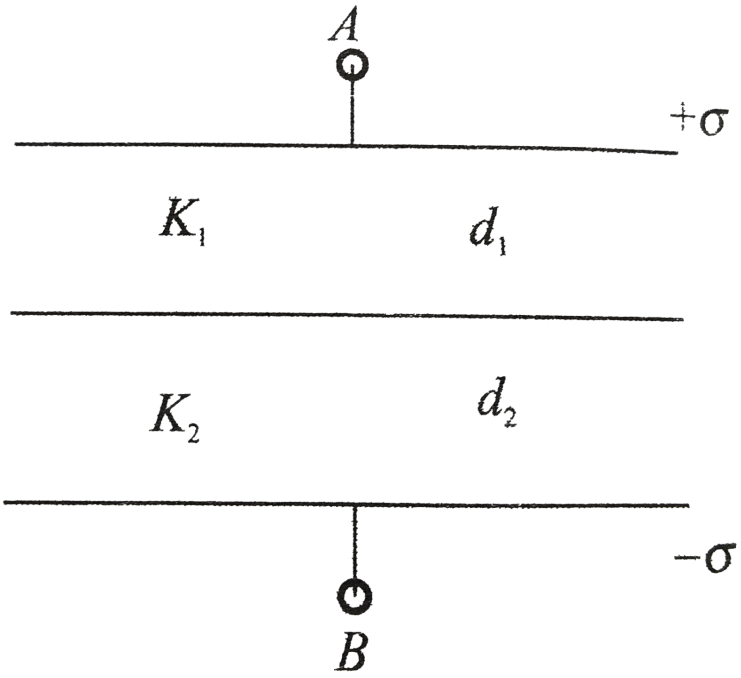
28. Find the capacitance between A and B if two dielectric alabs (each of area A) of dielectric constants K_1 and K_2 and thicknesses d_1 and d_2 are

inserted between the plates of a parallel plate capacitor of plate area A.



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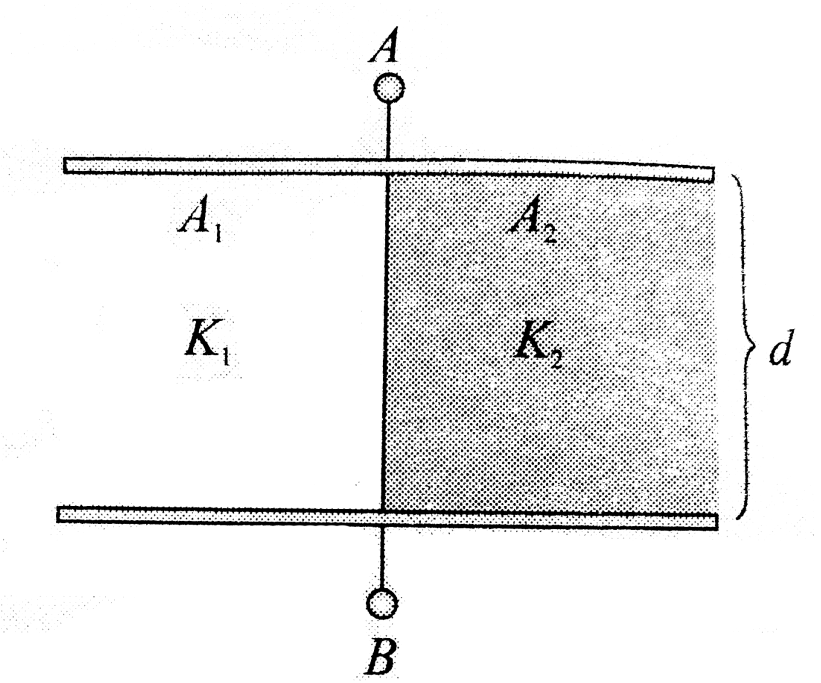
29. Find the capacitance between A and B if two dielectric slabs (each of thickness d) of dielectric constants K_1 and K_2 and areas K_1 and K_2 and

inserted between the plates of a parallel plate capacitor of plate area A.



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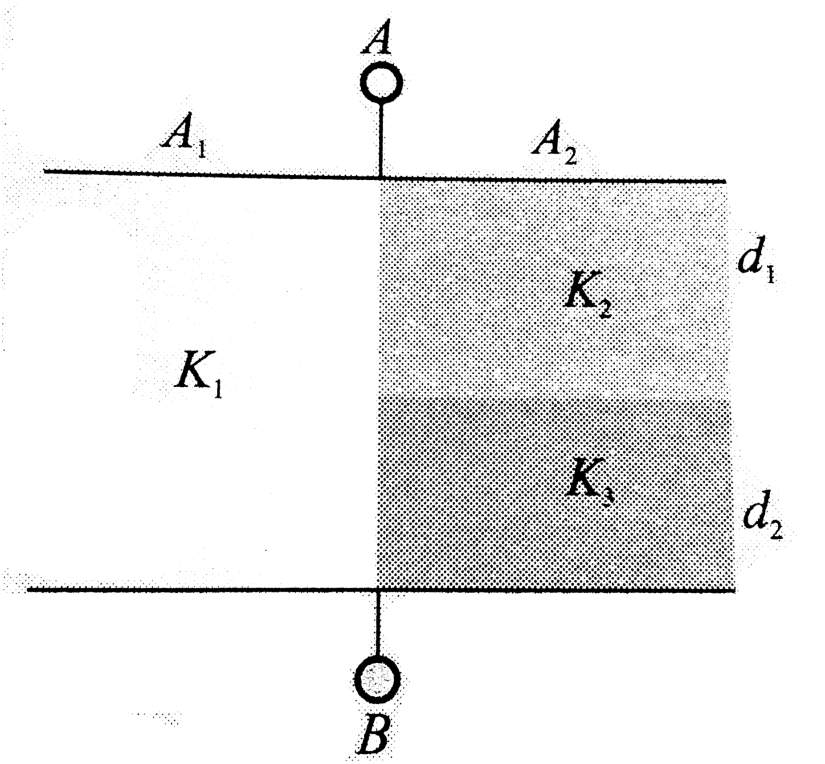
30. Find the capacitance between A and B if three dielectric slabs of dielectric constants $K_1 area$A _(2) and $thick \neq ss$d_(2) $\Big)are \in sertedbetweentheplatesofaparal \leq llate \cap aci \rightarrow rofplateareaA$

d_(1)=d_(2)+d_(2)`.)



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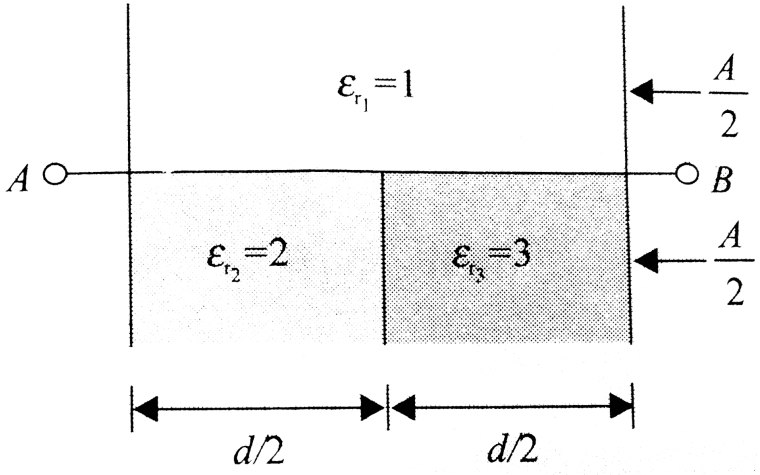
31. Three dielectrics of relative permittivities $\varepsilon_{r_1} = 1$, $\varepsilon_{r_2} = 2$, and $\varepsilon_{r_3} = 3$ are introduced in a parallel plate capacitor of plate A and B. Find

equivalent capacitance between A and B



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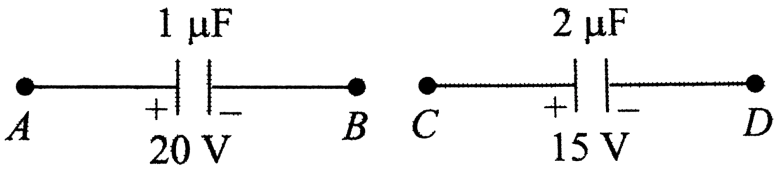
32. T Two capacitors of capacitances $1\mu F$ and $2\mu F$ are charged to potential differnces $20V$ and $15V$ as shown in. If terminals B and C connected together and terminals A and D are connected with the positive and negative ends of the battery, respectively, then find the final charges on both the capacitors.



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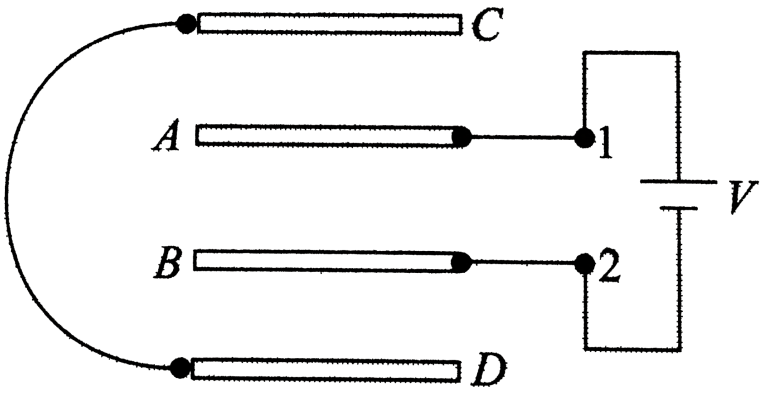
Subjective

1. Four identical metal plates are arranged in air at equal distance d from each other. The area of each plate is A. A batery of emf V is connected across plates 1 distribution and find the capacitance of the system between points 1 and 2 if the other two plates are connected by a conducting wire as shown in.



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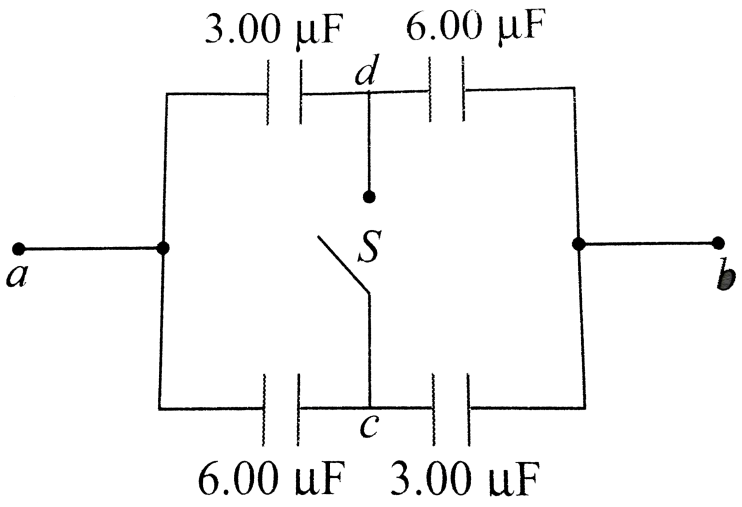
2. The capacitors in are initially uncharged and are cannected as in the diagram with switch S open. The applied potential differnce is $V_{ab} = +360V$.



a. What is the potential differnce V_{cd}

b What is the potential deffernce across each capacitor afrer switch S is closed?

c. How much charge will flow through the awitch after it is closed?

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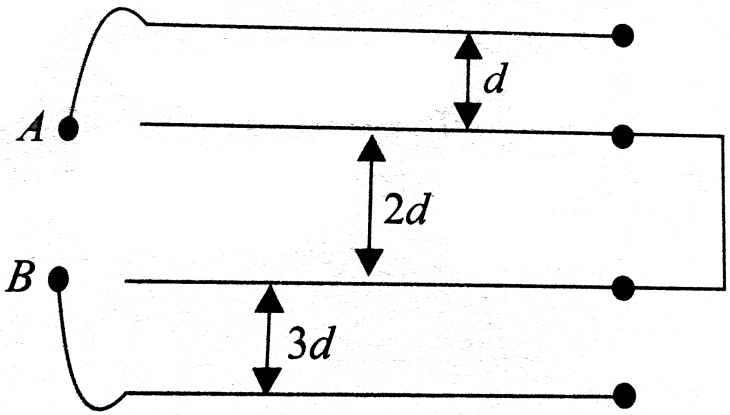
3. If the area of each plate is A and then successive separations are d, $2d$ and $3d$, then find the equivalent capacitance across A and B.



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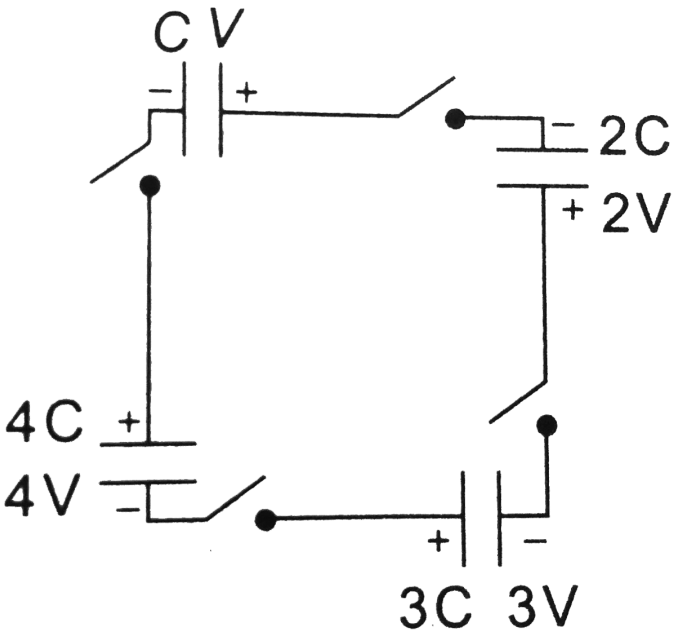
4. Condensers with capacities$C, 2C, 3C$ and $4C$ are charged to the voltage, $V, 2V, 3V$ and $4V$ correspondingly. The circuit is closed. Find the

voltage on all condensers in the equilibrium.



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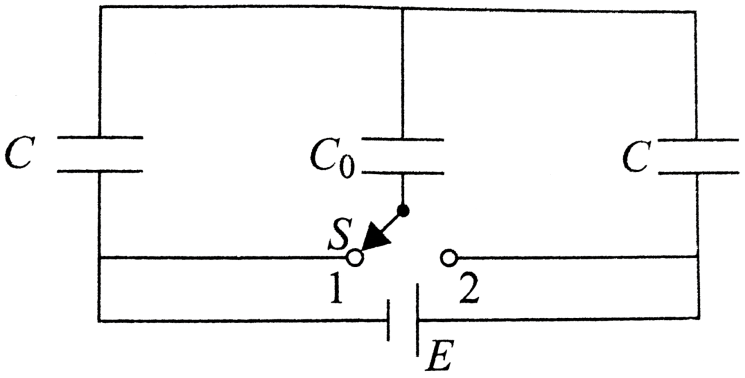
5. In when the switch is swapped from 1 to 2, find the heat produced in the circuit.



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6. A capacitor of capacitance $C_1 = 1\mu F$ withstand a maximum voltage of $V_1 = 6KV$, and another capacitor of capacitance $C_2 = 2\mu F$, can with stand a maximum voltage of $V_2 = 4KV$. If they are connected in series, what maximum voltage will the system withstand?

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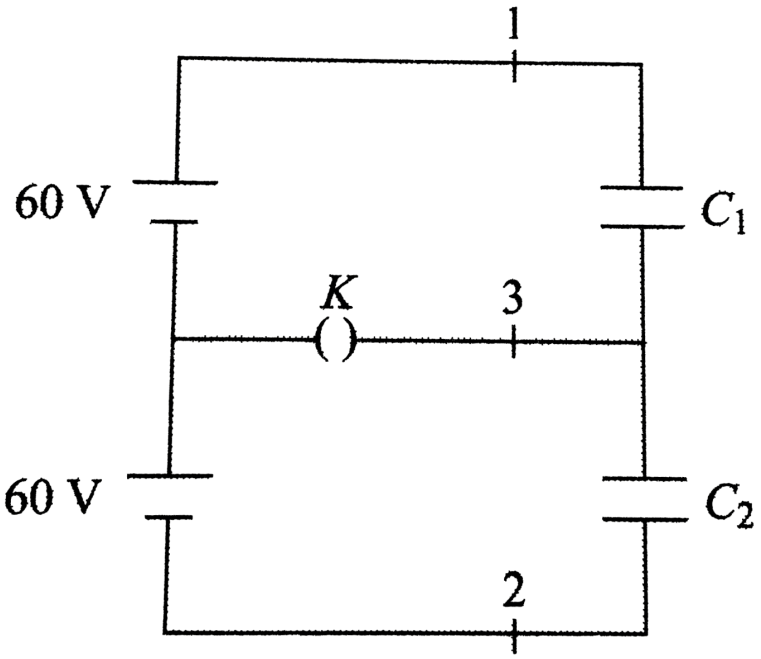
7. In the circuit shown , the emf of each battery is $60V$ and $C_1 = 2\mu F$ and $C_2 = 3\mu F$. Find the charges that will flow through the sections 1, 2 and 3

after the Key is closed.



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8. A parallel plate capacitor contanins a mica sheet (thickness $0.5+\times 10^{-3}m$) . And a sheet of fiber (thickness $0.5\times 10^{-3}m$) . The dielectric constant of mica is 8 and that of thye fiber is 2.5 Assuming that the fiber breaks down when subjected to an electric field of $6.4\times 10^{6}Vm^{-1}$. , find the maximum safe voltage that can be applied to the capacitor.

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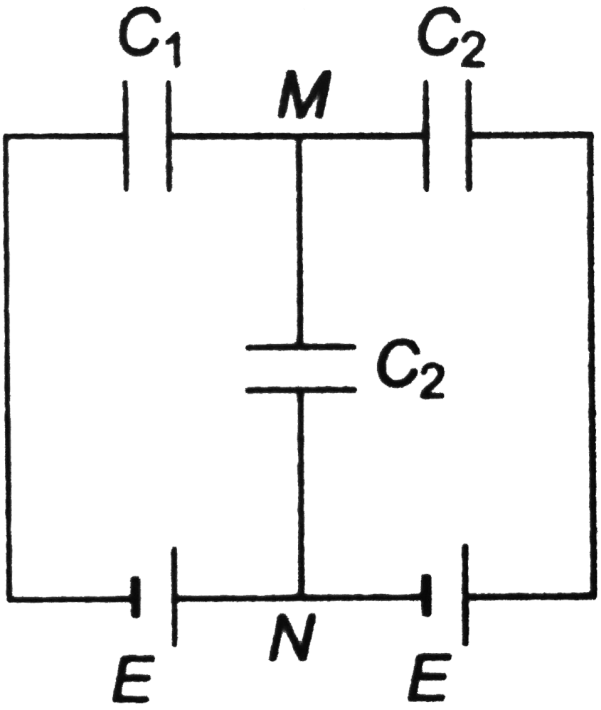
9. Find the potential difference between points M and N of the system shown in figure, if the emf is equal to $E = 110V$ and the capacitance ratio $\frac{C_1}{C_2} is 2.$



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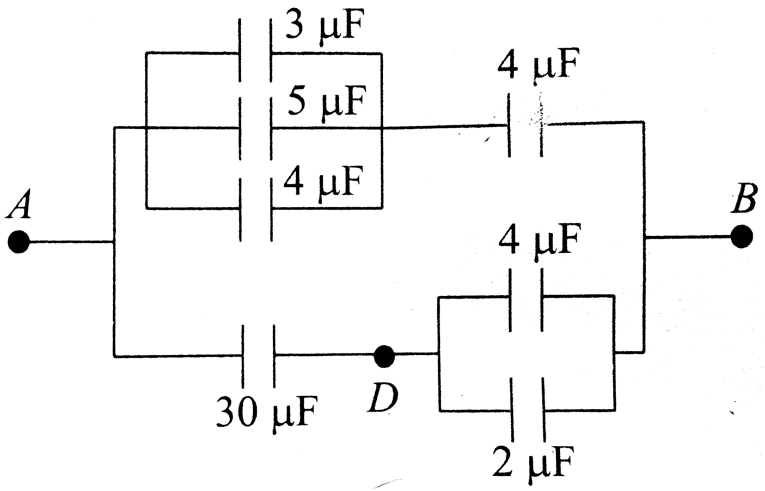
10. Several capacitors are connected as shown in. If the charge on the $5\mu F$ capacitor is $120\mu C$, the potential between points A and D` is



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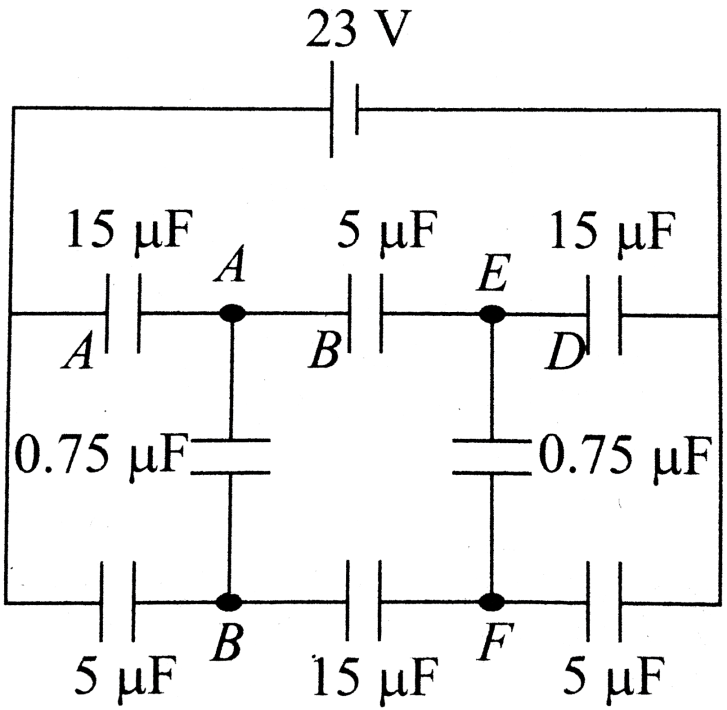
11. Find the potential differnce between the points A and B and that between E and F of the circuit in.



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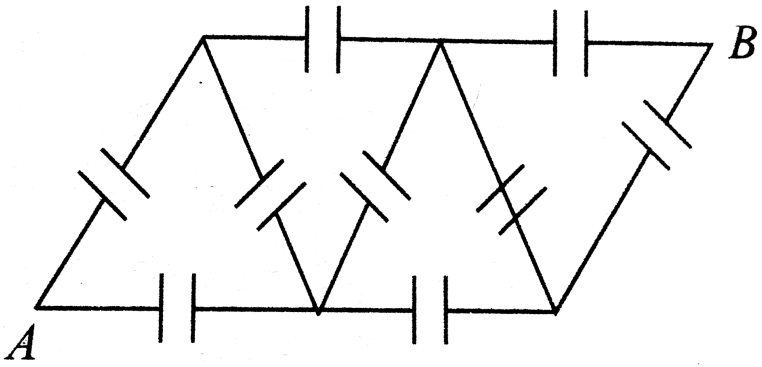
12. Some capacitors each of capacitance $30\mu F$ are connected as shown in.

Calculate the equivalent capacitance between terminals A and B



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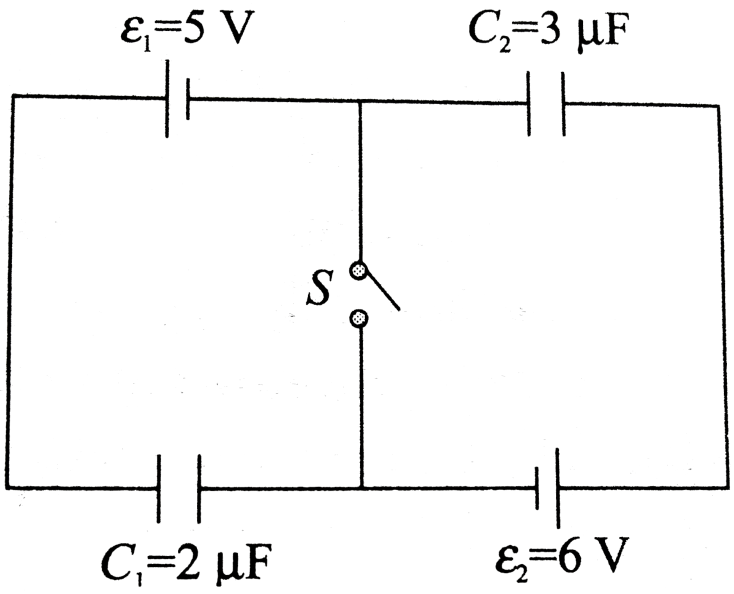
13. Two capacitors C_1 and C_2 are connected with two batteries of emf ε_1 and ε_2. The circuit components are connected with a switch S as shown in. Initially the switch is open and the capacitors are charged. Find the

heat produced when switch S is closed.



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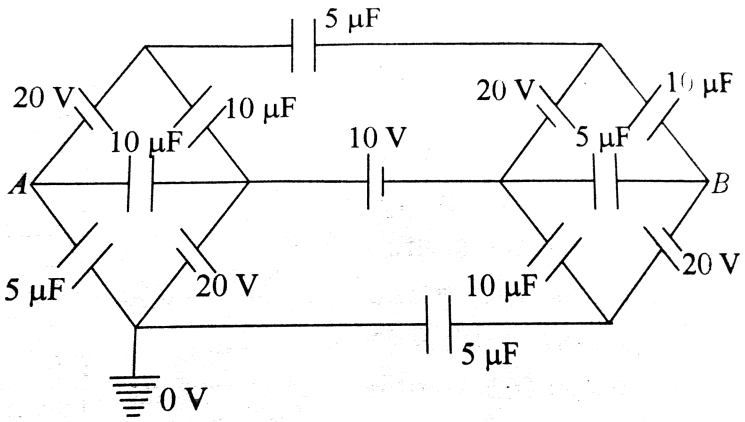
14. Find the potential difference between the points A and B in the circuit shoun in.



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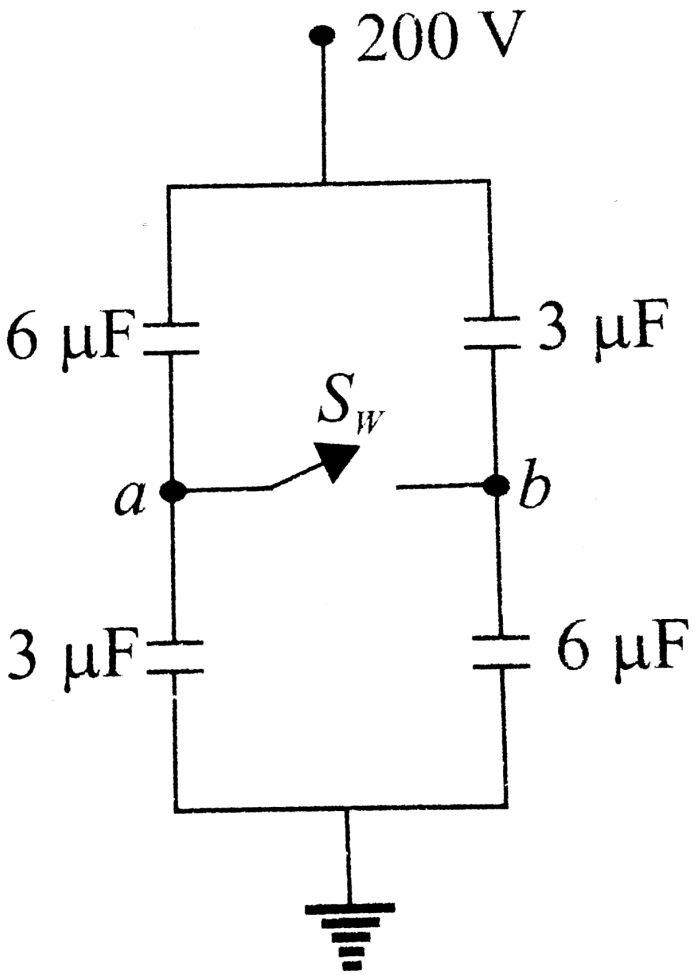
15. Shows a capacitive circuit, with a switch S_W.



a. What is the potential difference between a and b when the switch is open?

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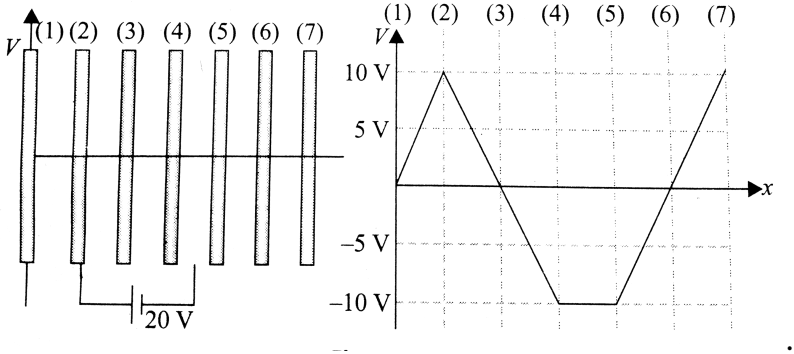
16. Shows an arrangement of identical metal plates paraed parallel to each other. The diagram also shows the variation of potential berween the plates . Using the details given in the diagram, find the equivalent capacitance connected across the battery (sepaaration between the consecutive plates is equal to l and the cross-sectional area of each plate is A).



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17. Two identical capacitors connected as shown and having initial charge Q_0 separation between plates of capacitor is d_0. Suddenly the left plate of upper capacitor start moving with velocity V towards left and right plate of capacitor remains fixed, (given $\frac{Q_0 v}{2d} = 1A$). Find the value of

current (in amp) in the circuit

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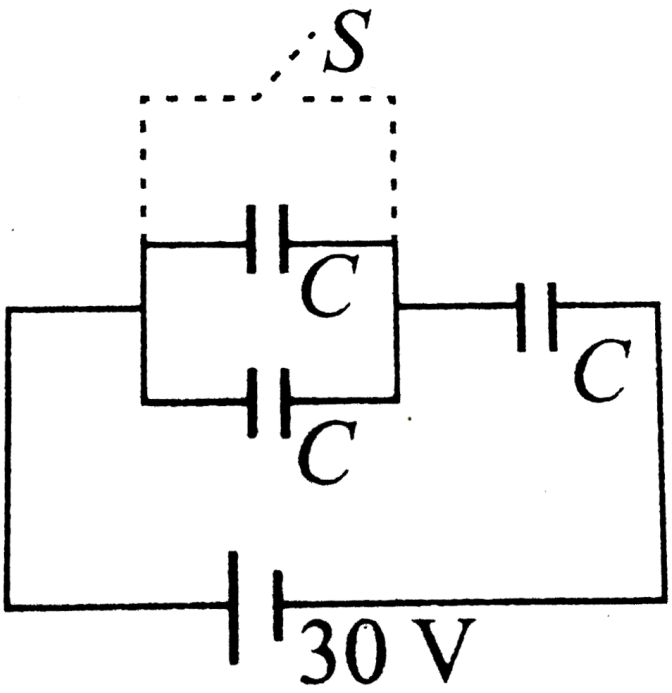
18. Three capacitors each having capacitance $C = 2\mu F$ are connected with a battery of emf$30V$ as shown in. when the switch S is closed, find

a. the amount of charge flowing through the battery ,

b. the heat generated in the circuit,

c. the energy supplied by the battery,

d. the amount of charge flowing through the switch S.



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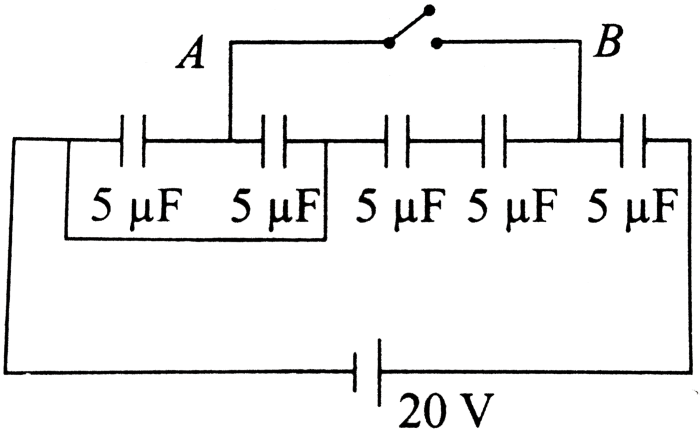
19. Five identical capacitors each of magnityde $5\mu F$ are arranged with a battery of emf $20V$ as shown in . Initially, the switch is open. The charge

that flows from point A to point B, when the switch is closed.



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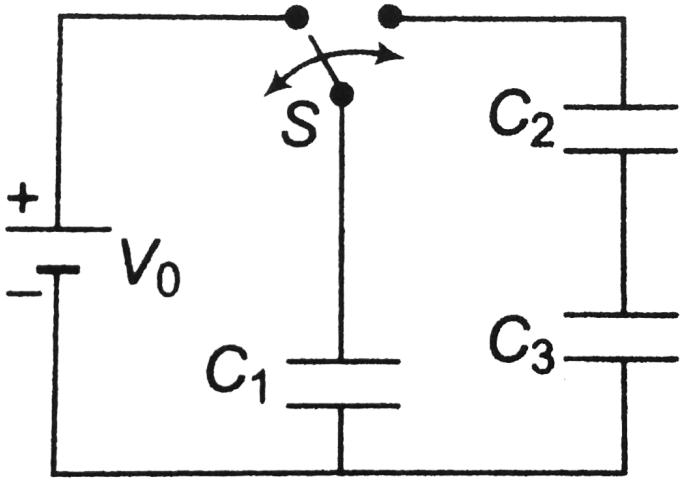
20. When switch S is thrown to the left in figure, the plates of capacitor 1 acquire a potential difference V_0. Capacitors 2 and 3 are initially uncharged. The switch is now thrown to the right. What are the final

charges q_1, q_2 and q_3 on the capacitors?



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21. A capacitor of capacitance C_0 is charged to a patential V_0 and then isolated. A small capacitor C is then charged from C_0, discharged and charge again, the process being is decreased to V. Find the value of C.

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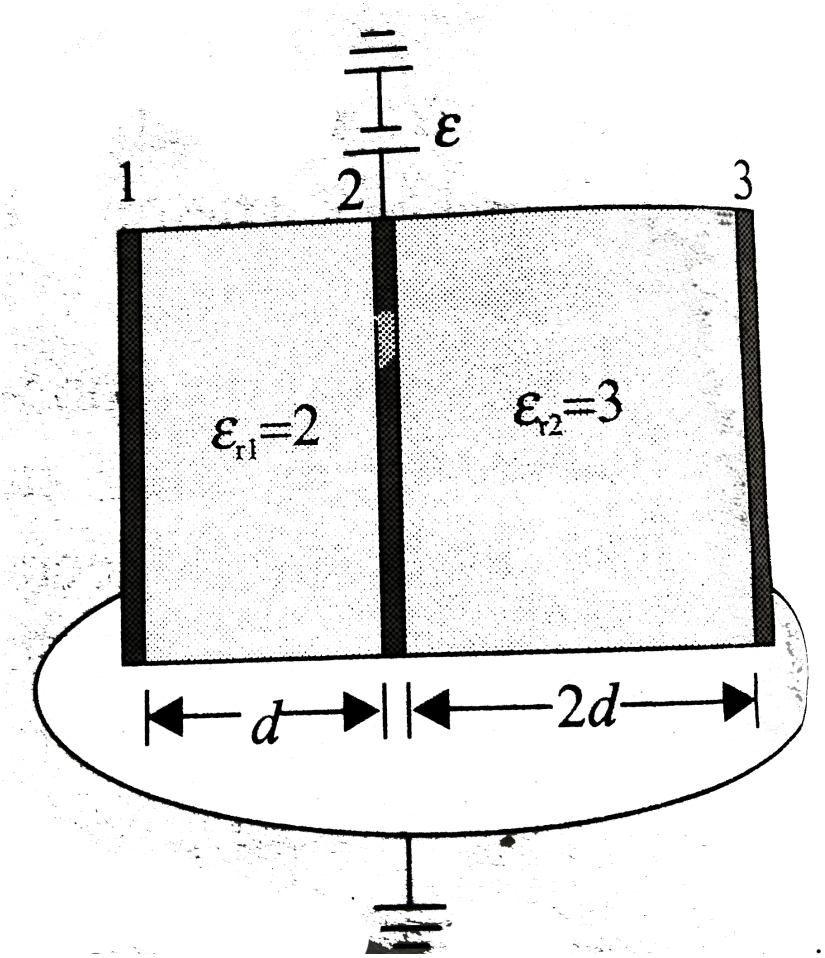
22. Two dielectric slabs of relative oremittivities

$\varepsilon_{r_1} = 2$ and $\varepsilon_{r_2} = 3$ and thickness $s = 2d$ are filled in between the grounde plattery each of area A If a battery of emf ε is connected to the middle conducting plate, dind the

a. capacitance of the system,

b. charge flowing through the battery,

c. energy stored in the system.



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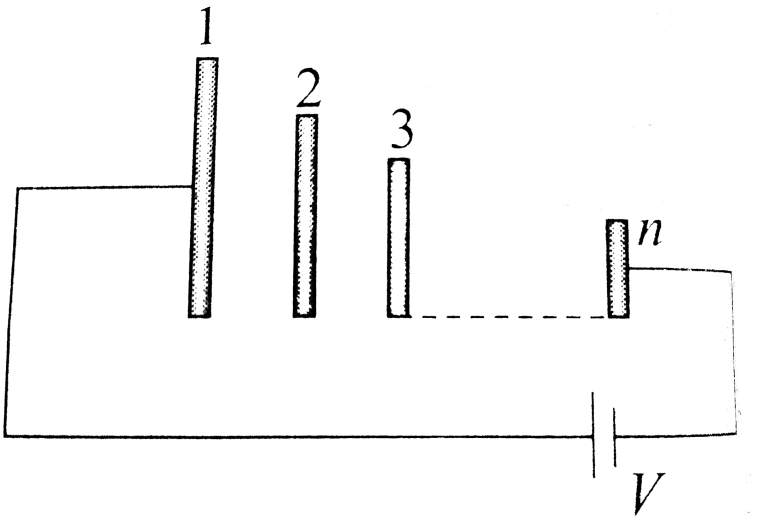
23. Suppose n conducting face to face, and the distance between two successive plates is d. Each plate is half of the area of the previous one. If area of first plate is A



(i) If the area of the first plate is A, find the equyivalent capacitance of the system.

(ii) If a cell of emf V is connected as shown in and a dielectric of dielectric constant k is inserted between the first and second plates, dind the charge on the nth plate.

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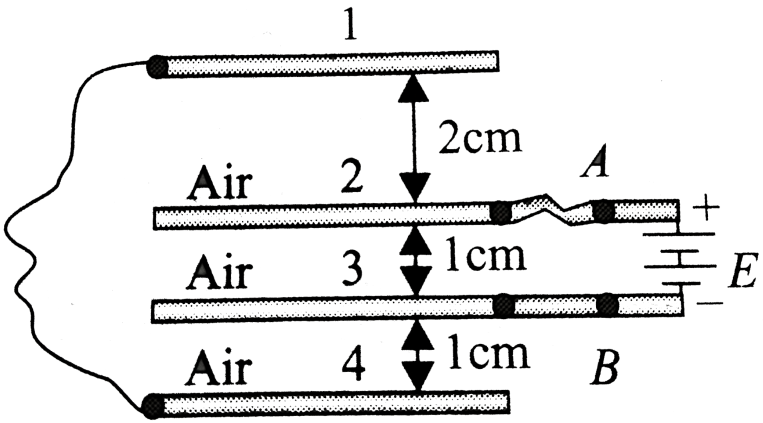
24. The arrangement of parallel conducting plates shown in are of the same surgface area $A = 10cm^2$. A battery of $E = 10V$ is connected aross the kends A and B. Plate 2 is slowly moved upward by some exteral force.



find the position of plate at which the energy stored in the system is minimum. Also, find this mimimum energy Take $\varepsilon_0 = 8.8 \times 10^{-12} Fm^{-1}$.

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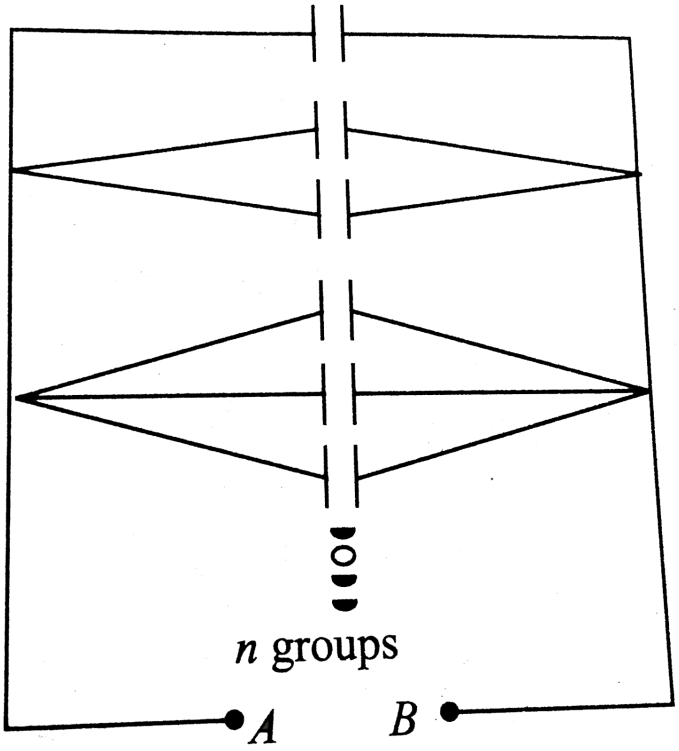
Single Correct

1. A number of capacitors, each euqal capacitance C, are arranged as shown in . The equialent capacitance between A and B is



A. n^2C

B. $(2n+1)C$

C. $\frac{(n-1)n}{2}C$

D. $\frac{(n+1)n}{2}C$

Answer: D

Watch Video Solution

2. The plates of a parallel plate capacitor are charge upto 100 V. A 2 mm thick insulator sheet is inserted between the plates. Then to maintain the capacitor plates is increased by 1.6 mm, dielectric constant of the insulator is

A. 5

B. 1.25

C. 4

D. 2.5

Answer: A

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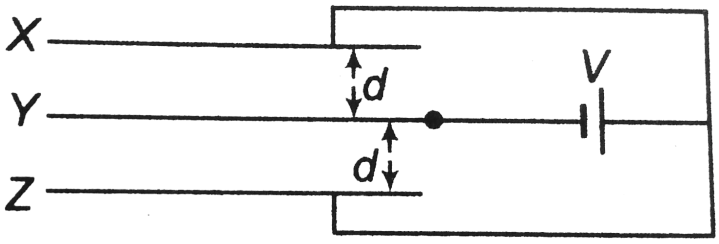
3. Consider the arrangement of three plates X, Y and Z each of the area A and separation d. Find the energy stored when the plates are fully

charged.



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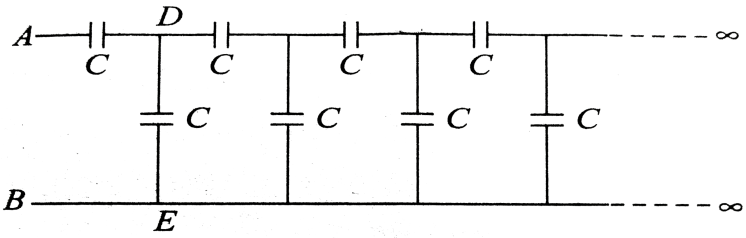
4. The equivalent capacitance of an infinite ladder of a circuit formed by the repetition of the same link consisting of identical capacitors, each with capacitance C, is



A. *zero*

B. $\frac{\sqrt{5}-1}{2}C$

C. $\frac{\sqrt{5}+1}{2}C$

D. infinite

Answer: B

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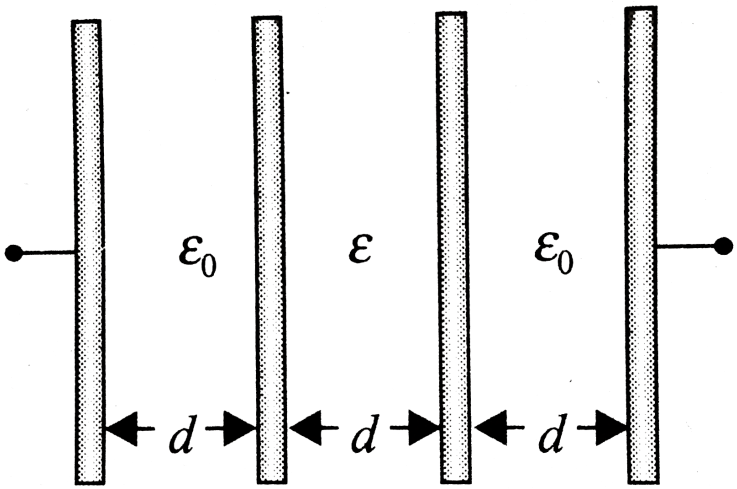
5. For the configuration, having parallel plates each of area A, as shown in the equivalent capacitance is .



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

B. $\varepsilon\varepsilon_0 A / d$

C. $\frac{\varepsilon\varepsilon_0 A}{d(\varepsilon+\varepsilon_0)}$

D. $\frac{\varepsilon\varepsilon_0 A}{(2\varepsilon+1)d}$.

Answer: D

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6. A parallel plate capacitor is connected across a battery. Now, keeping the battery connected, a dielectric slab is inserted between the plates. In the process,

A. no work done

B. work is done by the battery and the stored energy increases.

C. work is done by the external agent, and the stored energy decteases. It

D. work is done by the battery as well as the external agent, but the stored energy done not charge.

Answer: B

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7. Seven capacitors each of capacitance $2\mu F$ are to be connected in a configuration to obtain an effective capacitance of $\left(\frac{10}{11}\right)\mu F$. Which of the combination (s) shown in figure will achieve the desired result?

A. 2 in parallel, 5 in series

B. 3 in parallel, 4 in series.

C. 4 in parallel, 3 in series

D. 5 in parallel, 2 in series

Answer: D

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8. A sherical capacitor has an inner sphere of radius $12cm$ and an outer spere of radius $13cm$. The outer sphere is earthed, and the inner sphere is given a charge of $2.5\mu C$. The space between the concentric spjheres is filled with a liquid of dielectric caonstant 32. Determine the potential of the inner sphere.

A. $400V$

B. $450V$

C. $500V$

D. $300V$

Answer: B

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9. A pararllel plate capacitor has plates of area A and separation d and is charged to potential diference V. The charging battery is then

disconnected and the plates are pulle apart until their separation is $2d$. What is the work required to separate the plates?

A. $2\varepsilon_0 AV^2/d$

B. $\varepsilon AV^2/d$

C. $3\varepsilon_0 AV^2/2d$

D. $\varepsilon_0 AV^2/2d$

Answer: D

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10. The separation between the plates of a charged parallel-plate capacitor is increased. Which of the following quantities will change?

A. The charge on the capacitor increases.

B. The charge on the capacitor decreases.

C. The capacitance of the capacitor increases.

D. The potential difference across the plates increases.

Answer: D

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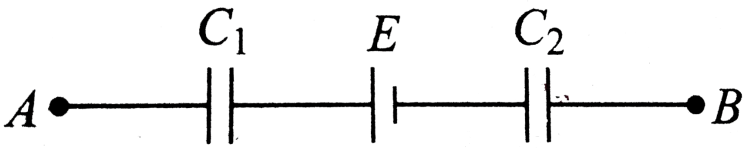
11. For section AB of a circuit shown in , $C_1 = 1\mu F, C_2 = 2\mu F, E = 10V,$ and the potential difference $V_A - V_B = -10V$. Charge on capacitor C_1 is



A. $0\mu C$

B. $20/3\mu C$

C. $40/3\mu C$

D. none of these

Answer: C

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12. A $600pF$ capacitor is charged by a $200V$ supply. It is then disconnected from the supply and is connected to another uncharged $600pF$ capacitor. What is the common potential in V and energy lost in J after reconnection?

A. $100, 6 \times 10^{-6}$

B. $200, 6 \times 10^{-5}$

C. $200, 5 \times 10^{-6}$

D. $100, 6 \times 10^{-5}$

Answer: A

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13. Two parallel plate capacitors of capacitances C and 2C are connected in parallel and charged to a potential difference V. The battery is then

disconnected and the region between the plates of the capacitor C is completely filled with a material of dielectric constant K. The potential differences across the capacitors now becomes.....

A. $\frac{2V}{K+2}$

B. $\frac{V}{K+2}$

C. $\frac{3V}{K+3}$

D. $\frac{3V}{K+2}$

Answer: D

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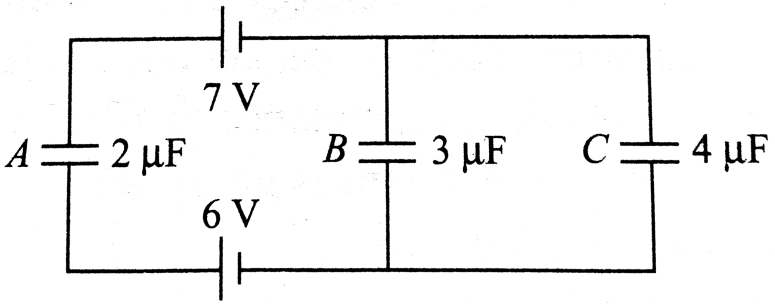
14. Three capacitor A, B, and C, are connected in a circuit as shown in. What is the charge in μC on the capacitor B?



A. $1/3$

B. $2/3$

C. 1

D. $4/3$

Answer: B

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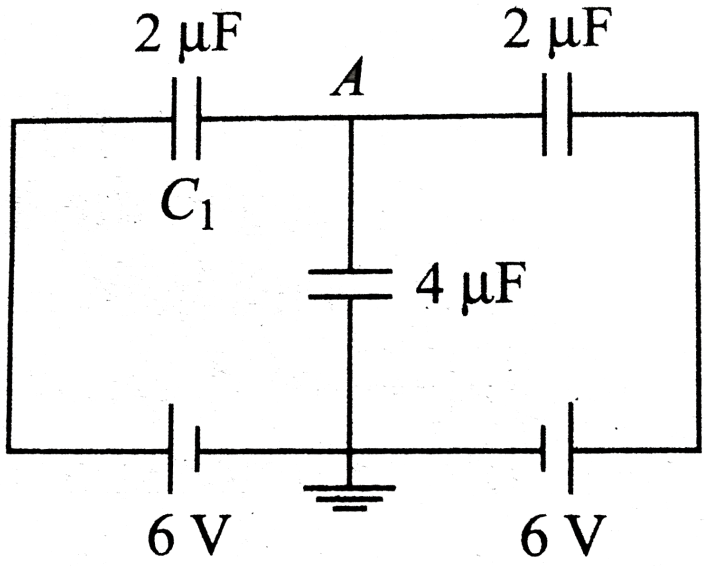
15. Three capacitors are connected as shwn in. Then, the charge on capacitor C_1 is .



A. $6\mu C$

B. $12\mu C$

C. $18\mu C$

D. $24\mu C$

Answer: A

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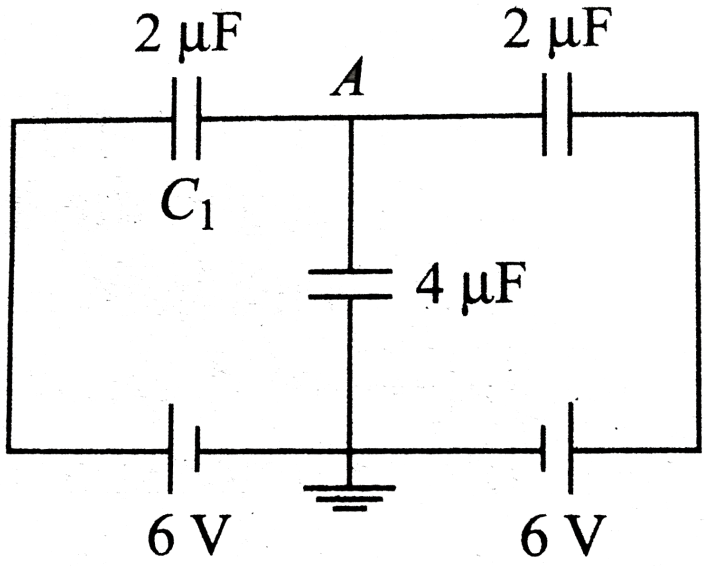
16. Three capacitors are connected as shown in fig.



. In this question, the potential of point A is `

A. $3V$

B. $6V$

C. $9V$

D. zero

Answer: A

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17. A capacitor of capacitance $C_1 = 1.0\mu F$ charged upto a voltage $V = 110V$ is connected in parallel to the terminals of a circuit consisting of two uncharged capacitors connected in series and possessing the capacitance $C_2 = 2.0\mu F$ and $C_3 = 3.0\mu F$. What charge will flow through the connecting wires?

A. $40\mu C$

B. $50\mu C$

C. $60\mu C$

D. $110\mu C$

Answer: C

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18. Ten capacitors are joined in parallel and charged with a battery up to a potential V. They are then disconnected from the battery and joined in

series. Then potential of the combination will be .

A. $1V$

B. $10V$

C. $5V$

D. $2V$

Answer: B

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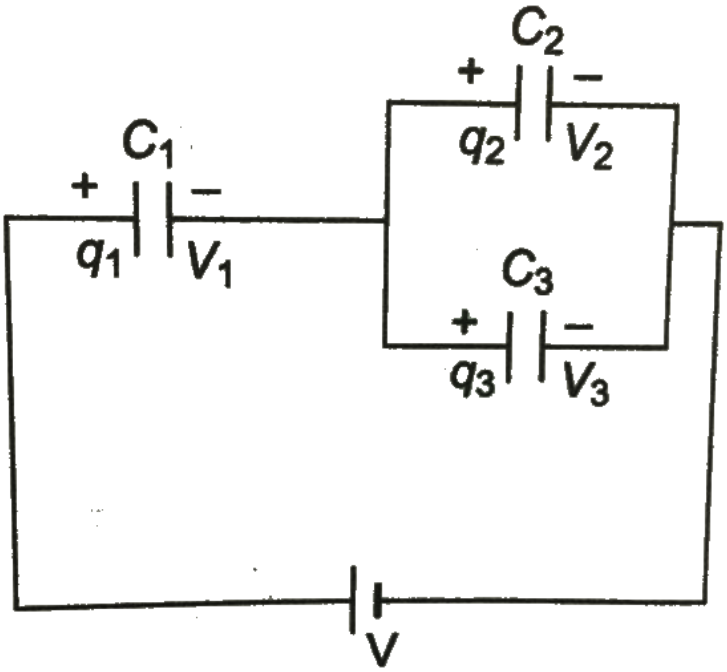
19. In the circuit as shown in figure if all the symbols have their usual meanings, then identify the correct statements,



A. 1. $Q_1 = Q_2 = Q_3$ and

$V_1 = V_2 = V_3 = V$

B. 2. $Q_1 = Q_2 + Q_3$ and

$V = V_1 + V_2 + V_3$

C. 3. $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2$

D. 4. $Q_2 = Q_3$ and $V_2 = V_3$

Answer: c.

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20. An uncharged parallel plate capacitor having a dielectric of dielectric constant K is connected to a similar air core parallel plate capacitor charged to a potential V_0. The two share the charge, and the common potential becomes V. The dielectric constant K is`

A. $\frac{V_0}{V} - 1$

B. $\frac{V_0}{V} + 1$

C. $\frac{V}{V_0} - 1$

D. $\frac{V}{V_0} + 1$

Answer: A

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21. Two identical parallel plate capacitors are connected in series and then joined in series with a battery of $100V$. A slab of dielectric constant

$K = 3$ is inserted between the plates of the first capacitor. Then, the potential difference across the capacitor will be, respectively.

A. $25V, 75V$

B. $75V, 25V$

C. $20V, 80V$

D. $50V, 50V$

Answer: A

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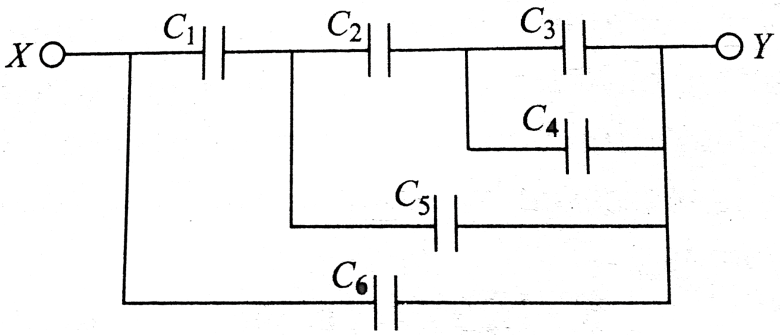
22. In the given network of capacitors as shown in, given that $C_1 = C_2C_3 = 400pF$, and $C_4 = C_5 = C_6 = 200pF$, The effective

capacitance of the circuit between X and Y is.



A. $810pF$

B. $205pF$

C. $600pF$

D. $410pF$

Answer: D

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23. The work done in increasing the potential of a capacitor from V volt to $2V$ volt is W Then, the work done in increasing the potential of the same capacitor from $2V$ volt to $4V$ volt will be.

A. W

B. $2W$

C. $4W$

D. $8W$

Answer: C

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24. A $5.80\mu F$ parallel-plate air capacitor has a plate separation of $5.00mm$ and is charged to a potential difference of $400V$. Calculate the energy density in the region between the plates, in $\frac{J}{m^3}$

A. 0.113

B. 0.117

C. 0.152

D. none of these

Answer: B

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25. Three identical capacitors, each of capacitance C, are connected in series with a battery of emf V and get fully charged. Now the battery is removed and the capacitors are cannected in parallel with positive terminals at one point and negative terminals at other point. Then, The connon potintial will be.

A. V

B. $3V$

C. $V/3$

D. zero

Answer: C

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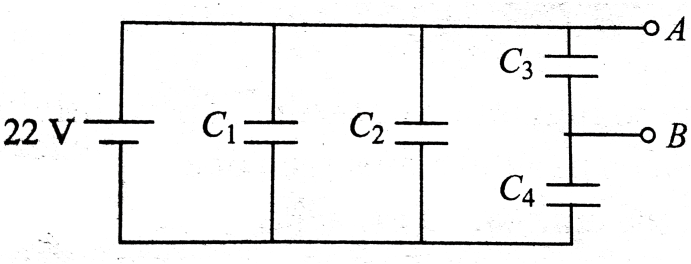
26. In, given $C_1 = 3\mu F$, $C_2 = 5\mu F$, $C_3 = 9\mu F$, and $C_4 = 13\mu F$. What is the potential differnce between points A and B?



A. $13V$

B. $9V$

C. $0V$

D. 11V`

Answer: A

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27. Two condensers C_1 and C_2 in a circuit are joined as shown in figure. The potential of point A is V_1 and that of B is V_2. The potential of point D

will be

A. $\frac{1}{2}(V_1 + V_2)$

B. $\frac{C_1V_2 + C_2V_1}{C_1 + C_2}$

C. $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

D. $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

Answer: C

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28. A capacitor is charged with a battery and energy stored is U. After disconnecting battery another capacitor of same capacity is connected in parallel with it. Then energy stored in each capacitor is:

A. $3U/2$

B. U

C. $U/4$

D. $U/2$

Answer: C

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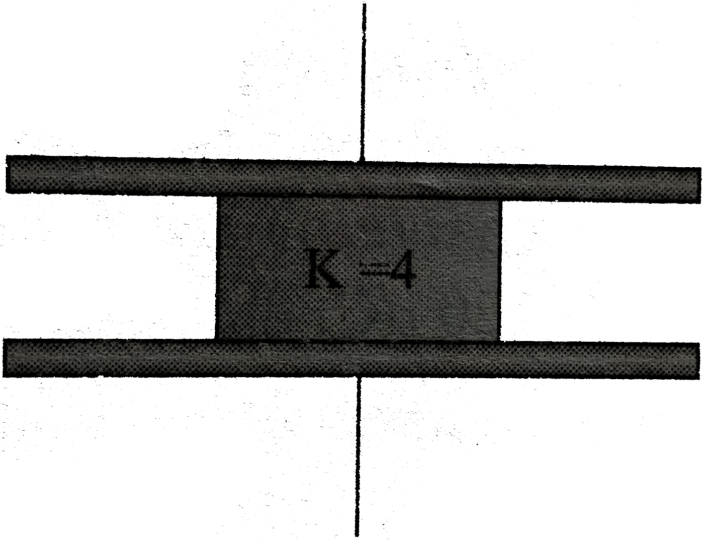
29. Consider a disconnected plate capacitor of capacity $10\mu F$ with air filled in the gap between the plates. Now one-half of the space between the plates is filled with a dielectric of dielectric constant 4 as shown in .The capacity of the capacitor changes to



A. $25\mu F$

B. $20\mu F$

C. $40\mu F$

D. $5\mu F$

Answer: A

Watch Video Solution

30. A $2\mu F$ capacitor is charged to 100 V and then its plates are connected by a conducting wire. The heat produced is

A. $0.001J$

B. $0.01J$

C. $0.1J$

D. $1J$

Answer: B

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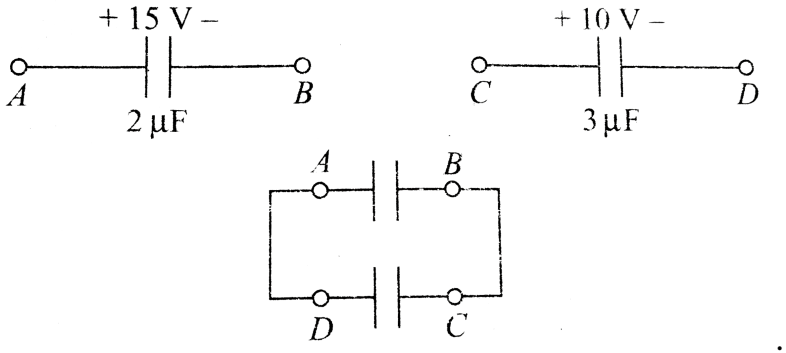
31. In, the initial status of capacitors and their connections is show. Which of the folllowin is incorrect about this circuit?



A. Final charge on each capacitor will be zero.

B. Final total electrical energy of the cpacitor will be zero.

C. Total charge flowing from A to D is $30\mu C$,

D. Total charge flowing from A to D is $60\mu C$,

Answer: D

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32. A capacitor of capacitance C_0 is charged to a patential V_0 and then isolated. A small capacitor C is then charged from C_0, discharged and charge again, the process being is decreased to V. Find the value of C.

A. $C_0\left(\frac{V_0}{V}\right)^{\frac{1}{n}}$

B. $C_0\left[\left(\frac{V_0}{V}\right)^{1/n}-1\right]$

C. $C_0\left[\left(\frac{V}{V_0}\right)-1\right]^n$

D. $C_0\left[\left(\frac{V}{V_0}\right)^n+1\right]$

Answer: B

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33. In the circuit shown in figure $C=6\mu F$. The charge stored in the capacitor of capacity C is

A. zero

B. $90\mu C$

C. $40\mu C$

D. $60\mu C$

Answer: C

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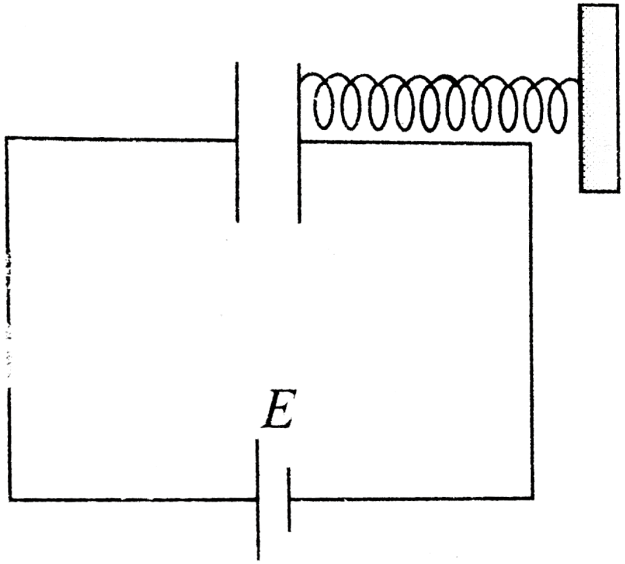
34. One plate of a capacitor is fixed, and the other is connected to a spring as shown in. Area of both the plates is A In strady state (equilibrium), separation between the plates is $0.8d$ (spring was unstretched , and the distance between the plates was d when capacitor

was uncharged). The force conntant of the spring is approximately.



A. $\frac{125}{32}\frac{\varepsilon_0 AE^2}{d^3}$

B. $\frac{2\varepsilon_0 AE^2}{d^3}$

C. $\frac{6\varepsilon_0 E^2}{Ad^2}$

D. $\frac{\varepsilon_0 AE^3}{2d^3}$

Answer: A

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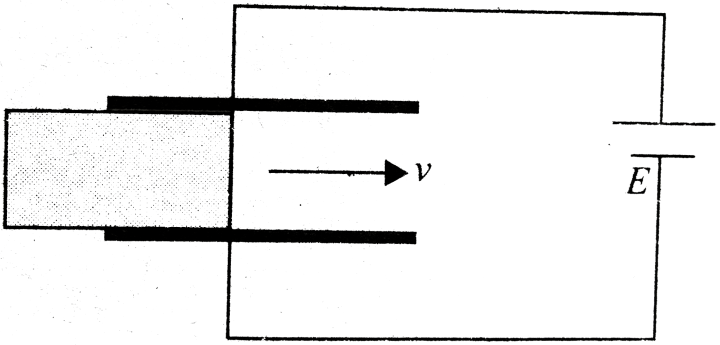
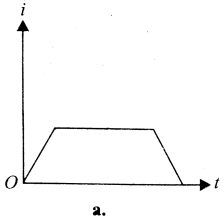
35. A dielectric slab of area A and thickness d is inderted between then plates of a capaitor of area $2A$ with constant speed v as shown in. Dustance between the plates is (d).

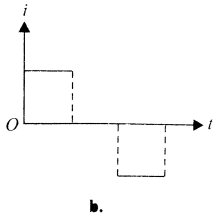


The capacitor is connected to a battery of emf E. The current in the ciruit varies with time as.

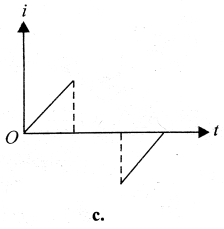
A.



B.

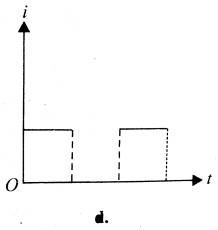


C.



c.

D.



d.

Answer: B

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36. A photographic flash unit consists of a xenon-filled tube. It givers a flash of average power $2000W$ for $0.04s. The flash is due \to dischar \geq of a flychar \geq d \cap aci \to rof$40 muF` The valtage to which it is charged before a flash is given by The unit is .

A. $1500V$

B. $2000V$

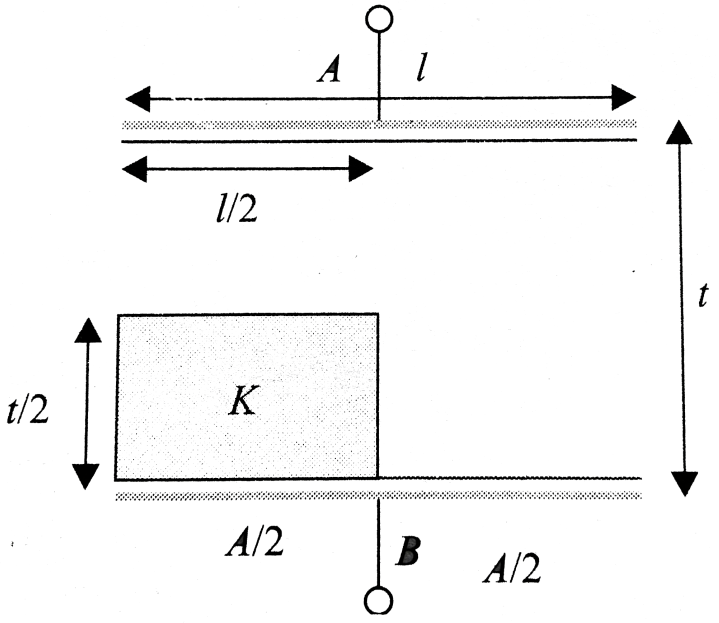
C. $2500V$

D. $3000V$

Answer: B

Watch Video Solution

37. Two square plates $(l \times l)$ and dielectric $\left(\frac{l}{2} \times \frac{t}{2} \times l\right)$ are arranged as shown in. Find the equivalent capacitance of the structrue.



A. $\frac{\varepsilon_0 A}{t}\left(\frac{3K+1}{2(K+1)}\right)$

B. $\frac{2\varepsilon_0 A}{t}\left(\frac{K+1}{K+3}\right)$

C. $\frac{\varepsilon_0 A}{t}\left(\frac{K+1}{K+3}\right)$

D. $\frac{\varepsilon_0 A}{t}\left(\frac{2K+1}{2K+3}\right)$

Answer: A

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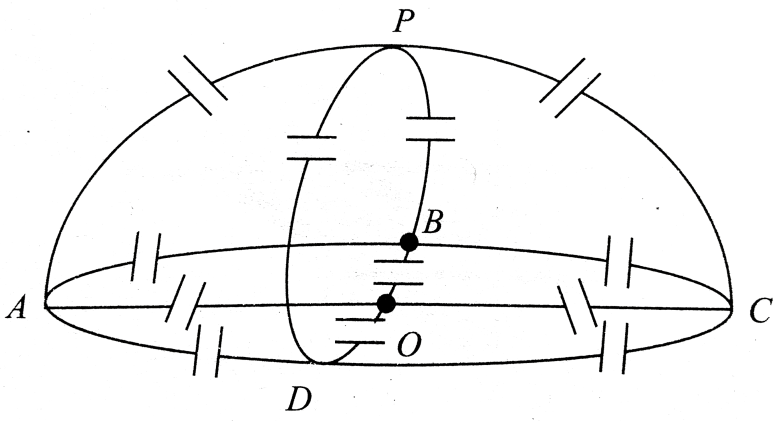
38. Find the capacitance between P and O. Each capacitor has capacitance C.



A. $2C$

B. $3C$

C. $8C$

D. $6C$

Answer: A

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39. In the circuit shown here $C_1 = 6\mu F$, $C_2 = 3\mu F$ and battery B = 20 V. The switch S, is first closed. It is then opened and afterwards S_2 is closed. What is the charge finally on C_2 ?

A. $120\mu C$

B. $80\mu C$

C. $40\mu C$

D. $20\mu C$

Answer: C

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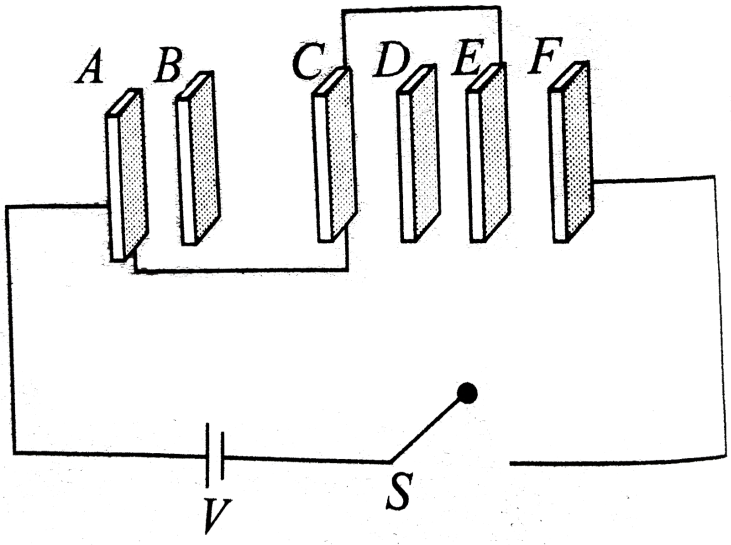
40. $A, B, C, D, E,$ and F are conducting plates each of area A, and any two consecutive plates are separated by a distance d, The energy in system after the switch S is closed is`



A. $\frac{3\varepsilon_0 A}{2d}V^2$

B. $\frac{5\varepsilon_0 A}{12d}V^2$

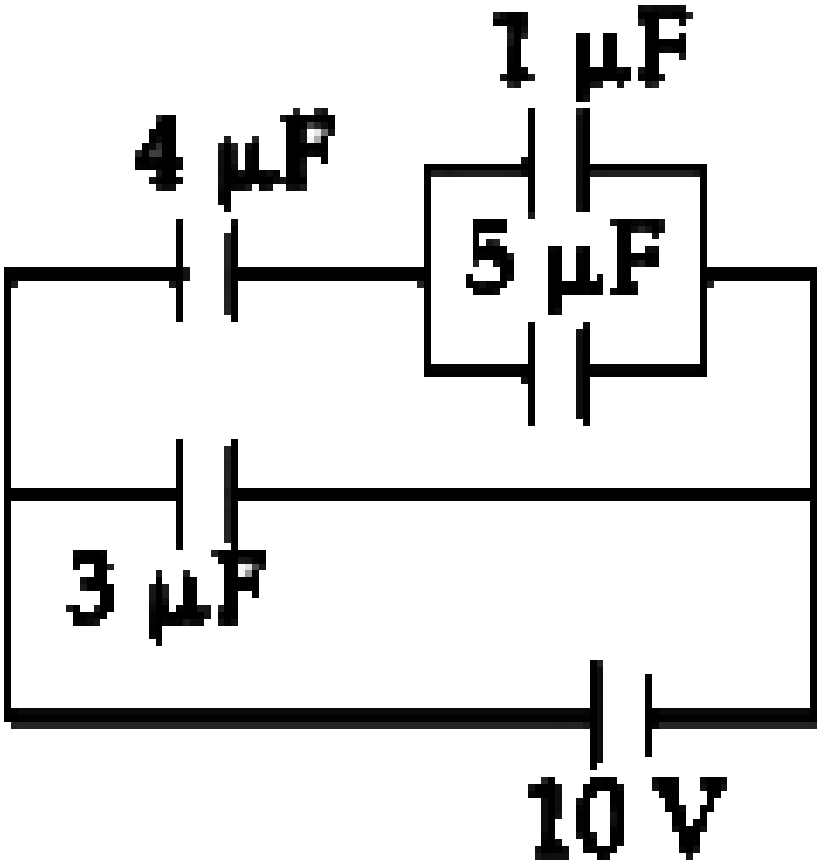
C. $\frac{3\varepsilon_0 A}{2d}V^2$

D. $\frac{\varepsilon_0 A}{d} V^2$

Answer: C

Watch Video Solution

41. In the given circuit, the charge on $4\mu F$ capacitor will be :



A. $4.5\mu C$

B. $9\mu C$

C. $15\mu C$

D. none of these

Answer: C

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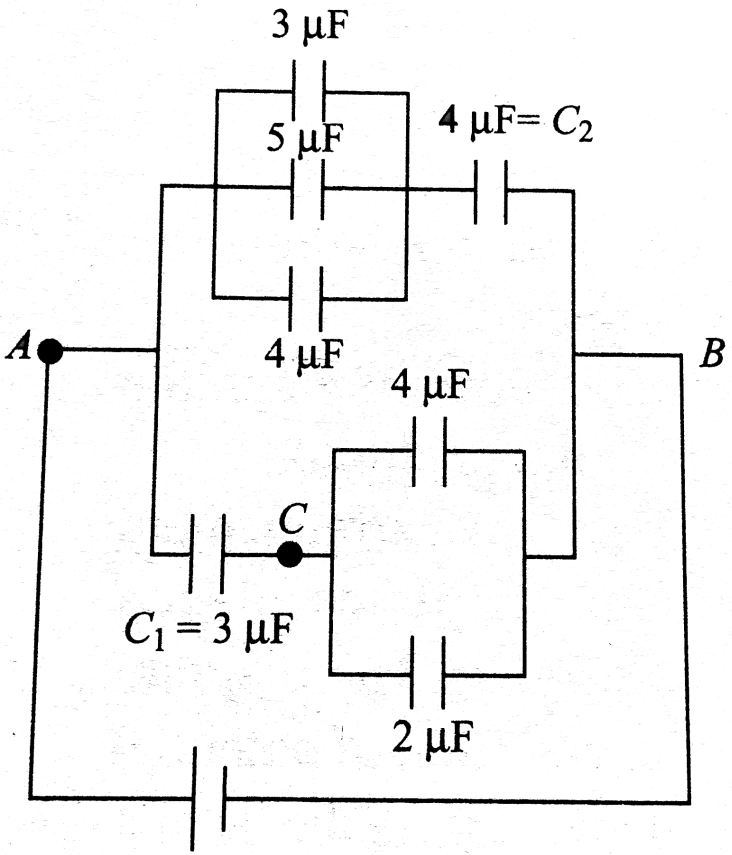
42. Shows a netword of seven capacitors. If the charge on the $5\mu F$ caacitor is $10\mu C$, dind the potential difference between the points A and

C,



A. $16V$

B. $32V$

C. $64V$

D. none of these

Answer: A

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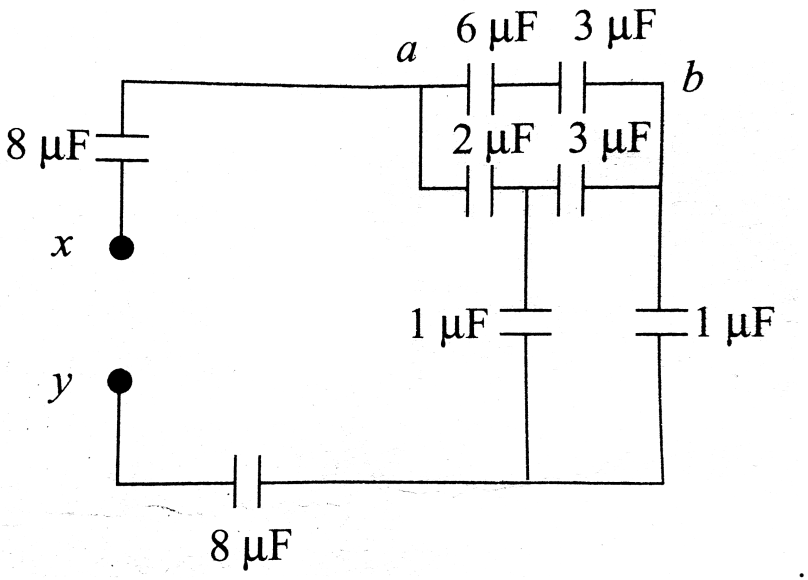
43. In the circuit shown the effertive capacitance bewteen poits X and Y is .



A. $3,\ 33\mu F$

B. $1\mu F$

C. $0.44\mu F$

D. none of these

Answer: B

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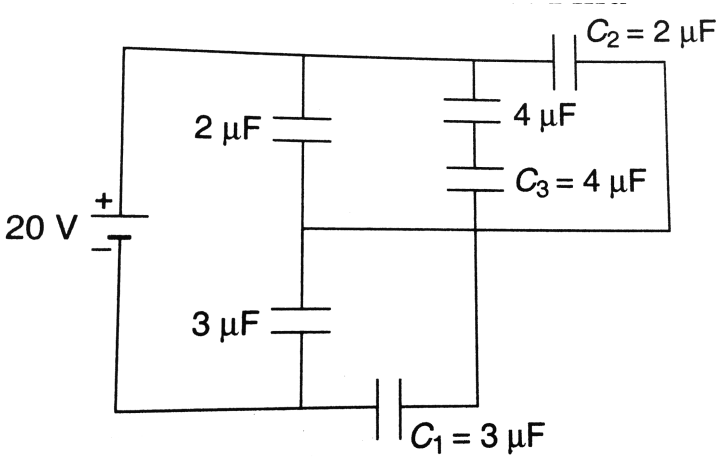
44. In figure the battery has a potential difference of $20V$. Find



(a) the equivalent capacitance of all the capacitors across the battery and

(b) the charge stored on that, equivalent capacitance. Find the charge on

(c) capacitor 1,

(d) capacitor 2, and

(e) capacitor 3.

A. $20\mu F$

B. $40\mu F$

C. $10\mu C$

D. none of these

Answer: A

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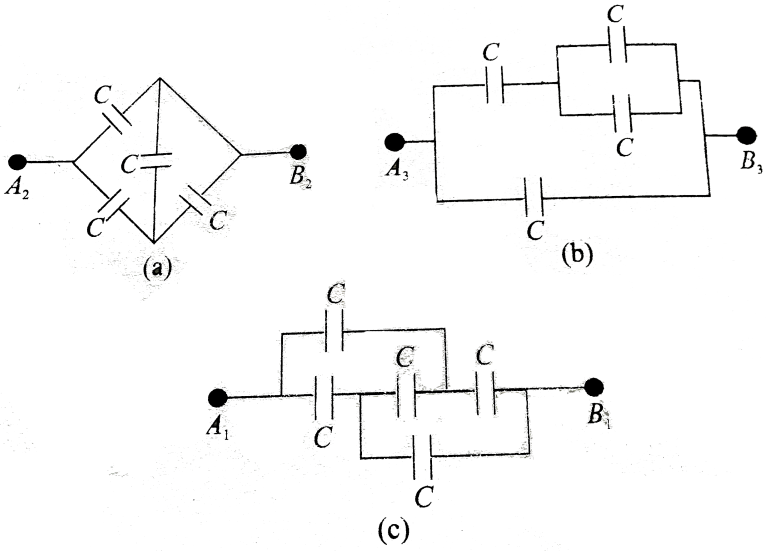
45. In, identical capacitors are connected in the following three configurations.



The ratio of the total capacitances in (i), (ii), and (iii), respectively, is .

A. $3:5:5$

B. $3:3:5$

C. $5:4:4$

D. $5:5:3$

Answer: D

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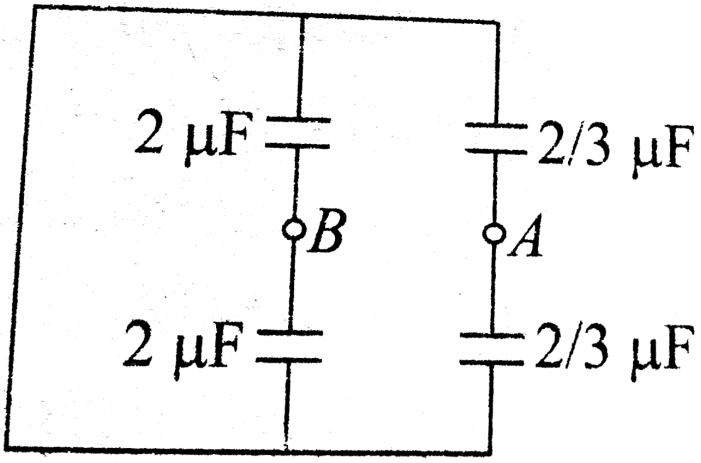
46. The equivalent capacitance of the circuit across the terminals (A)and (B) is equal to



A. $0.5\mu F$

B. $2\mu F$

C. $1\mu F$

D. none of these

Answer: C

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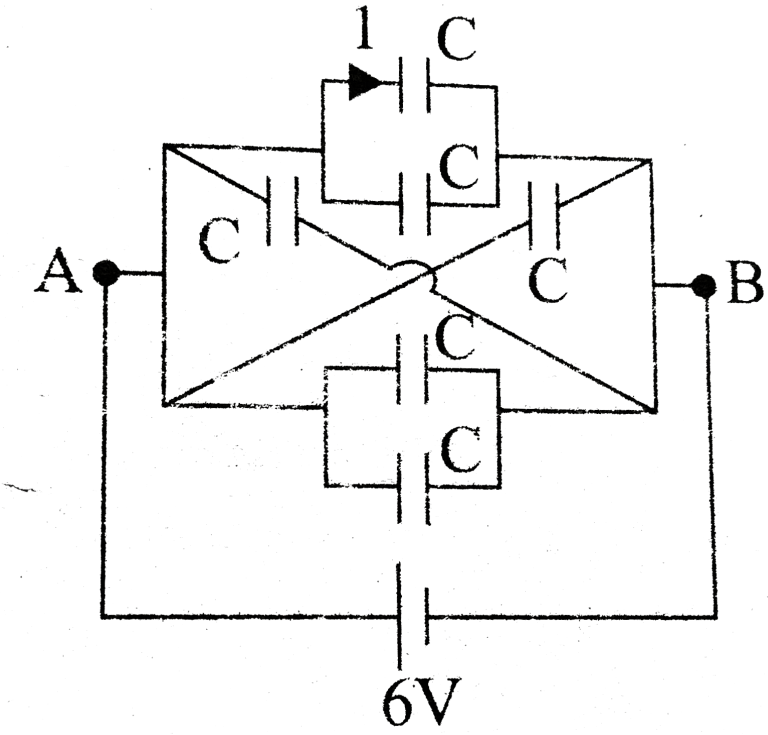
47. Six capacitors each of capacitance $1\mu F$ are connected as show in .

Find the charge flowing in direction 1 as shown in the figure will be



A. $12\mu C$

B. $6\mu C$

C. $3\mu C$

D. none of these

Answer: B

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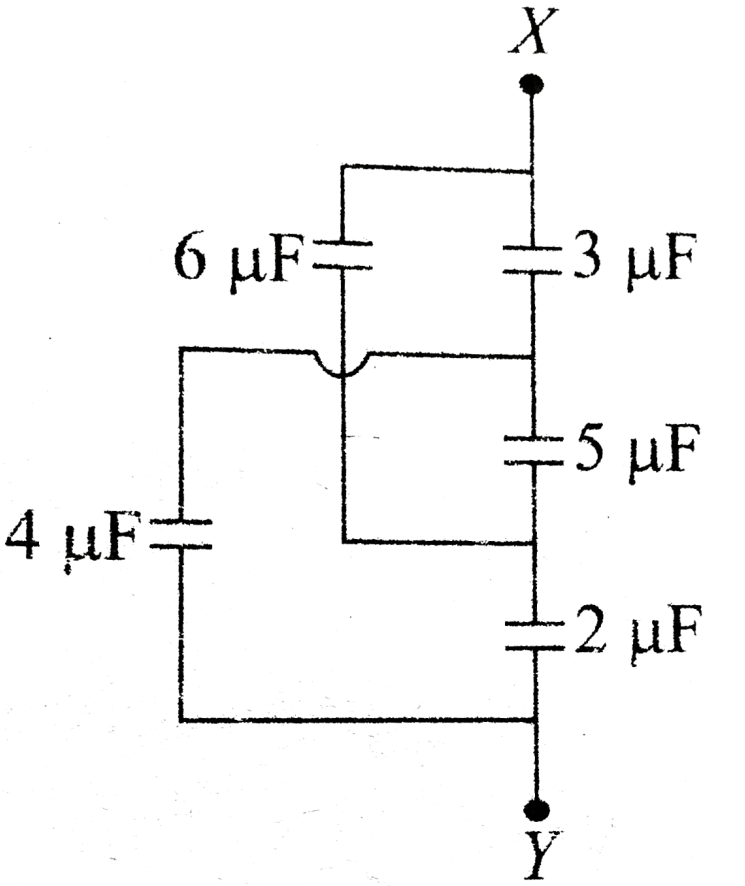
48. The equivalent capacitance between points X and Y in Fig. 4.182. is`



A. $6/5\mu F$

B. $4\mu F$

C. $\frac{18}{5}\mu F$

D. none of these

Answer: C

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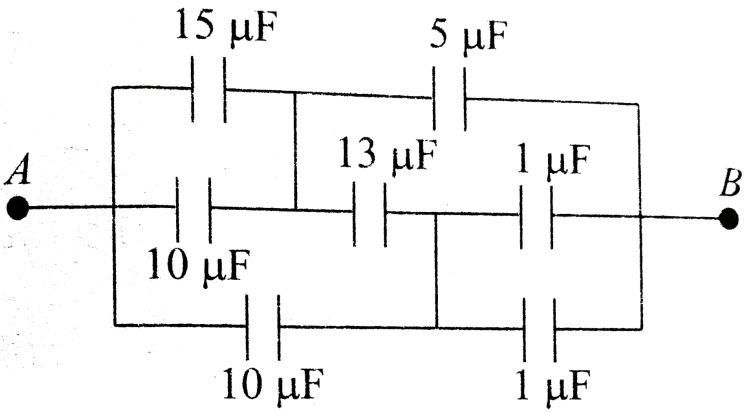
49. Find the equivalent capacitance across A and B.



A. $\frac{35}{6}\mu F$

B. $\frac{25}{6}\mu F$

C. $15\mu F$

D. none of these

Answer: A

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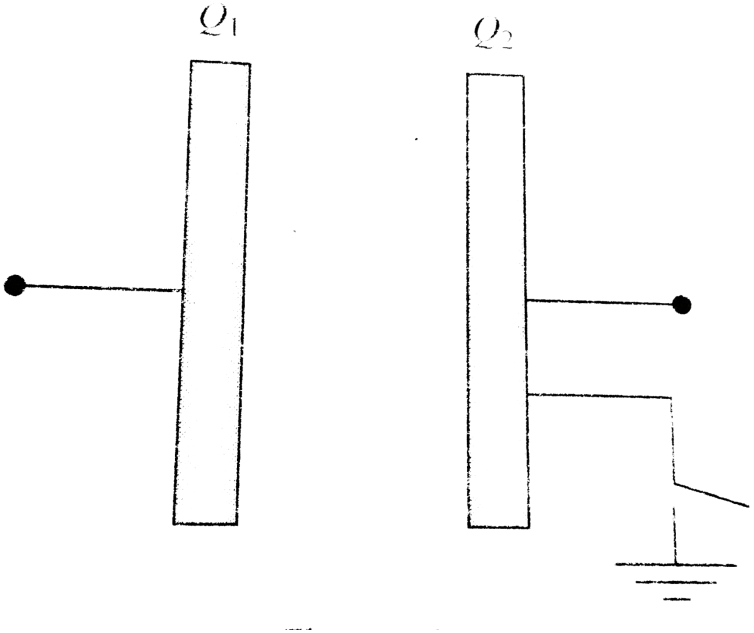
Multile Correct

1. Charges Q_1 and Q_2 are given to two plates fo a parllel plate capacitor. The capacity of the capacitor is C. When the switch is closed , mark correct statement (s) . (Assume both Q_1 and Q_2 to be positive).



A. The charge flowing through switch is zero.

B. The chrage flowing through the switch is $Q_1 + Q_2$.

C. Potential difference across the capacitor plate is Q_1 / C.

D. the charge of the capacitor is Q_1.

Answer: B::C::D

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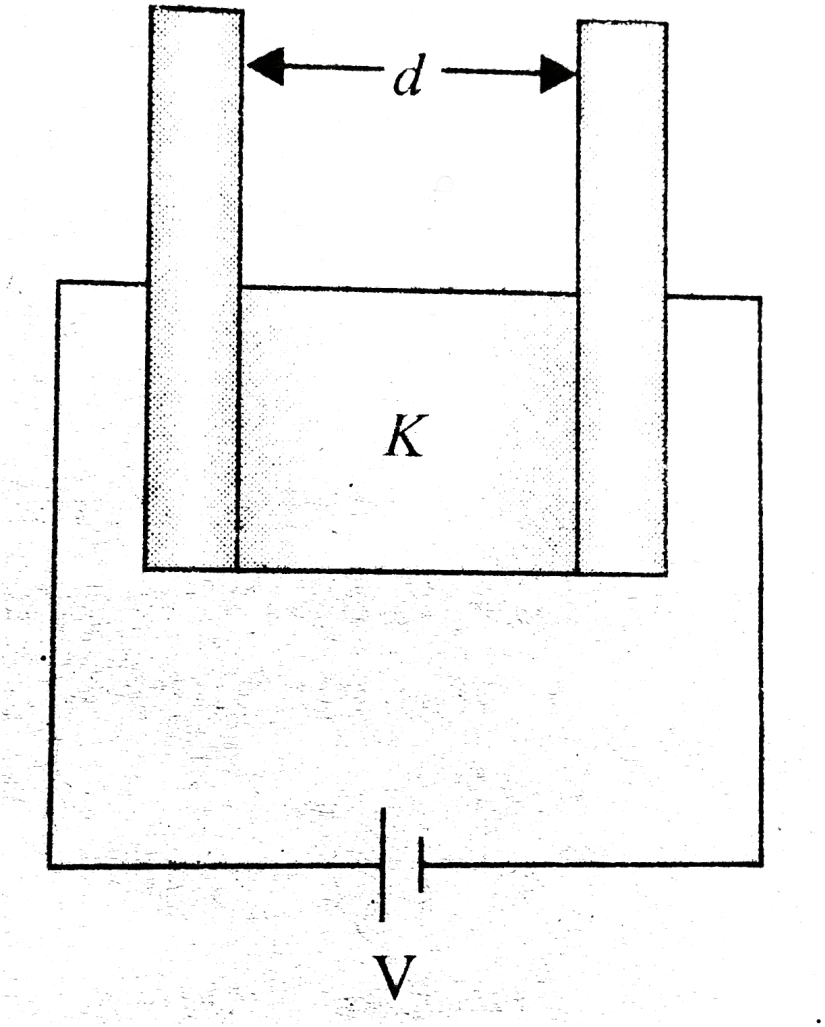
2. A dielectric slab fills the lower as shown in. (Take plate area as A).



A. Equivalent is $(\varepsilon_0 A / 2d)(1 + K)$.

B. The net charge of the lower half of the left hand plate is $1 / K$ times the charge on the upper half the plate.

C. Net charge on the lower and upper halves of the left hand plate are different.

D. Net charge on the lower half oof thenleft hand plate is $\frac{K\varepsilon_0 A}{2d} \times V$.

Answer: A::C::D

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3. A parallel plate air capacitor has initial capacitance C. If plate separation is slowly increased from d_1 to d_2, then mark the correct statement (s). (Take potential of the capacitor to be constant, i.e. throughout the process it remains connected to battery.)

A. Work done by electric force=negative of work done by external agent.

B. Work done by external force $= -\int \vec{F}.\vec{dx}$, where $\vec{F}$ is the electric force of attraction between the plates at plate setaration x.

C. Work done by electric force $\neq$ negative of work done by external agent.

D. Work done by battery $=$ two times the change in electric potential energy stored in capacitor.

Answer: A::B::D

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4. A capacitor of $5\mu F$ is charged to a potential of $100V$. Now, this charged capacitor is connected to a battery of $100V$ with the posiitive terminal of the battery connected to to the negative plate of the capacitor . For the given situation, mark the correct statement(s).

A. The charge flowing through the $100V$ battery is $500\mu C$,

B. The charge flowing through the $100V$ battery is $1000\mu C$

C. Work done by on the battery is $0.1J$

D. Work done on the battery is $0.1J$.

Answer: B::C

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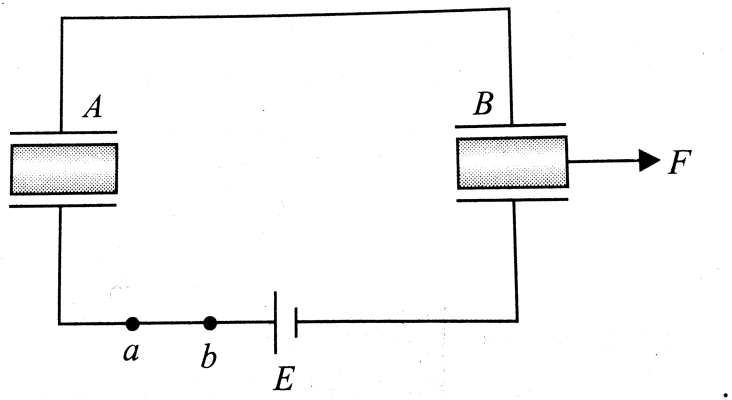
5. Two identical capacitors with identical dielectric slabs in between them are connected in series as shown in. Now, the slab of one capacitor is pulled out slowly with the help of an external force F at steady state as shown. Mark the correct statement(s).



A. During the pring the process, charge (positive) flows frows from b to a.

B. Diring the process, the charge of capacitor B is from b equal to the charge on A at all instants.

C. Work done by F is positive.

D. During the process, the battery has been charged.

Answer: B::C::D

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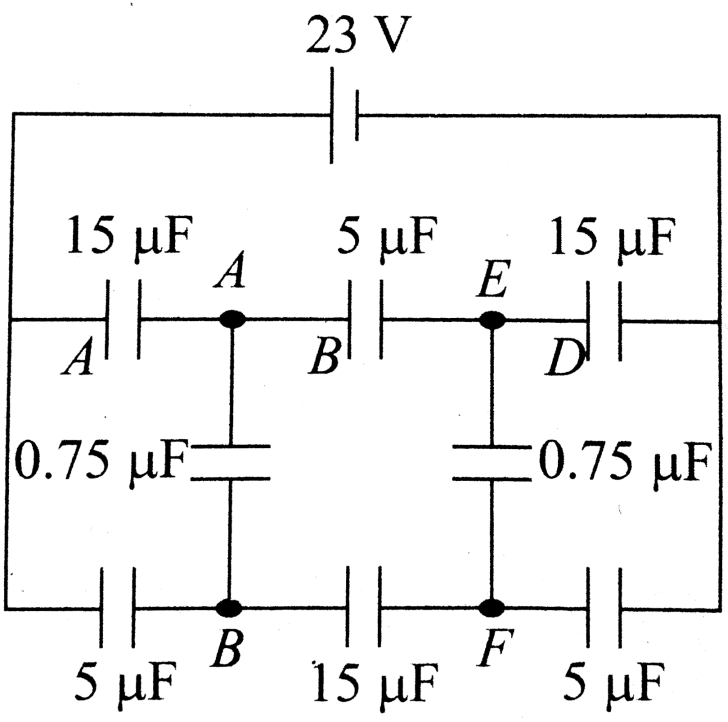
6. Find the potential differnce between the points A and B and that between E and F of the circuit in.



A. $V_{AB} = 5V$

B. $V_{EF} = 5V$

C. $V_{AB} = 0$

D. $V_{EF} = 0$

Answer: A::B

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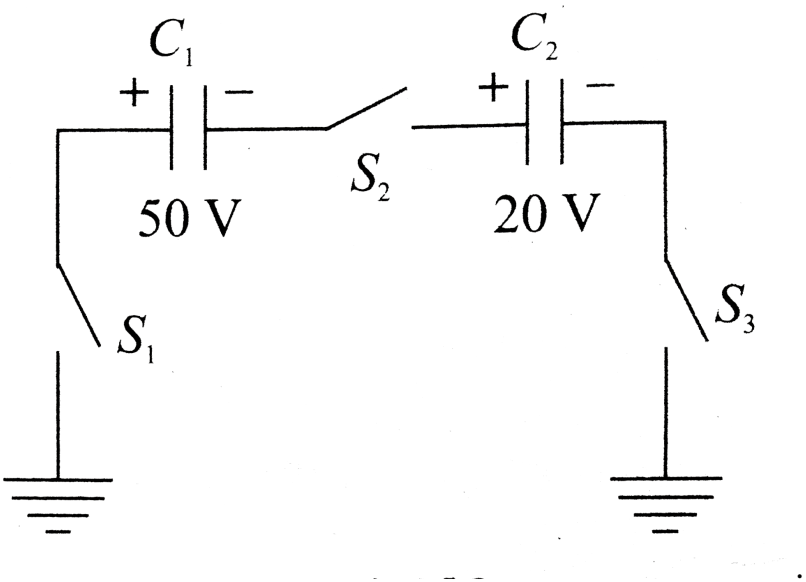
7. In the circuit shown, $C_1 = C_2 = 2\mu F$. Capacitor C_1 is charged to $50V$ and C_1 is charge to $20V$. After charging they are connected as shown.

When S_1, S_2, and S_3, are clsosed,



A. $70\mu C$ of charge will pass through S_1

B. $100\mu C$ of chaarge will pass throuth S_1

C. $70\mu C$ of charge will pass throuth S_3

D. $40\mu C$ of chaarge will pass throuth S_3.

Answer: A::C

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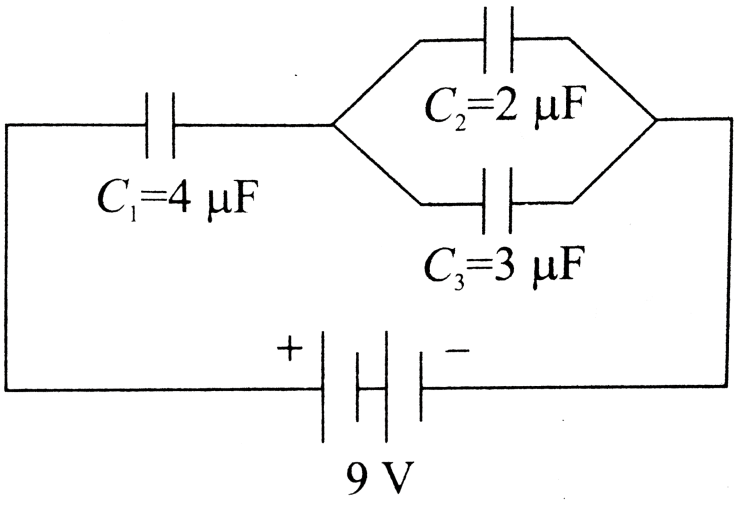
8. In figure, the charges on $C_1, C_2,$ and $C_3,$ are $Q_1, Q_2,$ and $Q_3,$ respectively.



A. $Q_2 = 8\mu C$

B. $Q_3 = 12\mu C$

C. $Q_1 = 20\mu C$

D. $Q_2 = 12\mu C$

Answer: A::B::C

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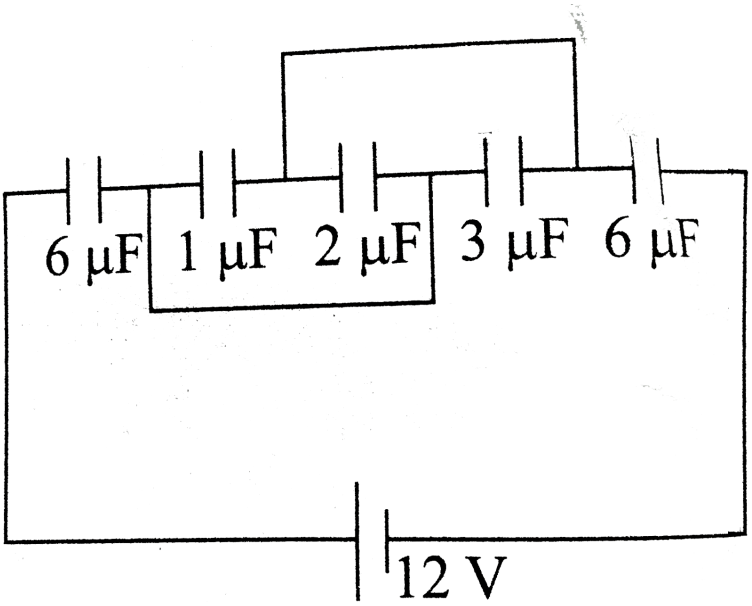
9. In the circuit diagram shown in Figure,



A. the charge on $2\mu F$ capacitor is $8\mu C$

B. the charge on each $6\mu F$ capacitor is $72\mu C$

C. the pottential drop across $1\mu F$ capacitor is $4V$.

D. the potential drop across $3\mu F$ is 4 V`

Answer: A::C::D

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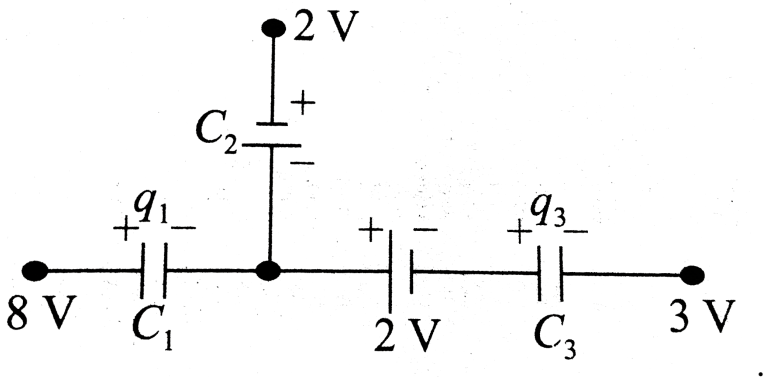
10. Shows a part of a circuit. If all the capacitors have a capacitance of $2\mu F$, then the



A. charge on C_3 is zero

B. charge on C_3 is $12\mu C$

C. charge on C_1 is $6\mu C$

D. charge on C_1 in $6\mu C$

Answer: A::C::D

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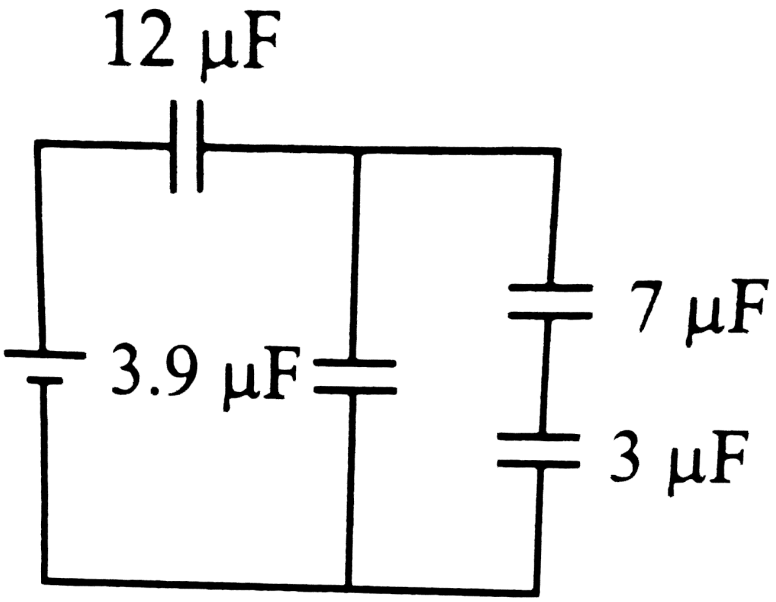
11. Four capacitors and a battery are connected as shown in the figure. If the potential difference across the $7\mu F$ capacitor is 6 V, then which of the following statement is incorrect ?



A. The potential drop across the $12\mu F$ capacitor is $10V$.

B. The charge in the $3\mu F$ capacitor is $42\mu C$.

C. The potential drop across the $3\mu F$ capacitor is $10V$

D. The emf of the battery is $30V$.

Answer: A::B::D

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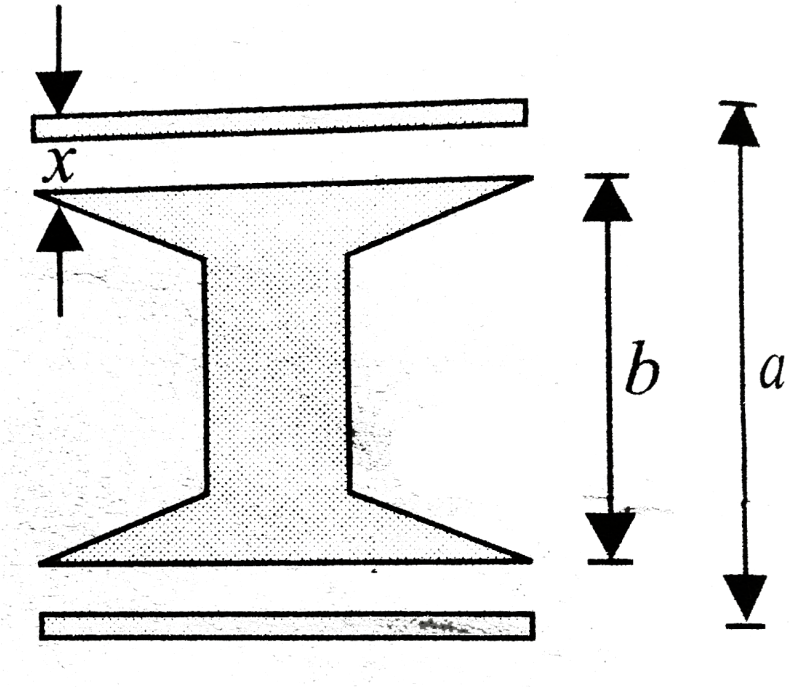
Comprhension

1. Shows two capacitors in series, the rigid central conducting section of length b being movable vertically.



The equivalent capacitance of the given structure is .

A. $\frac{\varepsilon_0 A}{(a-b-x)}$

B. $\frac{\varepsilon_0 A}{(a-b)}$

C. $\frac{\varepsilon_0 A}{(b-x)}$

D. $\frac{\varepsilon_0 A}{(a-x)}$

Answer: B

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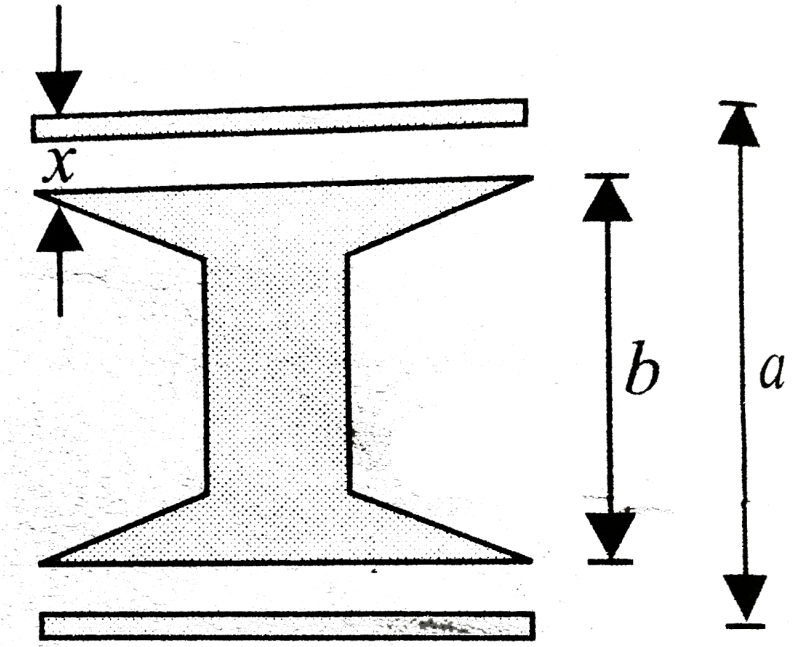
2. shows two capacitors in series, the rigid central conducting section of length b being movable vertically.



If the potentials of the upper and lower plates are V_1 and V_2 respectively, then potebtial of rigid segid secton is.

A. $V_1 - \frac{(V_1 - V_2)x}{(a-b)}$

B. $V_1 - \frac{(V_2 - V_1)x}{(a-b)}$

C. $V_1 - \frac{(V_1 - V_2)x}{(a+b)}$

D. $V_1 - \frac{(V_1 - V_2)x}{(a+b)}$

Answer: A

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3. A $1\mu F$ capacitor and a $2\mu F$ capacitor are connected in series across a $1200V$ supply line.

a. Find the charge on each capacitor and the voltage across them.

b. The charged capacitors are disconnected from the line and from each other and reconnected with terminals of like sign together. Find the final charge on each and the voltage across them.

A. Charge on capacitors are $1400/3\mu F$ and $3200/3\mu F$, and potential differnce across each chapacitor is $1600/3V$.

B. Charge on captential are $1600/3\mu F$ amd $3200/3\mu C$, and potential differnce across each capacitor is $1600/3V$.

C. Charge on each capacitor is $1600\mu C$, and potential difference aross each capacitor is $800V$.

D. Charge and potential differnce across each capacitor are zero.

Answer: B

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4. A $1\mu F$ capacitor and a $2\mu F$ capacitor are connected in series across a $1200V$ supply line.

a. Find the charge on each capacitor and the voltage across them.

b. The charged capacitors are disconnected from the line and from each other and reconnected with terminals of like sign together. Find the final charge on each and the voltage across them.

A. Charge on capacitors are $1400/3\mu F$ and $3200/3\mu F$ and potential deffernce across each capacitor is $1600/3V$.

B. Charge on capacitors are $1600\mu C$ and $3200/3\mu C$ and potential differnce across each capacitor is $1600/3$ V`.

C. Charge on each capacitor is $1600\mu F$, and potential difference across each capacitor is $800V$.

D. Charge and potential difference each capacitor are zero.

Answer: D

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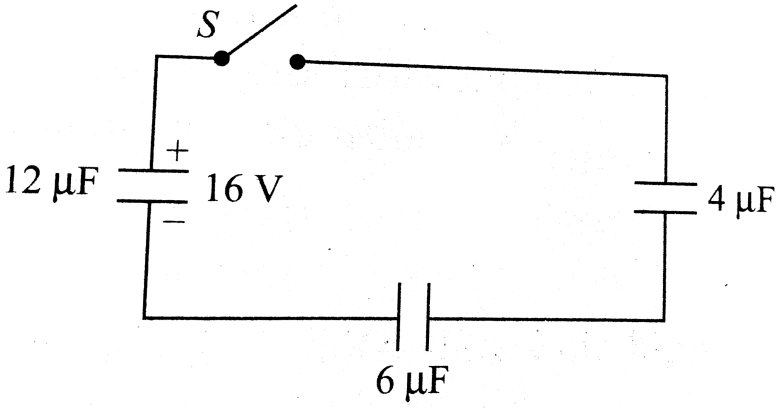
5. In the arrangement shown in in the switch S is , find



the final charge on the $6\mu F$ capacitor

A. $12\mu C$

B. $24\mu C$

C. $32\mu C$

D. $48\mu c$

Answer: C

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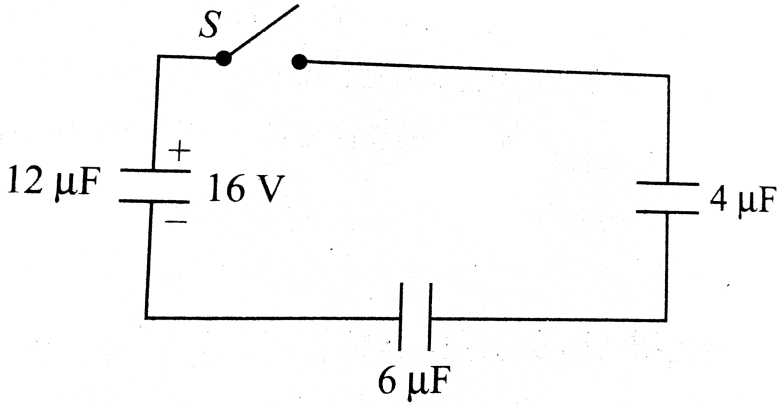
6. In the arrangement shown in , the switch S is find



the final potential difference across the $4\mu F$ capacitor

A. $12V$

B. $8V$

C. $20V$

D. $32V$

Answer: B

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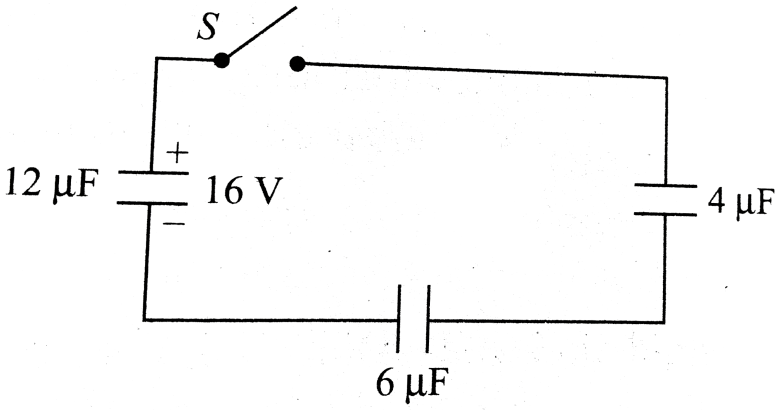
7. In the arrangement shown in, When the switch S is closed, find



the final potential difference across the $12\mu F$ capacitor.

A. $\frac{40}{3}V$

B. $\frac{20}{3}V$

C. $12V$

D. $24V$

Answer: A

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8. Each plate of a parallel plate air capacitor has area $S = 5 \times 10^{-3} m^2$ and the distance between the plates is $d = 8.80mm$.Plate A has positive charge $q_1 = +10^{-10} C$, and plate B has charge $q_2 = +2 \times 10^{-10} C$. A battery of emf $E = 10V$ has its positive terminal connected to plate A and the negative terminal to plate B. (Given $\varepsilon_0 = 8.8 \times^{12} Nm^2 C^{-2}$). Charge supplied by time the battery is .

A. $120pC$

B. $100pC$

C. $60pC$

D. $50pC$

Answer: B

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9. Each plate of a parallel plate air capacitor has area $S = 5 \times 10^{-3} m^2$ and the distance between the plates is $d = 8.80mm$. Plate A has positive

charge $q_1 = +10^{-10}C$, and plate B has charge $q_2 = +2 \times 10^{-10}C$. A battery of emf $E = 10V$ has its positive terminal connected to plate A and the negative terminal to plate B. (Given $\varepsilon_0 = 8.8 \times 10^{-12}Nm^2C^{-2}$)

.

Energy supplied by the battery is.

A. a. $10^{-9}J$

B. b. $5 \times 10^9 J$

C. c. $50 \times 10^{-9}J$

D. d. $25 \times 10^{-9}J$

Answer: A

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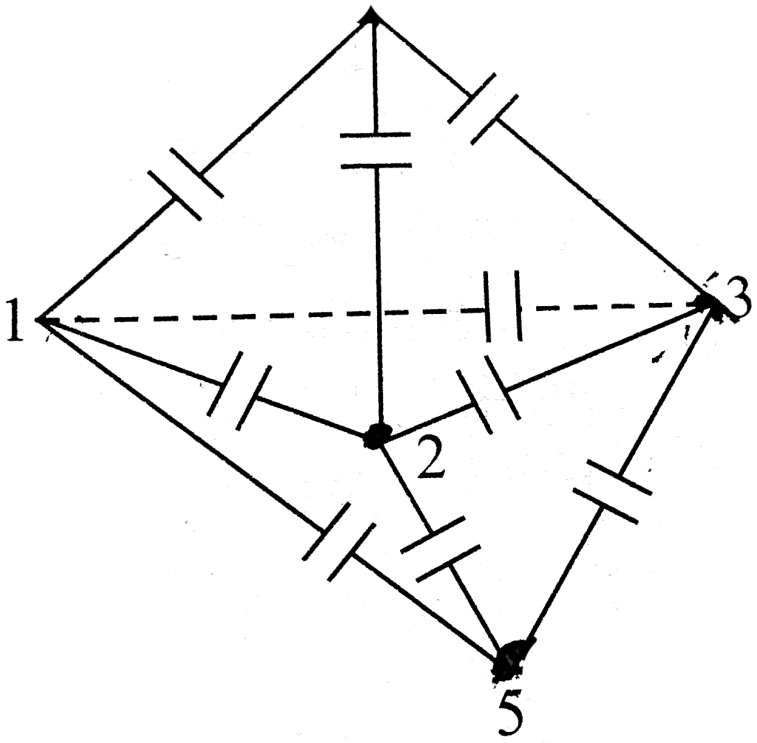
10. Each capacitor has cpacitance C.



The equivalent capacitance between 4 and 5 is .

A. $\frac{3C}{4}$

B. $\frac{3C}{2}$

C. $\frac{3C}{5}$

D. $\frac{5C}{4}$

Answer: B

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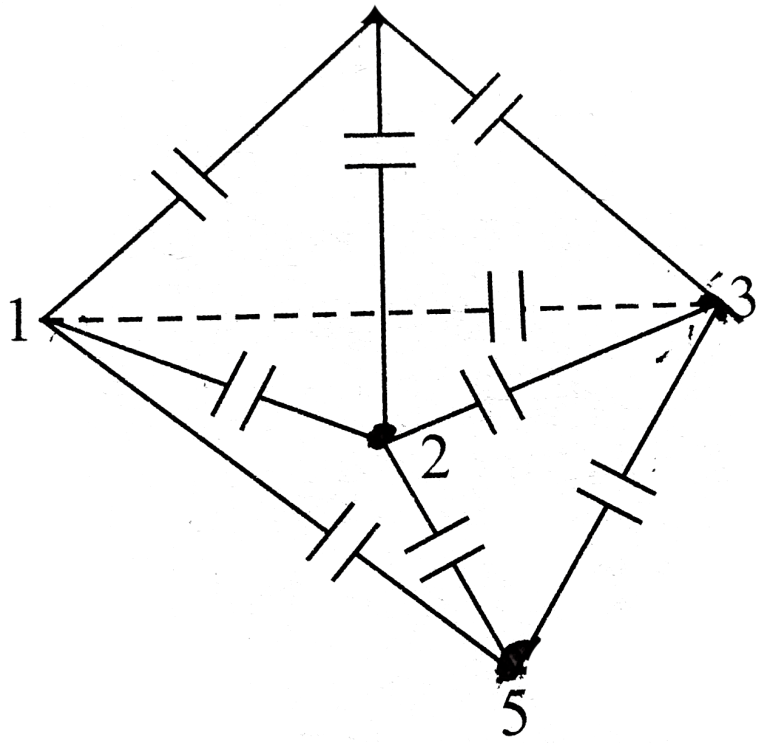
11. Each capacitor has cpacitance C.



The capacitance between 1 and 3 is.

A. $\frac{3C}{4}$

B. $\frac{3C}{2}$

C. $\frac{5C}{2}$

D. $\frac{5C}{4}$

Answer: C

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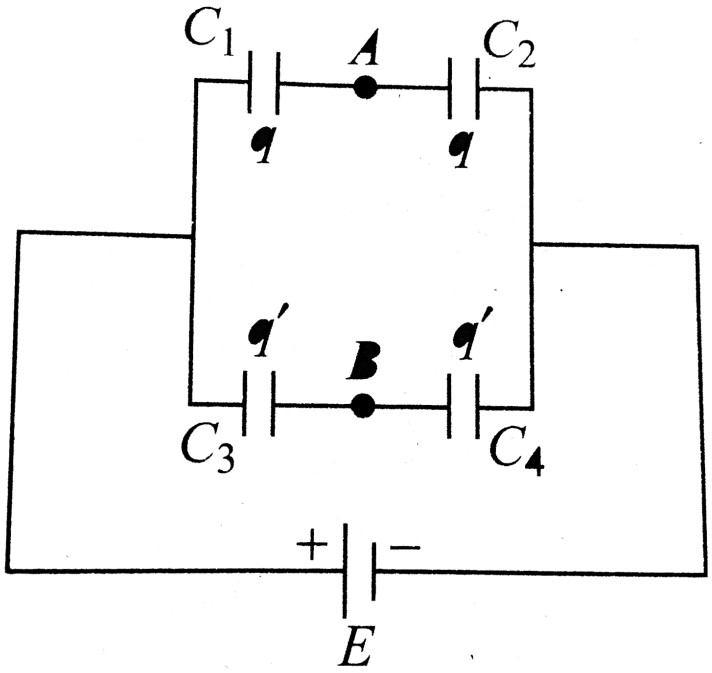
12. Consider



The charge appearing is C_2 is.

A. $E\left(\frac{C_3C_4}{C_1+C_2}\right)$

B. $E\left(\frac{C_1C_2}{C_1+C_2}\right)$

C. $E\left(\frac{C_1C_2}{C_3+C_4}\right)$

D. $E\left(\frac{C_3C_4}{C_3+C_4}\right)$

Answer: B

Watch Video Solution

13. Consider

The potential difference $V_A - V_B$ is.

A. $E\left[\frac{C_1C_4 - C_2C_3}{(C_1+C_2)(C_3+C_4)}\right]$

B. $E\left[\frac{C_1C_4 + C_2C_3}{(C_1+C_3)(C_2+C_4)}\right]$

C. $E\left[\frac{C_1C_3 + C_2C_4}{(C_1+C_2)(C_3+C_4)}\right]$

D. $E\left[\frac{C_1C_3 + C_2C_4}{(C_1 + C_3)(C_2 + C_4)}\right]$

Answer: A

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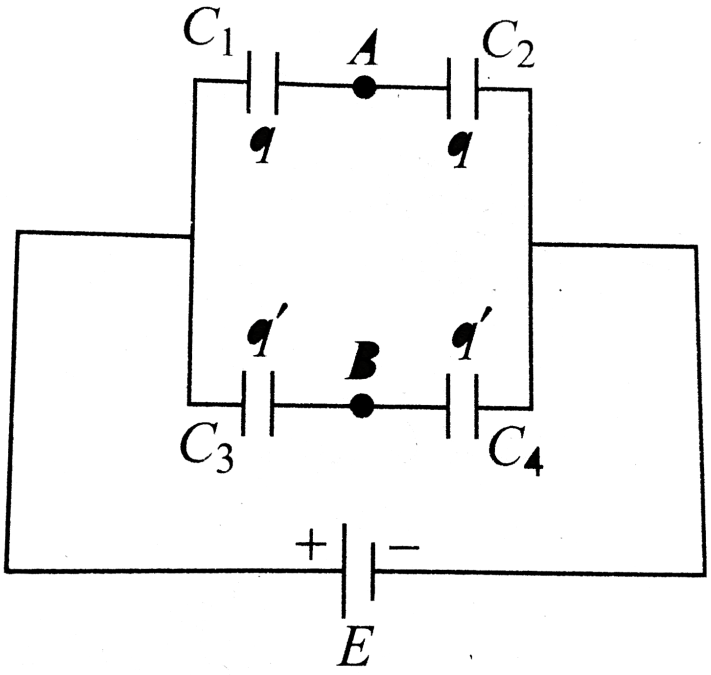
14. Consider



The condition for which the potential difference between A and B is zero is.

A. $C_1C_2 = C_3C_4$

B. $C_1C_4 = C_2C_3$

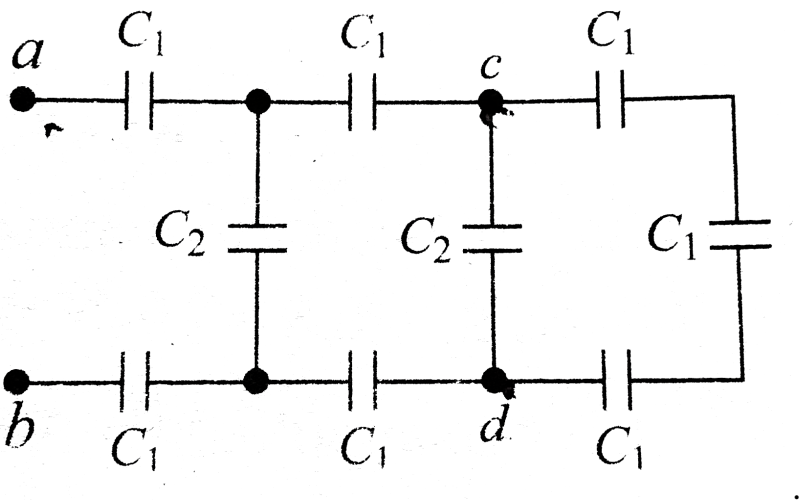
C. $C_1C_3 = C_2C_4$

D. none of these

Answer: B

Watch Video Solution

15. In each capacitance C_1 is $6.0\mu F$, and each capacitance C_2 is $4.0\mu F$.



The equivalent capacitance of the netwok between ponts a and b is.

A. $2\mu F$

B. $4\mu F$

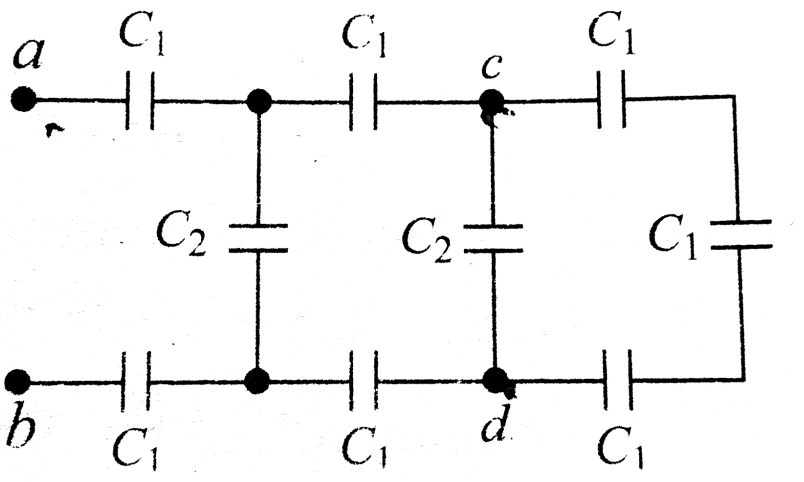
C. $6\mu F$

D. $8\mu F$

Answer: A

Watch Video Solution

16. In each capacitance C_1 is $6.0\mu F$, and each capacitance C_2 is $4.0\mu F$.



The charge on C_1 nearest to a when $V_{ab} = 420V$ is.

A. $840\mu C$

B. $560\mu C$

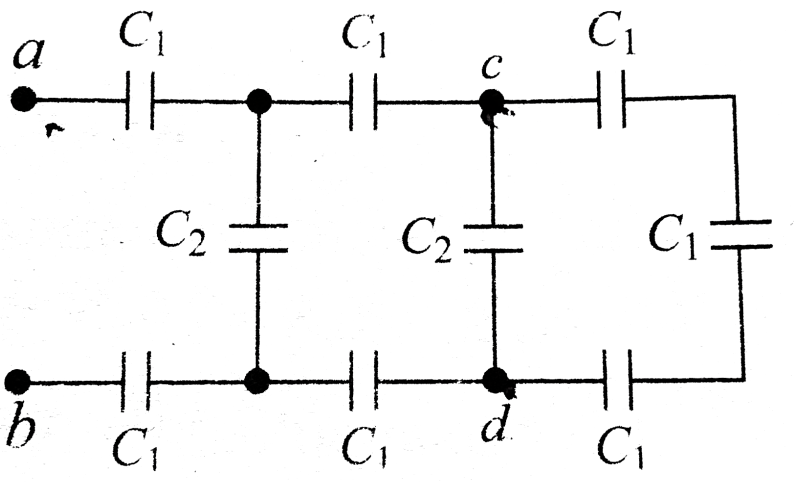
C. $600\mu C$

D. $320\mu C$

Answer: A

Watch Video Solution

17. In each capacitance $C_1 is 6.0\mu F$, and each capacitance C_2 is $4.0\mu F$.



With $420V$ across a and b the value of $V_c - V_d$ is.

A. $24.6V$

B. $46.7V$

C. $18V$

D. $72V$

Answer: B

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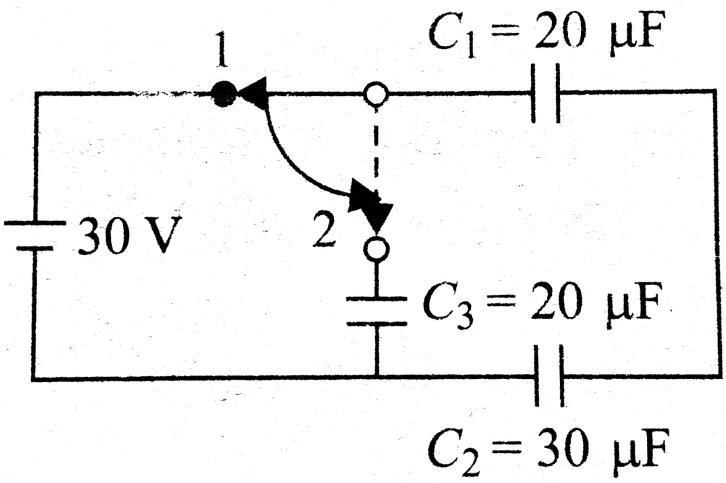
18. Condsider



In the circuit shown is the switch can be shifted to positions 1 and 2 The charge on capacitor C_1 when the switch is at position 1 is.

A. $120\mu C$

B. $240\mu C$

C. $360\mu C$

D. $80\mu C$

Answer: C

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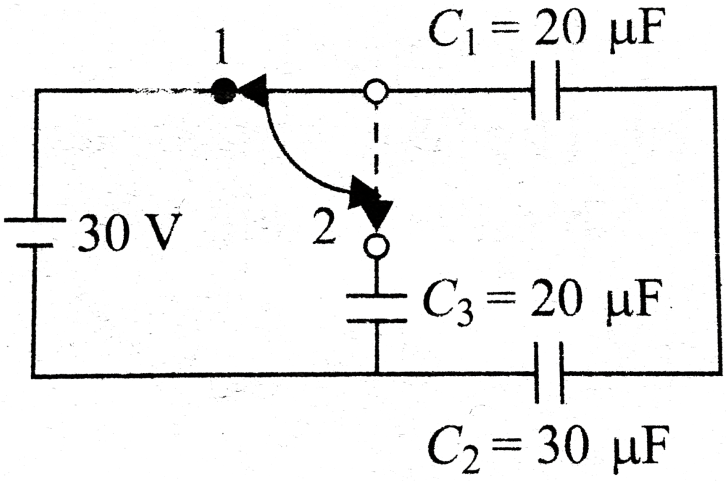
19. Condsider



Now the switch is shifted to position 2. The charge appearing on capacitor C_3 is`

A. $225\mu C$

B. $235\mu C$

C. $270\mu C$

D. $75\mu C$

Answer: A

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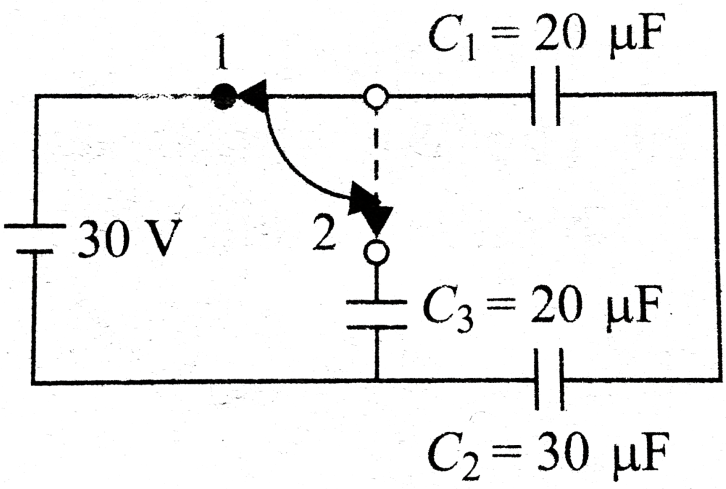
20. Condsider



The charge on capacitor C_1 is.

A. $225\mu C$

B. $135\mu C$

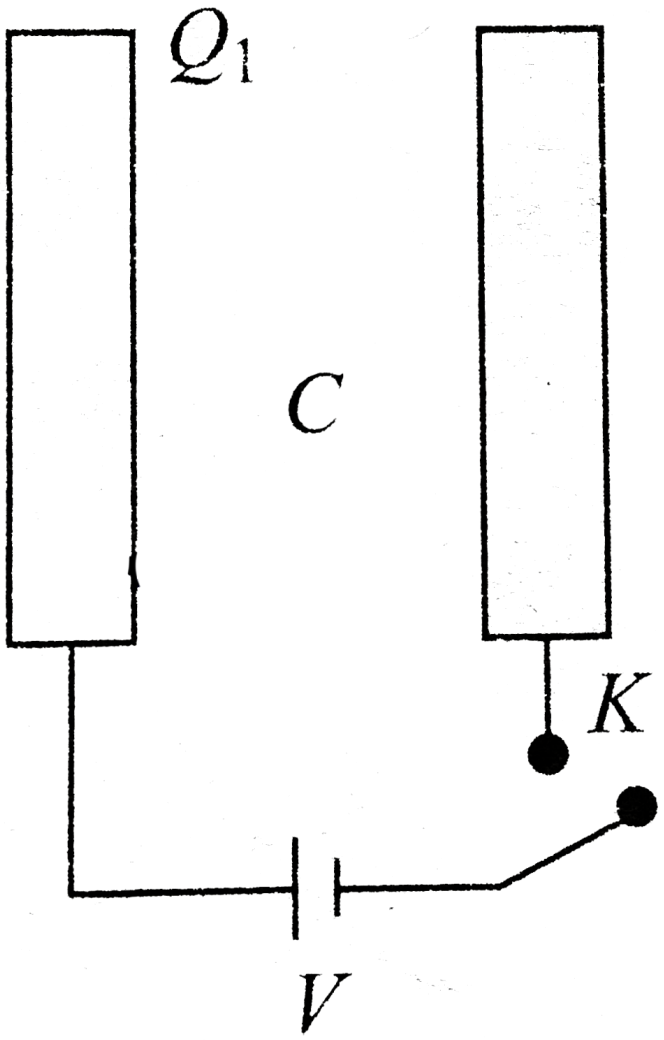
C. $270\mu C$

D. $360\mu C$

Answer: B

Watch Video Solution

21. For the system shown in capacitance is C The left plate is given a charge Q_1 and the is closed.



Find the amount of charge that will flow through the battery before the steady state is achieved.

A. CV

B. $CV - Q_1$

C. $CV + \frac{Q_1}{2}$

D. $CV - \frac{Q_1}{2}$

Answer: D

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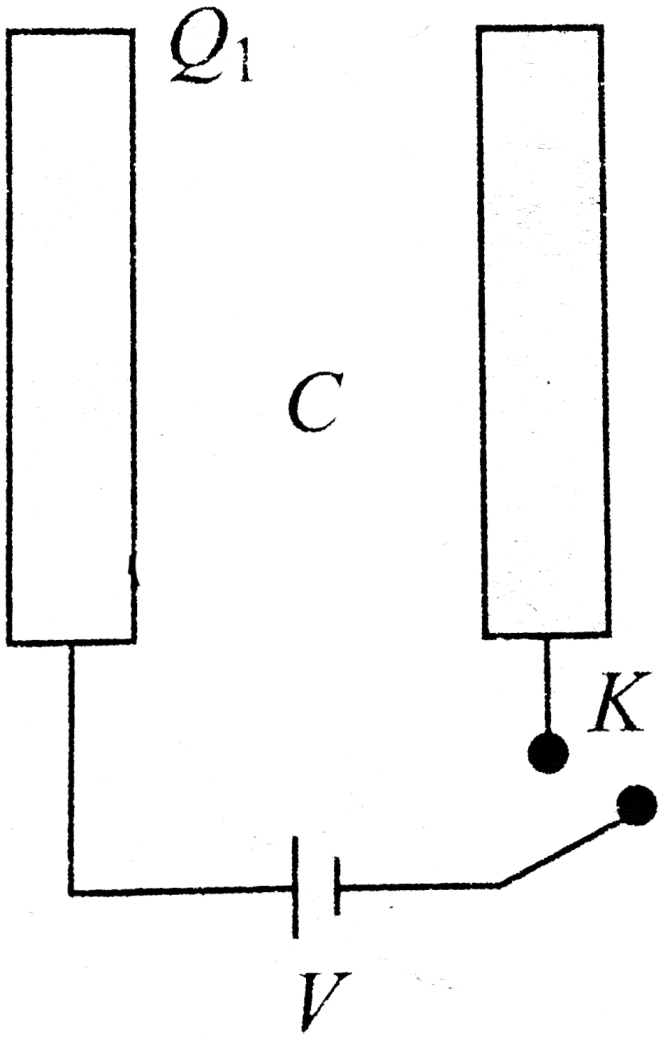
22. For the system shown in capacitance is C The left plate is given a charge Q_1 and the switch is closed.



Find the charge appearing on the inner face of the left plate.

A. $CV - \frac{Q_1}{2}$

B. $CV + Q_1$

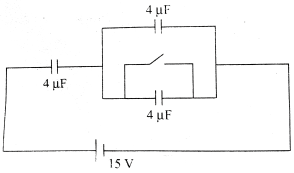
C. $CV + \frac{Q_1}{2}$

D. CV

Answer: D

Watch Video Solution

23. Consider the circuit shown in figure, after switch S is closed.



What amount of charge will flow through the switch?

A. $20\mu C$

B. $60\mu C$

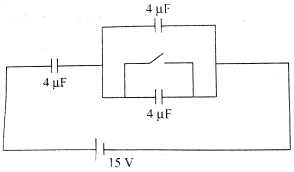
C. $40\mu C$

D. no charge will flow

Answer: A

Watch Video Solution

24. Consider the circuit shown in figure, after switch S is closed.



What amount of charge will flow through the switch?

A. $20\mu C$

B. $60\mu C$

C. $40\mu F$

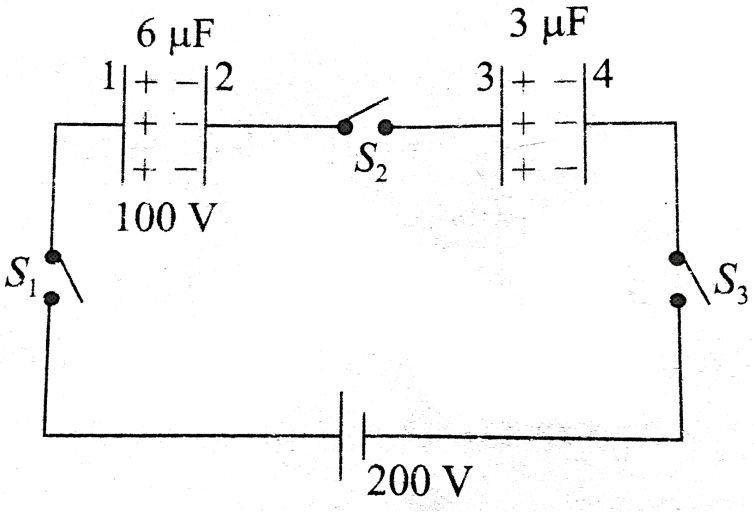
D. no charge will flow

Answer: B

Watch Video Solution

25. Two capacitors of capacity $6\mu F$ and $3\mu F$ are charge $100V$ and $50V$ separately and connected as shown in Now all the three switches S_1,

S_(2) , and `S_(3) are closed.



Which plates form an isolated system?

A. plate 1 and $plate4$` separately .

B. plate 2 and plate 3 separately .

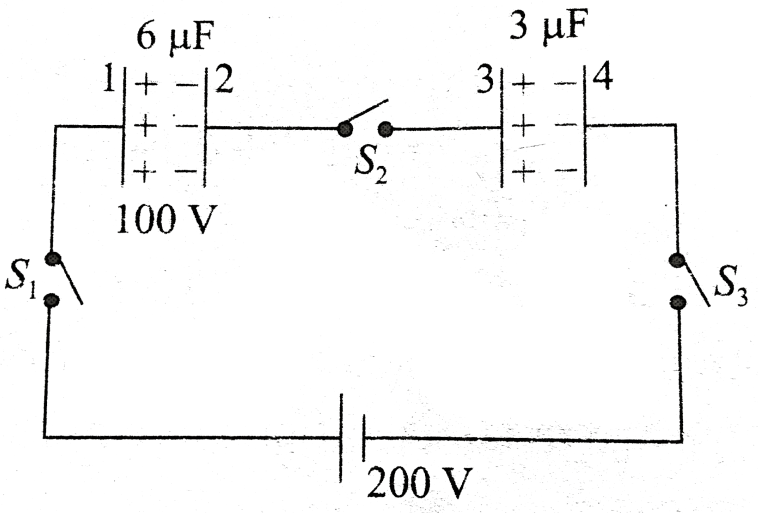
C. plate 2 and plate 3 jointly .

D. none of these.

Answer: C

Watch Video Solution

26. Two capacitors of capacity $6\mu F$ and $3\mu F$ are charge $100V$ and $50V$ separately and connected as shown in (Fig.4.201.) Now all the three switches S_1, S_2, and S_3 are closed.



Charge on the $6\mu F$ capacitor in steady state will be.

A. $400\mu C$

B. $700\mu C$

C. $800\mu C$

D. $250\mu C$

Answer: B

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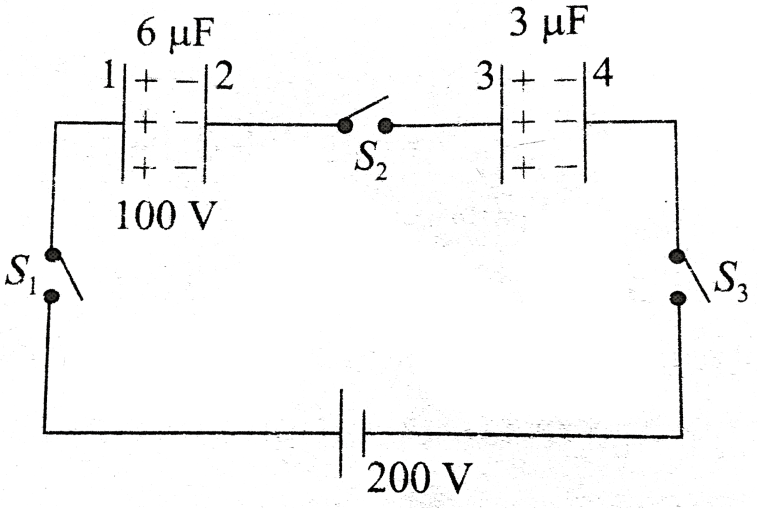
27. Two capacitors of capacity $6\mu F$ and $3\mu F$ are charge $100V$ and $50V$ separately and connected as shown in figure. Now all the three switches S_1, S_2, and S_3 are closed.



Charge on the $3\mu F$ capacitor in steady state willl be.

A. $400\mu C$

B. $700\mu C$

C. $800\mu C$

D. $250\mu C$

Answer: D

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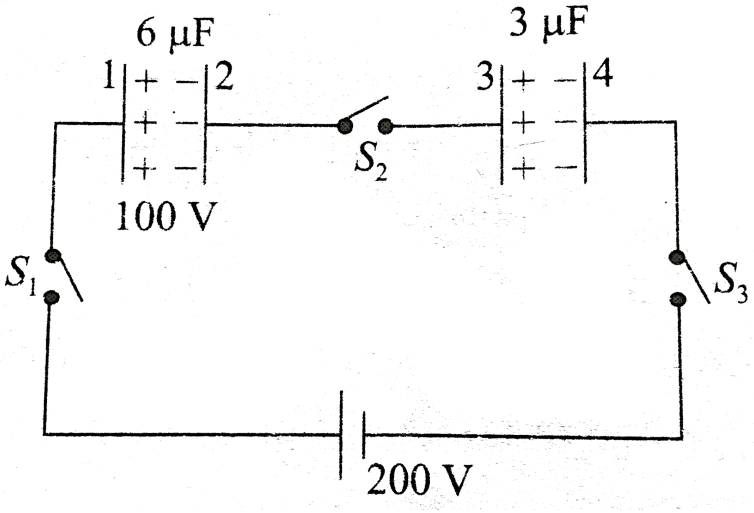
28. Two capacitors of capacity $6\mu F$ and $3\mu F$ are charge $100V$ and $50V$ separately and connected as shown in figure. Now all the three switches S_1, S_2, and S_3 are closed.



Charge on the $3\mu F$ capacitor in steady state willl be.

A. $q_1 = q_3$ and $q_2 = 0$

B. $q_1 = q_3 = \frac{q_2}{2}$

C. $q_1 = q_3 = 2q_2$

D. $q_1 = q_2 = q_3$

Answer: D

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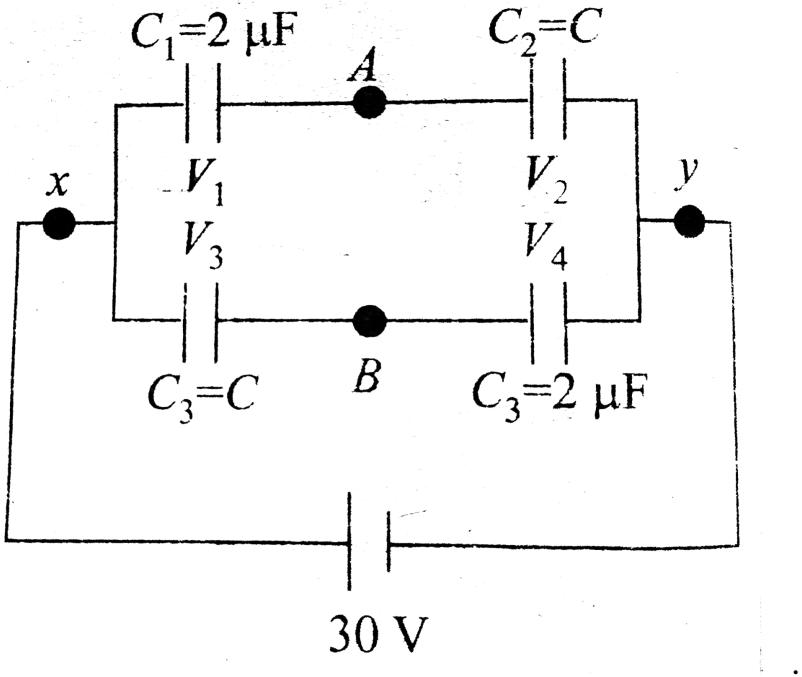
29. The given circuit shows an arrangement of four capacitors. A potential differnce $30V$ is applied across the combination. It is observed that potentials at connected between $AandB$ differ by $5V$. Also if a conducting wire is connected between A and B, electrons will flow from A to B. Of course, we have bot actually connected any wire between A and B, we have described only an if situation. Answer the following question.



Potential differnce across C_4 is.

A. $12.5V$

B. $15.5V$

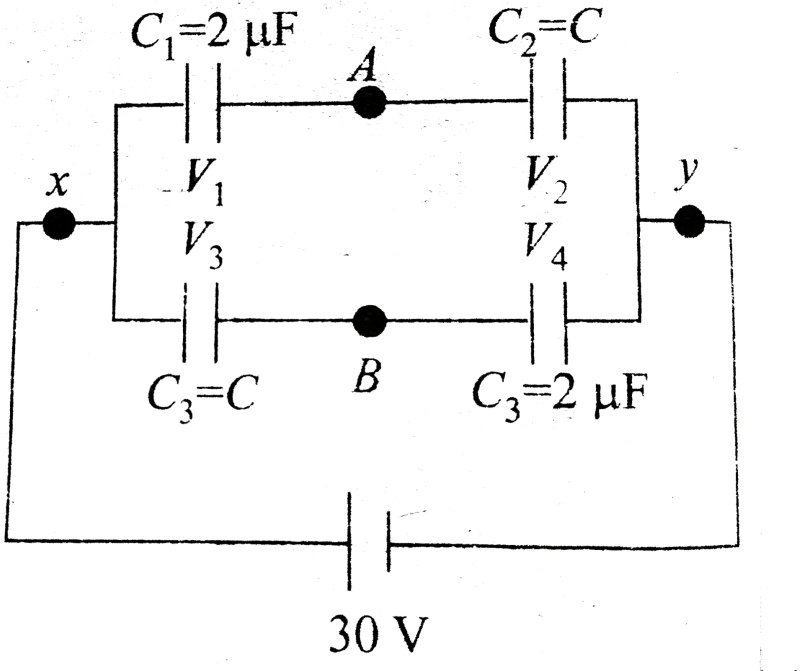
C. $17.5V$

D. $22.5V$

Answer: C

Watch Video Solution

30. The given circuit shows an arrangement of four capacitors. A potential differnce $30V$ is applied across the combination. It is observed that potentials at connected between A and B differ by $5V$. Also if a conducting wire is connected between A and B, electrons will flow from A to B. Of course, we have bot actually connected any wire between A and B, we have described only an if situation. Answer the following question.



Equivalent capacitor between X and Y is.

A. $2.34\mu F$

B. $1.54\mu F$

C. $1.22\mu F$

D. $0.77\mu F$

Answer: A

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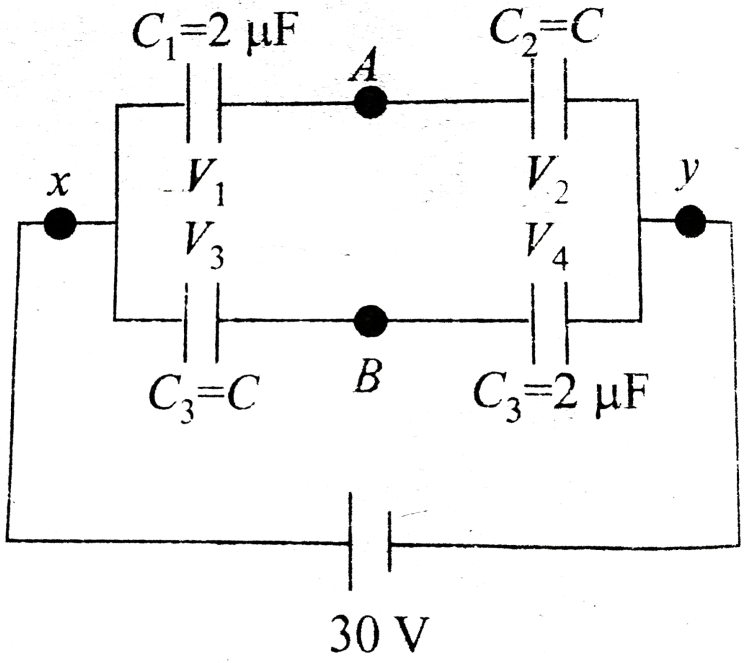
31. The given circuit shows an arrangement of four capacitors. A potential differnce $30V$ is applied across the combination. It is observed that potentials at connected between A an B differ by $5V$. Also if a conducting wire is connected between A and B, electrons will flow from $A \rightarrow B$. Of course, we have bot actually connected any wire between A and B, we have described only an if situation. Answer the following



question.

Charge on capacitor C_1 is.

A. $60\mu C$

B. $52\mu C$

C. $42\mu C$

D. $35\mu C$

Answer: D

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32. Let us now connect two more capacitors in the circuit. One of them, C_5, is connected in the part of the circuit between X and A. It connected between either in series or in parallel with C_1. The other, C_6, is connected between A and B. It is observed X and Y hass the the same malue C_5 is.

Capacitance C_5 is.

A. $1.24\mu F$ in series with C_1

B. $1.92\mu F$ inh parallel with C_1

C. $2.28\mu F$ in series with C_1

D. $2.56\mu F$ in parallel with C_1

Answer: B

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33. Let us now connect two more capacitors in the circuit. One of them, C_5, is connected in the part of the circuit between X and A. It connected

between either in series or in parallel with C_1. The other, C_6, is connected between A and B. It is observed X and Y hass the the same malue C_5 is.

Capacitance C_5 is.

A. $32\mu C$

B. $28\mu C$

C. $24\mu C$

D. $16\mu C$

Answer: C

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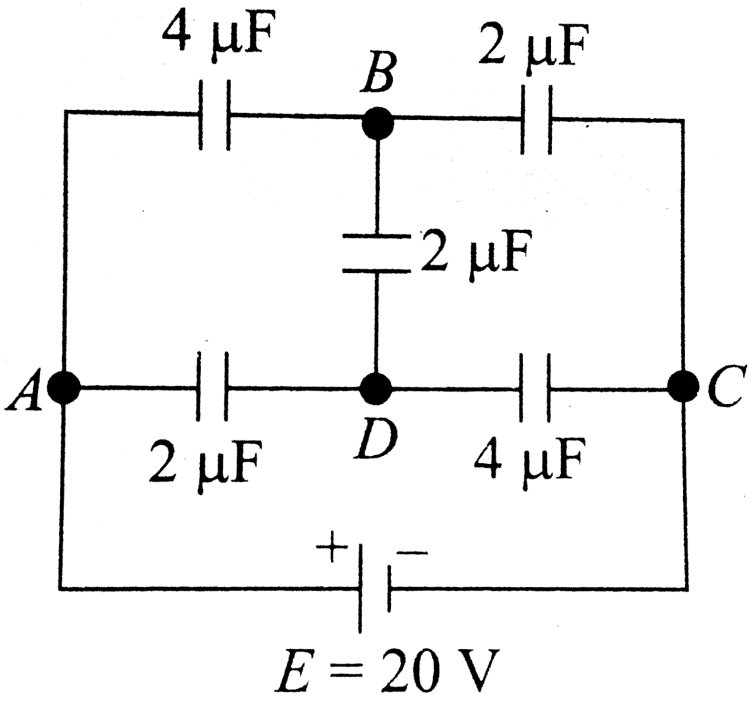
34. Shows a diagonal symmetric arrangement of capacitors and a battery.



If the potential of C is zero, then identify the incorrect statement.

A. Both the $4\mu F$ capacitors carry equal charges in opposite sense.

B. Both the $4\mu F$ capacitors carry equal charges in the same sense.

C. $V_B - V_D = 0$

D. $V_D - V_B > 0$

Answer: B

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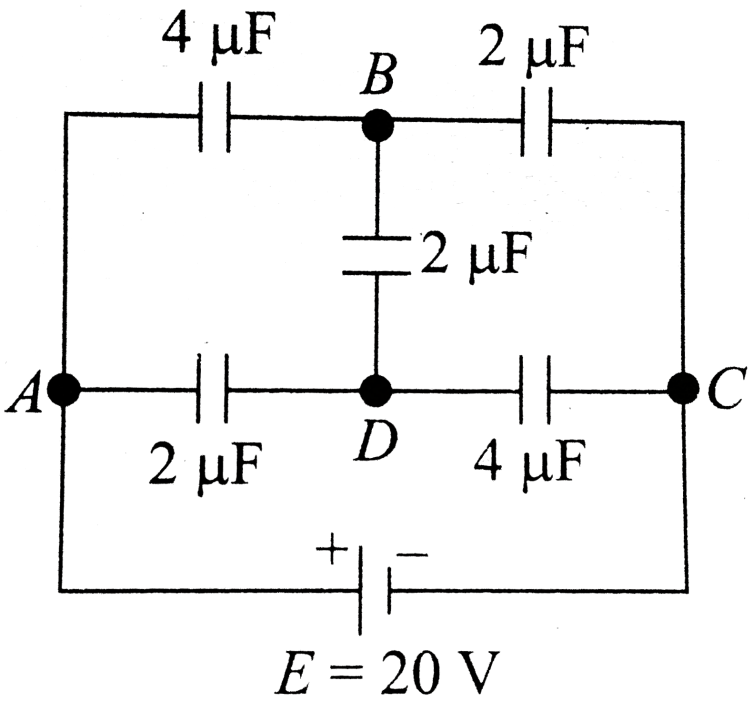
35. Shows a diagonal symmetric arrangement of capacitors and a battery.



If the potential of C is zero, then identify the incorrect statement.

A. $V_A = +15V$

B. $4(V_A - V_B) + (V_D - V_B) = 2V_B$

C. $2(V_A - V_D) + 2(V_B - V_D) = 4V_D$

D. $V_A = V_B + V_D$

Answer: A

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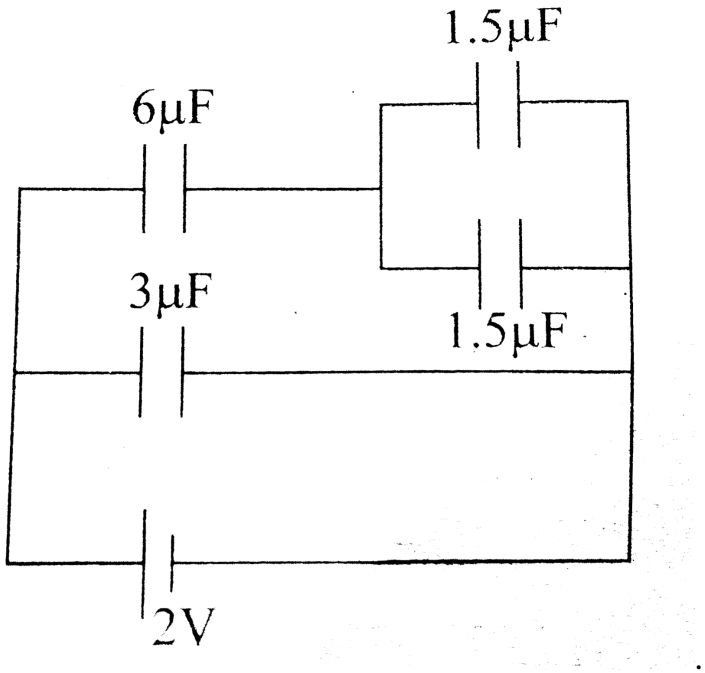
Integer

1. Each capacitance shown in is in μF. Find the charge on $6\mu F$.



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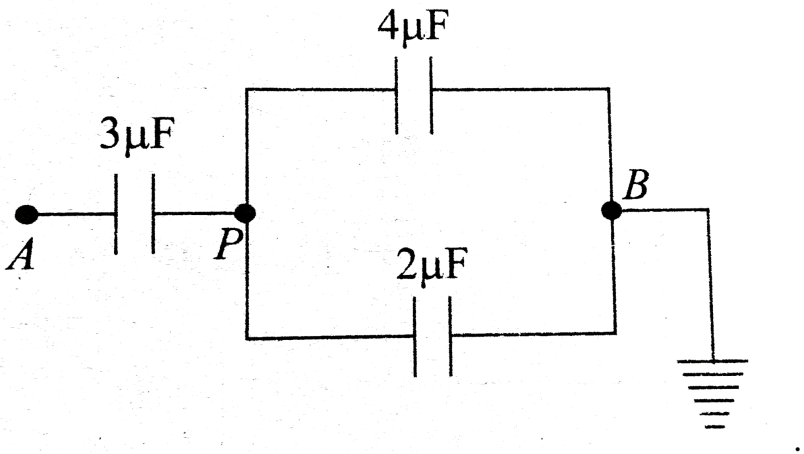
2. In, a potential of $+12V$ is given to point A, and point B is earthed. What is the potential at the point P in V?



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3. Capacitance of a parallel plate capacitor becomes 4/3 times its original value, if a dielectric slab of thickness $t = d/2$ is inserted between the plates (d is the separation between the plates). The dielectric constant of the slab is

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4. A spherical drop of capacitance $12\mu F$ is broken into eight drops of equal radius. What is the capacitance of each small drop in μF?

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5. A parallel plate capacitor of capacity C_0 is charged to a potential V_0, E_1 is the energy stored in the capacitor when the battery is disconnected and the plate separation is doubled, and E_2 is the energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is dounled. find the ratio E_1 / E_2.

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Others

1. A parallel plate capacitor is to be designed which is to be connected across 1kv potential.The dielectric meteral which is to be Filled between the plates has dielectric constant $K = 6\pi$ and dielectric strenght $10^7 V/m$. For safly the eletric field is never to exceed 10 % of the dielectirc strenght.With such specification, of we want a capacitor of 50pF, What minumim area (in mm^2) of plates is required for safe working ?

$$\left(\text{use} \quad \varepsilon_0 = \frac{1}{36\pi} \times 10^{-9} \text{inMKS}\right)$$

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2. A parallel plate capacitor is filled by a dielectric whose relative permittivity varies with the applied voltage (U) as $\varepsilon = \alpha U$ where alpha $= 2V^{-1}$. A similar capacitor with no dielectric is charged to $U_0 = 78V$. It is then is connected to the uncharged capacitor with the dielectric. Find the final voltage on the capacitors.

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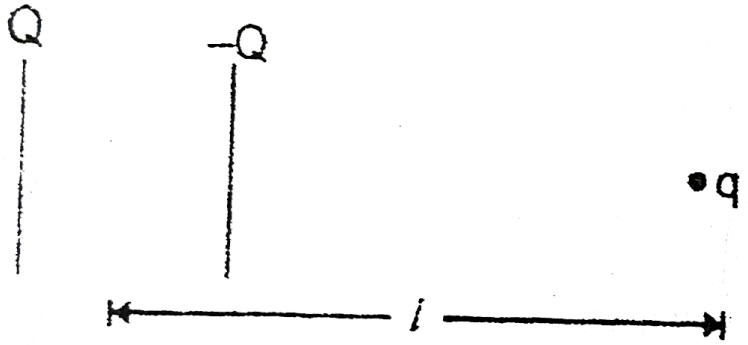
3. The plates of small size of a parallel plate capacitor are charged as shown. The force on the charged particle of 'q' at a distance 'l' from the capacitor is : (Assume that the distance between the plates is $d << l$)



A. zero

B. $\frac{Qqd}{2\pi\varepsilon_0 l^3}$

C. $\frac{Qqd}{\pi\varepsilon_0 l^3}$

D. $\frac{Qqd}{4\pi\varepsilon_0 l^3}$

Answer: B

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4. The true statement is, on increasing the distance between the plates of a parallel plate condenser

A. The electric insensity between the plate will decrease

B. The electric intensity between the plate will increase

C. The elelctric intensity between the plate remain uncharged

D. The PD between the plate will decrease

Answer: C

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5. Between the plates of a parallel plate condenser, a plate of thickness t_1 and dielectric constant k_1 is placed. In the rest of the space, there is another plate of thickness t_2 and dielectric constant k_2. The potential difference across the condenser will be

A. $\frac{Q}{A\varepsilon_0}\left(\frac{t_1}{k_1}+\frac{t_2}{k_2}\right)$

B. $\frac{\varepsilon_0 Q}{A}\left(\frac{t_1}{k_1}+\frac{t_2}{k_2}\right)$

C. $\frac{Q}{A\varepsilon_0}\left(\frac{t_1}{k_1}+\frac{t_2}{k_2}\right)$

D. $\frac{\varepsilon_0 Q}{A}(k_1 t_1 + k_2 t_2)$

Answer: A

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6. Force of attraction between the plates of a parallel plate capacitor is

A. $\frac{q^2}{2\varepsilon_0 AK}$

B. $\frac{q^2}{\varepsilon_0 AK}$

C. $\frac{q}{2\varepsilon_0 A}$

D. $\frac{q^2}{2\varepsilon_0 A^2 K}$

Answer: A

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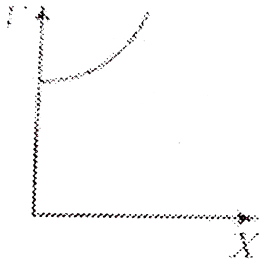
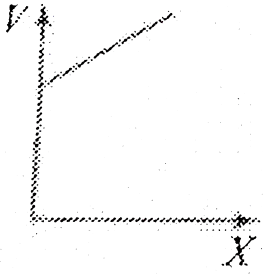
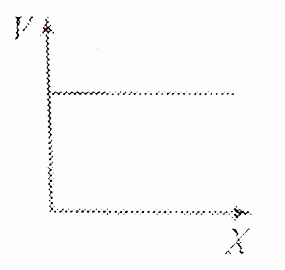
7. The space between plates of a parallel plate capacitor is filled by a dielectric and it is charged and then battery is removed. Now dielectric slab is slowly drawn out of the capacitor parallel to the plates. The variation of the potential of capacitor with respect to the length of the dielectric plate drawn out is

A. 

B. 

C. 

D. 

Answer: B

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8. A capacitor is charged by using a battery which is ten disconnected. A dielectric slab is than slipped between the plates which results in

A. redution of charge on the plates and increase the of potential difference across the plate

B. increase in the potential difference across the plate redution in stored energy, but no change on the plates

C. decrease in the potential difference across the plates redution in the stored energy but no change in the charge in the plates

D. None of above

Answer: C

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9. The capacity and the energy stored in a charged parallel plate condenser with air between its plates are respectively, C_0 and W_0. If the air is replaced by glass (dielectric constant = 5) between the plates, the capacity of the plates and the energy stored in it will respectively be

A. $5C_0.5W_0$

B. $5C_0, \frac{W_0}{5}$

C. $\frac{C_0}{5}, 5W_0$

D. $\frac{C_0}{5}, \frac{W_0}{5}$

Answer: B

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10. A parallel plate capacitor having a plate separation of $2mm$ is charged by connecting it to a $300v$ supply. The energy density is

A. $0.01j/m^2$

B. $0.01j/m^3$

C. $0.1j/m^3$

D. $10j/m^3$

Answer: B

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11. A parallel plate capacitor (without dielectric) is charged by a battery and kept connected to the battery. A dielectric salb of dielectric constant $'k'$ is inserted between the plates fully occupying the space between the plates. The energy density of electric field between the plates will:

A. increase k^2 times

B. decrease k^2 times

C. increase k times

D. decrease k times

Answer: C

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12. An uncharged parallel plate capacitor is connected to a battery. The electric field between the plates is 10V/m. Now a dielectric of dielectric constant 2 is inserted between the plates filling the entries space. The electric field between the plates now is

A. 5 V/m

B. 20 V/m

C. 10 V/m

D. none of these

Answer: C

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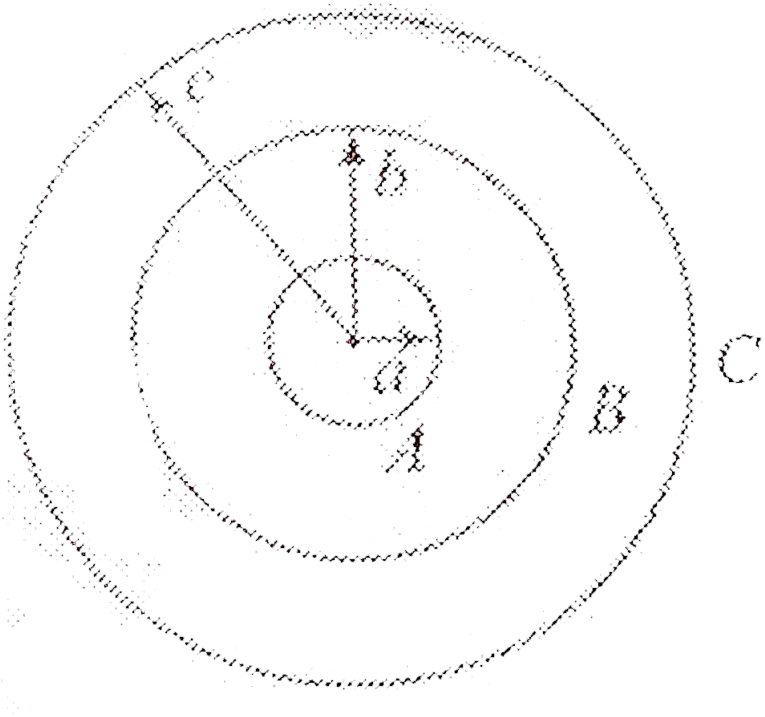
13. A and C are concentric conducting spherical shells of radius a and c respectively.A is sueeounded by a concentric dielectric medium of inner radius a, outer radius b and dielectric constant k. If sphere A is given a charge Q, the potential at the outer surface of the dielectric is



A. $\frac{Q}{(4\pi\varepsilon_0)kb}$

B. $\frac{Q}{4\pi\varepsilon_0}\frac{1}{a}+\left(\frac{10}{k(b-a)}\right)$

C. $\left(Q\frac{0}{94}\pi\varepsilon_0 b\right)$

D. none of these

Answer: C

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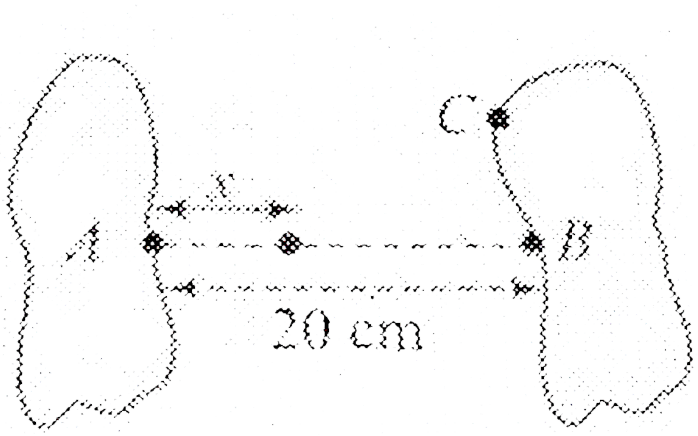
14. Two metallic bodies separated by a distance 20 cm are given equal and opposite charged on magintude 0.88 μC.The component of electric field along the line AB,between the plates, varies as $E_x = 3x^2 + 0.4N/C$, where x (in meter) is the distance from one body towards the other body

as shown



A. The capacitance of the system is 10 μF

B. The capacitance of the system is 20 μF

C. The potential difference between A and C is 0.088 volt

D. The potential difference between A and C natnot be determined from the given

Answer: A::C

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15. The plates of a parallel plate capacitor with no dielectirc are connected to a volatage source. Now a dielectric of dielectric constant K is inserted to fill the whose space between the plates with voltage source remainign connected to the capacitor-

A. The energy stored in the capacitor will become will decrease k times

B. The electric field of inside the capacitor will decrease k times

C. The force of attration between the plates will become K^2 times

D. The charge on the capacitor will become will k times

Answer: A::C::D

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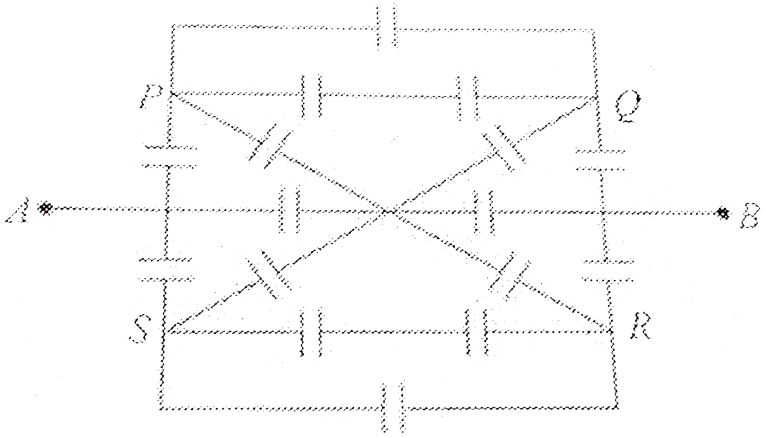
16. If each capacity C, find the capacitance between A and B



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17. The two metallic plates of radius r are placed at a distance d apart and its capacity is C. If a plate of radius $r/2$ and thickness $d$of dielectric constant 6 is placed between the plates of the condenser, then its capacity will be

A. 7C/2

B. 3C/7

C. 7C/3

D. 9C/4

Answer: D

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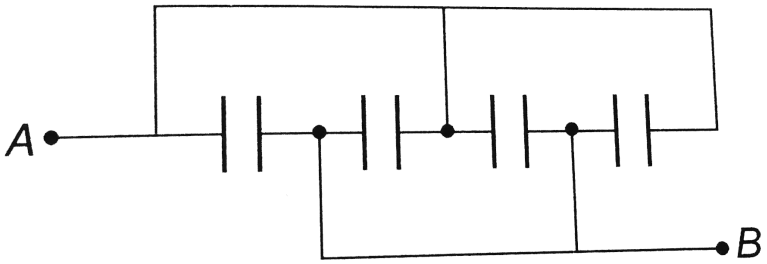
18. Four condenser are joined as shown in the adjoining figure. The capacity of each is $8\mu F$. The equivalent capacity between the points A and B will be



A. $32\mu F$

B. $2\mu F$

C. $8\mu F$

D. $16\mu F$

Answer: A

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19. The capacities connection of five capacitors are shown in the adjoining figure. The potential difference between the points A and B is 60 V. Then, the equivalent capacity between A and B and the charge on $5\mu F$ capacitance will be respectively

A. $44\mu F, 300\mu C$

B. $16\mu F, 150\mu C$

C. $15\mu F, 200\mu F$

D. $4\mu F, 50\mu C$

Answer: D

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20. In the adjoining figure, four capacitors are shown with their respective capacities and the potential difference is applied. The charge and the potential difference across the $4\mu F$ capacitor will be

A. $600\mu C$, 150volts

B. $300\mu C$, 75volts

C. $800\mu C$, 200volts

D. $580\mu C$, 200volts

Answer: D

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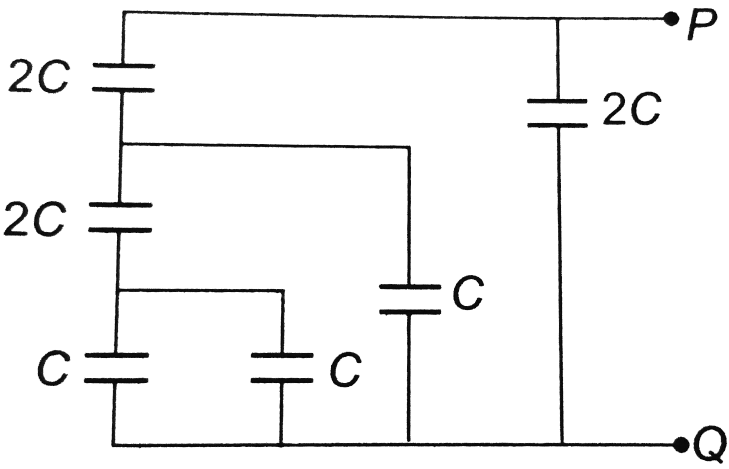
21. The resultant capacitance of given circuit is



A. 3C

B. 2C

C. C

D. $\frac{C}{3}$

Answer: A

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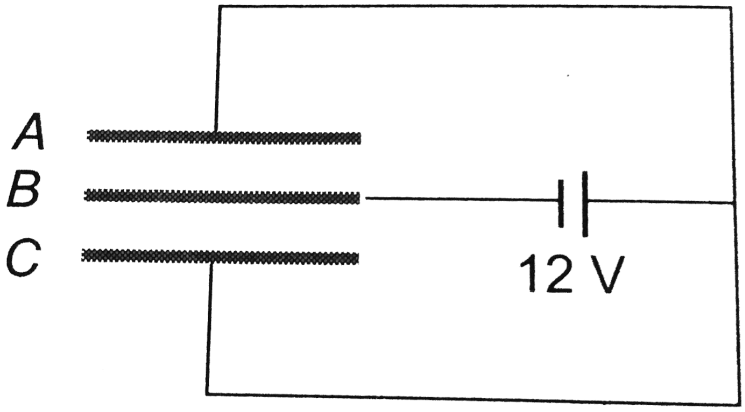
22. Three plates A, B, C each of area $50cm^2$ have separation $3mm$ between A and $3mm$ between B and C. The energy stored when the plates area fully charged is



A. $1.6 \times 10^{-9} j$

B. $2.1 \times 10^{-9} j$

C. $5 \times 10^{-9} j$

D. $7 \times 10^{-9} j$

Answer: B

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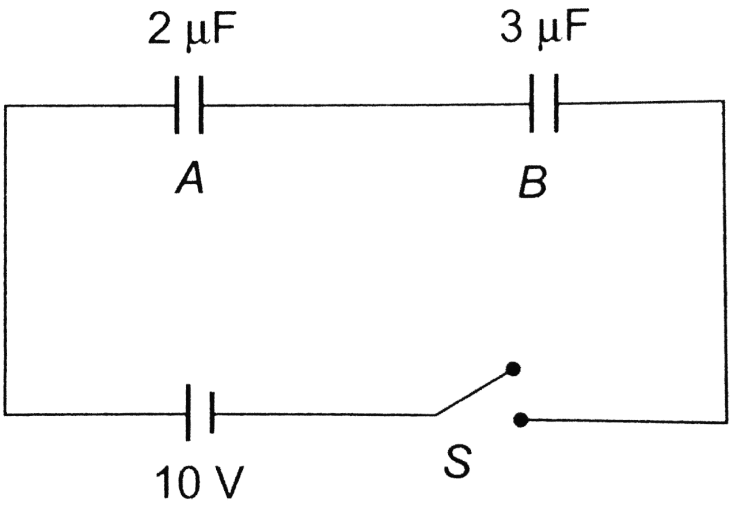
23. Two capacitors A and B are connected in series with a battery as shown in the figure. When the switch S is closed and the two capacitors get charged fully, then



A. The potential difference across the plates of A is 4 V and across the plates of B is 6V

B. The potential difference across the plates of A is 6V and across the plates of B is 4 V

C. The ratio of charge in A and B is $2:3$

D. The ratio of charge in A and B is $3:2$

Answer: B

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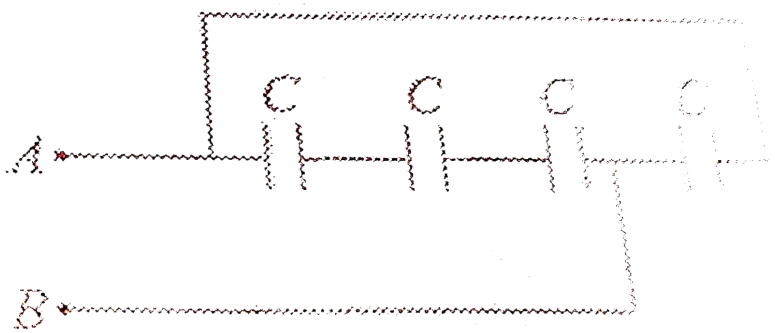
24. Two identical capactors have the same capacitance C.The equivalent capacitance between A and B is



A. $\frac{C}{4}$

B. $3\frac{C}{4}$

C. $\frac{C}{3}$

D. $4\frac{C}{3}$

Answer: D

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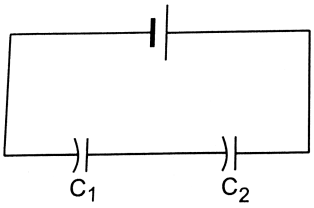
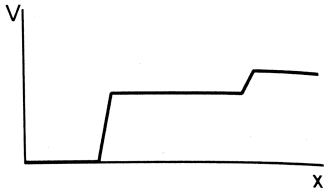
25. Figure show two capacitors connected in series and joined to a battery. The graph shows the variation in potential as one moves from left to right on the branch containing the capacitors.





A. $C_1 > C_2$

B. $C_1 = C_2$

C. $C_1 < C_2$

D. The information in not sufficient to decide the relation between C_1 and C_2

Answer: C

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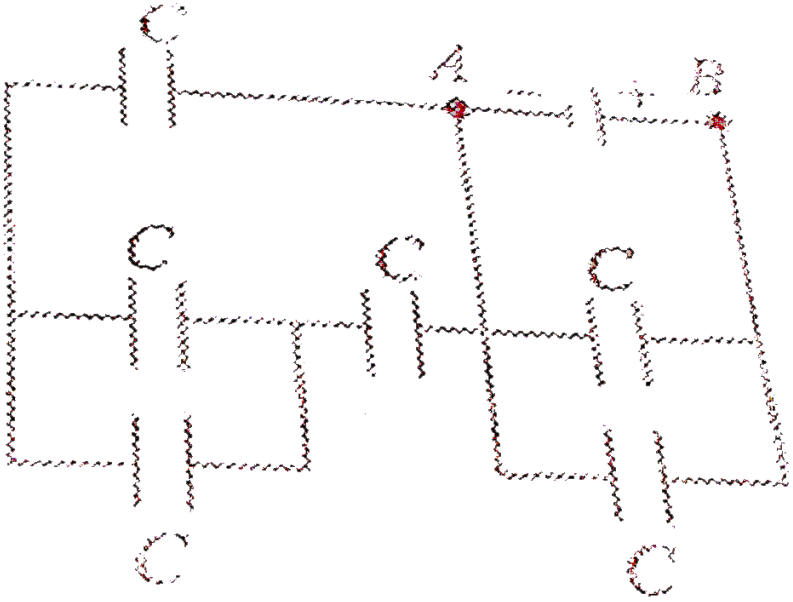
26. Ratio of amplitude for two wave is 1:2 .Find the ratio of maximum amplitude to minimum amplitude.

Watch Video Solution

27. Find equivalent capacitance between A and B



A. 6C

B. 5C

C. 3C

D. 2C

Answer: D

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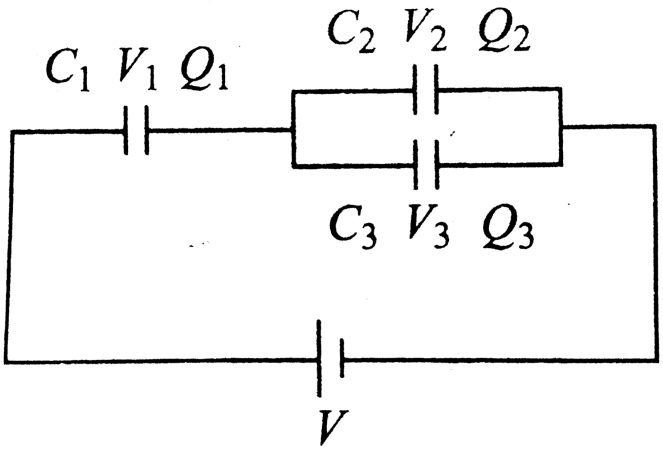
28. In three capacitors C_1, C_2, and C_3, are joined to a battery, With symbols having their usual meaning, the correct conditions will be



A. $Q_1 = Q_2 = Q_3 \text{and} V_1 = V_2 + V_3 = V$

B. $Q_1 = Q_2 + Q_3 \text{and} V = V_1 + V_2 = V_3$

C. $Q_1 = Q_2 + Q_3 \text{and} V = V_1 + V_2$

D. $Q_2 = Q_3 \text{and} V_2 = V_3$

Answer: C

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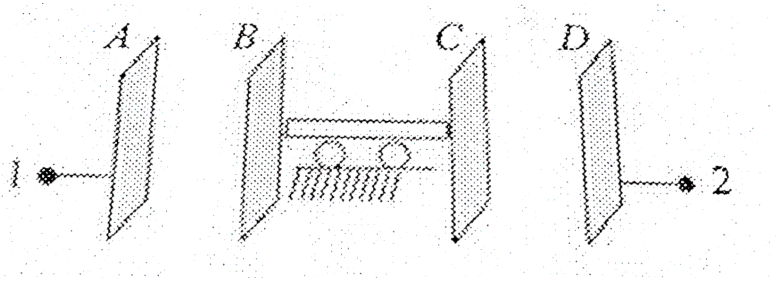
29. A, B C and D are large conduting plates kept parallel each other,A and D are fixed. Plates B and C connected to each other by a rigied conduction rod, can slide over friction less rails as shown,Initially the distence between T^1 ates C and D.If now the rod (along with plates B and C) is slightly moved toward right, the capacitance between the terminals 1 and 2



A. remains unchanged

B. increase

C. decrease

D. nothing can be said

Answer: A::C

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30. Four plates of equal area A are separated by equal distance d and are arranged as shown in the figure. The equivalent capacity is

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

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

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

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

Answer: d

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31. The capacities of two conductors are C_1 and C_2 and their respectively potentials are V_1 and V_2. If they are connected by a thin wire, then the loss of energy will be given by

A. $\frac{C_1C_2V_1 + V_2}{2(C_1 + C_2)}$

B. $\frac{C_1C_2V_1 - V_2}{2(C_1 + C_2)}$

C. $\frac{(C_1C_2V_1 - V_2)^2}{2(C_1 + C_2)}$

D. $\frac{(C_1C_2)(V_1 - V_2)}{C_1 + C_2}$

Answer: d

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32. Two identical parallel plate capacitors are connected in series to a battery of $100V$. A dielectric slab of dielectric constant 4.0 is inserted

between the plates of second capacitor. The potential difference across the capacitors will now be respectively

A. $50V, 50V$

B. $80V, 20V$

C. $20V, 80V$

D. $75V, 25V$

Answer: a

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33. The equivalent capacitance of three capacitors of capacitance $C_1 : C_2$ and C_3 are connected in parallel is 12 units and product $C_1 . C_2 . C_3 = 48$. When the capacitors C_1 and C_2 are connected in parallel, the equivalent capacitance is 6 units. then the capacitance are

A. $2, 3, 7$

B. $1.5, 2.5, 8$

C. $1, 5, 6$

D. $4, 2, 6$

Answer: d

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34. A parallel plate capacitor of area A, plate separation d and capacitance C is filled with four dielectric materials hving dielectric constants K_1, K_2, K_3 and K_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance c in this capacitor, then its dielectric constant K is given by

A. $\frac{1}{k} = \frac{1}{k_2} + \frac{1}{k_2} + \frac{1}{2k_3}$

B. $\frac{1}{k} = \frac{1}{k_2 + k_2} + \frac{1}{2k_3}$

C. $k = \frac{k_1 k_2}{k_1 + k_2} + 2k_3$

D. $k = k_1 + k_2 + 2k_3$

Answer: d

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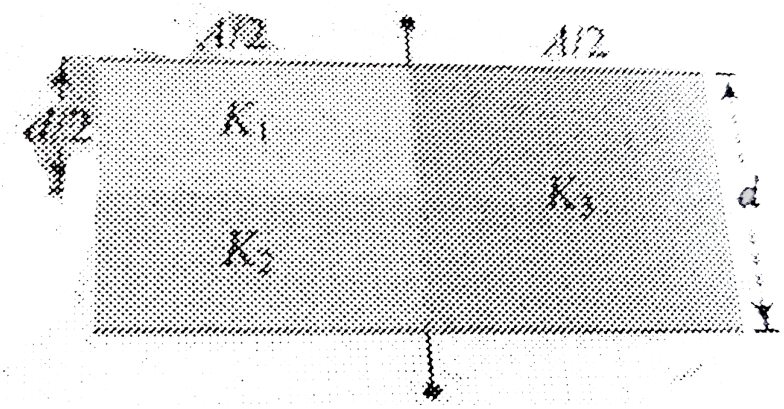
35. In the figure, a capacitor is field with dielectrics. The resultant capacitance is



A. $\frac{2\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$

B. $\frac{\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$

C. $\frac{2\varepsilon_0 A}{d}[k_1+k_2+k_3]$

D. None of these

Answer: a

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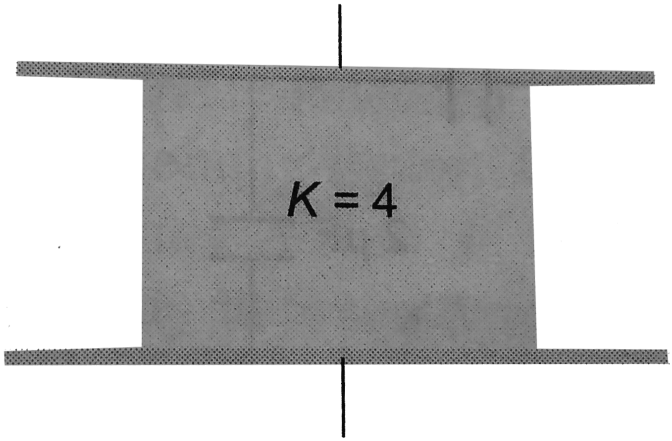
36. Consider a parallel plate capacitor of $10\mu F$ (micro-farad) with air filled in the gap between the plates. Now one half of the space between the plates is filled with a dielectric of dielectric constant 4, as shown in the figure. The capacity of the capacitor charges to



A. $25\mu F$

B. $20\mu F$

C. $40\mu F$

D. $5\mu F$

Answer: b

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37. The capacitors each of capacity $4\mu F$ are to be connected in such a way that the effective capacitance is $6\mu F$. This can be done by

A. connecting them In parallel

B. connecting two in series and one in parallel

C. connecting two in parallel and one in series

D. connecting all of them in series

Answer: b

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38. In the figure a potential of $+1200V$ is given to point A and point B is earthed, what is the potential at the point P ?

A. 100V

B. 200V

C. 400V

D. 600V

Answer: d

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39. The charge on $4\mu F$ capacitor in the given circuit is $(\text{in}\mu C)$

A. 12

B. 24

C. 36

D. 32

Answer: c

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40. Four identical capacitors are connected as shown in diagram. When a battery of 6 V is connected between A and B, then the charge stored is found to be $1.5\mu C$. The value of C_1 is

A. $1.5\mu F$

B. $15\mu F$

C. $1.5\mu F$

D. $0.1\mu F$

Answer: c

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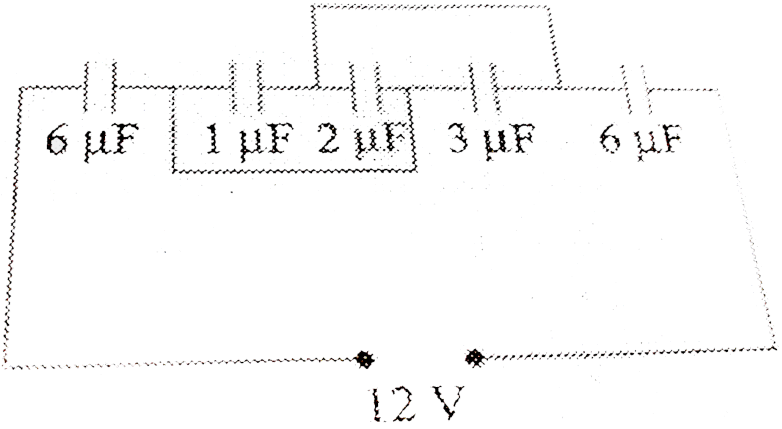
41. Figure shows five capacitors connected across a 12V power supply. What is the charge on the $2\mu F$ capacitor ?



A. $6\mu C$

B. $8\mu C$

C. $10\mu C$

D. $12\mu C$

Answer: d

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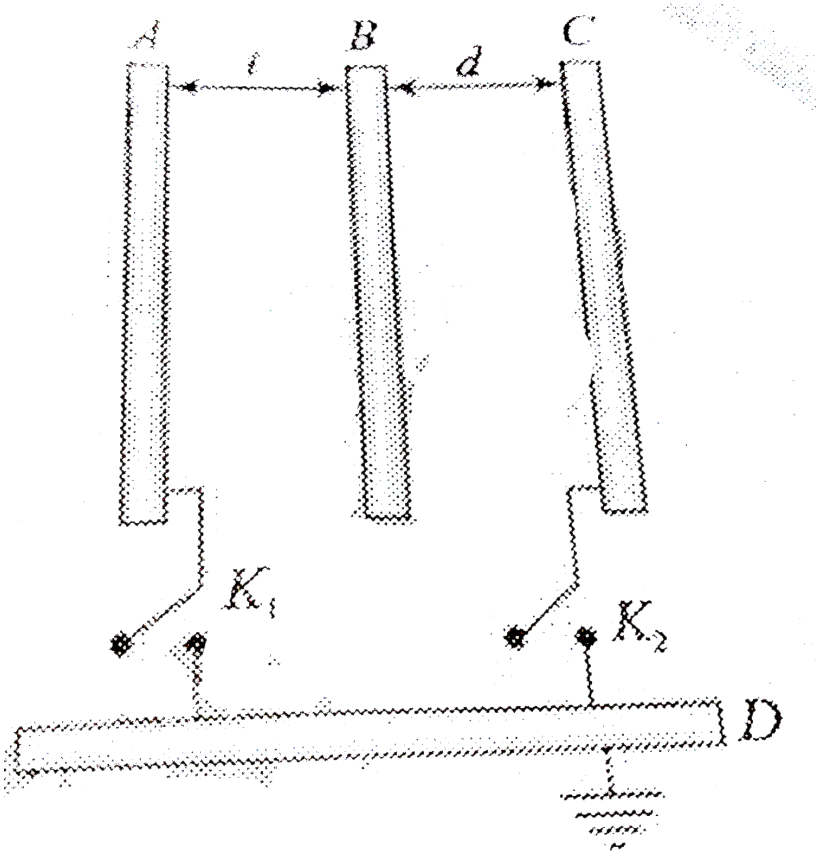
42. Three plates A, B and C are placed close to each other with $+Q$ charge given to the middle plate. The inner surfaces to A and C can be connected to earth through plate D and keys K_1 and K_2 . The plates D is a dielectric slab with dielectric constant K_1 then the charge that will flow through plate D and keys K_1 and K_2 . The plate D is a dielectric slab with dielectric constant K, then the charge that will flow though plate D when K_2 is closed and K_2 is open is



A. $-Q$

B. $-Q/2$

C. $Q\left(1-\frac{1}{K}\right)$

D. $\frac{Q}{2}\left(1-\frac{1}{K}\right)$

Answer: c

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43. In the previous problem, the maximum range of movement of the centre of the part of the circle from line AD in which charged particle of charge Q moves with a velocity v when (θ) is positive to when (θ) is negative is given by

A. $\frac{t}{(d+t)}Q$

B. $\frac{d}{(d+t)}Q$

C. $\frac{(d+t)}{t}Q$

D. $\frac{(d+t)}{d}Q$

Answer: a

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44. In the circuit shown in Fig, initially K_1 is closed and K_2 is open . What are the charges on each capacitor.

Then K_1 was opened and K_2 was closed (order is important). What will be the charge on each capacitor now ? $[C = 1\mu F]$

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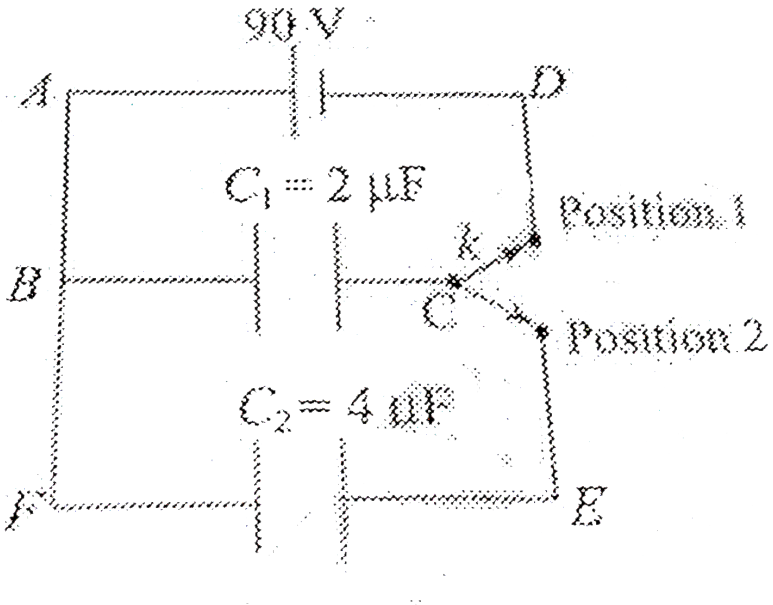
45. Figure shows two capacitors of capacitance $2\mu F$ and $4\mu F$ and a cell of 90 V. The switch 'k' is such that when it is in position 1, the circuit ABCD is closed and when it is in position 2, the circuit BCEF is closed.the resistance of both the circuits is negligible os that the capacitor gets fully charged instantly. Initially the switch is in position1. then it is turned in position 2 and then in position 1. Now two cycles are completed. Find the

charge $(\text{in}\mu C)$ after two cycles.



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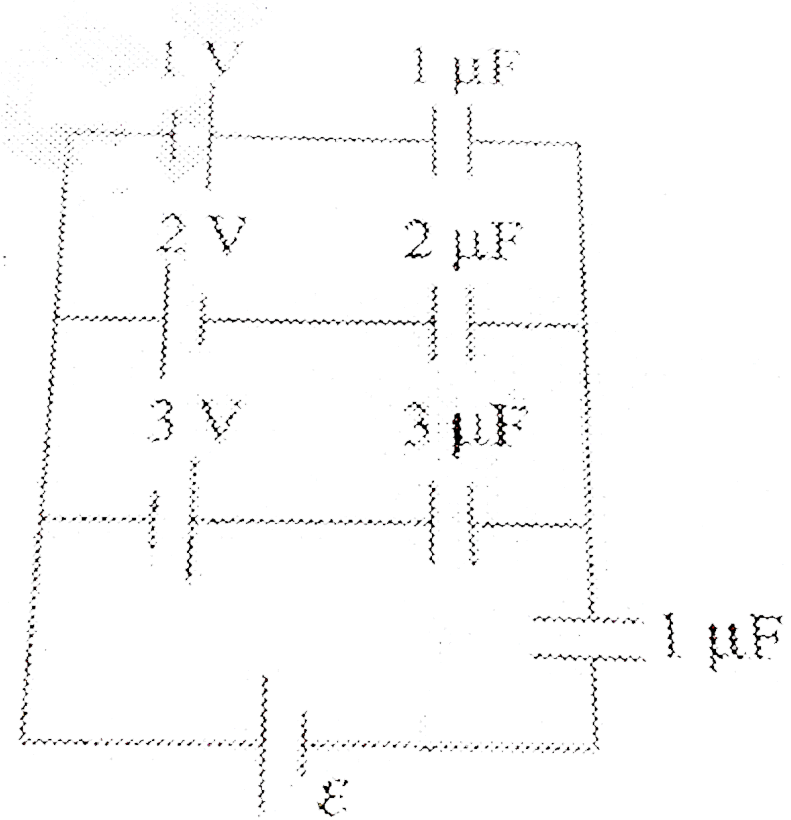
46. In the figure shown. Find the e.m.f. ε for which charge on $2\mu F$ capacitor is $4\mu C$.



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47. A condenser having a capacity of $6\mu F$ is charged to $100V$ and is then joined to an uncharged condenser of $14\mu F$ and then removed. The ratio of the charges on $6\mu F$ and $14\mu F$ and the potential of $6\mu F$ will be

A. $\frac{6}{14}$ and 50vollt

B. $\frac{14}{6}$ and 30volt

C. $\frac{6}{14}$ and 30volt

D. $\frac{14}{6}$ and 0volt

Answer: C

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48. A capacitor $4\mu F$ charged to $50V$ is connected to another capacitor of $2\mu F$ charged to $100V$ with plates of like charges connected together. The total energy before and after connection in multiples of $\left(10^{-2}J\right)$ is

A. 1.5 and 1.33

B. 1.33 and 1.5

C. 3.0 and 2.67

D. 2.67 and 3.0

Answer: A

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49. A condenser of capacity C_1 is charged to a potential V_0. The electrostatic energy stored in it is U_0. It is connected to another uncharged condenser of capacity C_2 in parallel. The energy dissipated in the process is

A. $\frac{C_2}{C_1 + C_2} U_0$

B. $\frac{C_1}{C_1 + C_2} U_0$

C. $\left(\frac{C_1 - C_2}{C_1 + C_2} \right) U_0$

D. $\frac{C_1 C_2}{2(C_1 + C_2)} U_0$

Answer: A

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50. In the circuit shown here $C_1 = 6\mu F$, $C_2 = 3\mu F$ and battery B = 20 V. The switch S, is first closed. It is then opened and afterwards S_2 is closed.

What is the charge finally on C_2 ?

A. $120\mu C$

B. $80\mu C$

C. $40\mu C$

D. $20\mu C$

Answer: C

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51. A $10\mu F$ capacitor and a $20\mu F$ capacitor are connected in series across a $200V$ supply line. The chraged capacitors are then disconnected from the line and reconnected with their positive plates together and negative plates together and no external voltage is applied. what is the potential difference across each capacitor ?

A. $\frac{400}{9}V$

B. $\frac{800}{9}V$

C. $400V$

D. $200V$

Answer: B

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52. Two condensers C_1 and C_2 in a circuit are joined as shown in figure. The potential of point A is V_1 and that of B is V_2. The potential of point D will be

A. $\frac{1}{2}(V_1 + V_2)$

B. $\frac{C_2V_1 + C_1V_2}{C_1 + C_2}$

C. $\frac{C_1V_1 + C_2V_2}{C_1 + V_2}$

D. $\frac{C_2V_1 - C_1V_2}{C_1 + V_2}$

Answer: C

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53. Two identical capacitors have the same capacitance C. one of them is charged to potential V_1 and the other to V_2. The negative ends of the capacitors are connected together. What the positive eneds are also connected, the decrease in neergy of the combine system is

A. $\frac{1}{4}C\left(V_1^2 - V_2^2\right)$

B. $\frac{1}{4}C\left(V_1^2 + V_2^2\right)$

C. $\frac{1}{4}C(V_1 - V_2)^2$

D. $\frac{1}{4}C(V_1 + V_2)^2$

Answer: C

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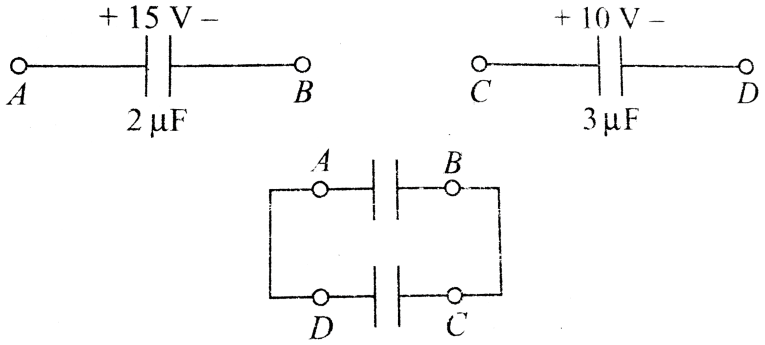
54. In, the initial status of capacitors and their connections is show. Which of the folllowin is incorrect about this circuit?



A. Final charge on each capacitor will be zero

B. Final total electrical energy of the capacitors will be zero

C. Total charge flown from A to D is $30\mu C$

D. Total charge flown from $A\text{to}D\text{is}-30\mu C$

Answer: C

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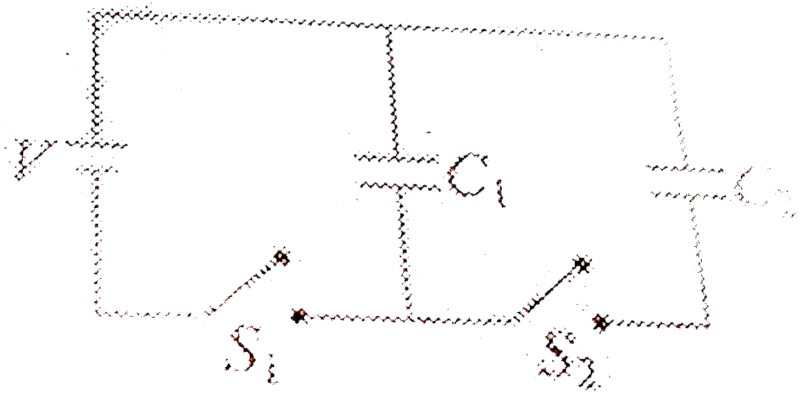
55. Consider the circuit shown where $C_1 = 6\mu F, C_2 = 3\mu F$ and $V = 20V$. Capacitor C_1 is first charged by closing the switch S_1. Switch S_1 is then opened, and the charged capacitor is connected to the uncharged capacitor C_2 by closing S_2.



A. Total charge that has flown through the battery is $120\mu C$.

B. Final charge on C_1 after opening switch S_1 and closing switch $S_2 \text{is} 80\mu C$.

C. Final charge on C_2 after opening switch S_1 and closing switch $S_2 \text{is} 40\mu C$

D. Total heat produced after closing switch $S_2 \text{is} 1.8mJ$.

Answer: $(A, -B, C)$

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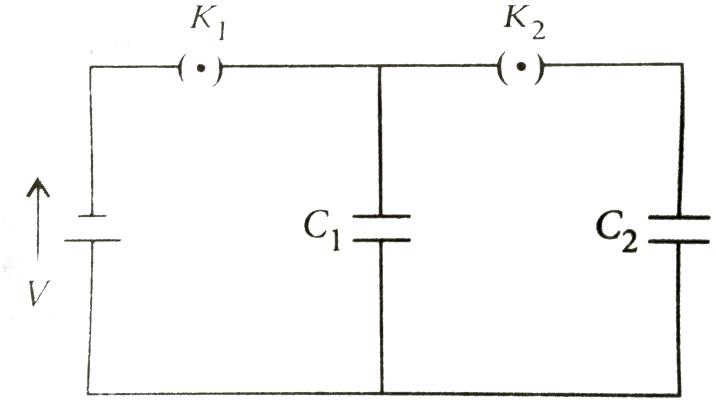
56. In the given circuit, initially K_1 is closed and K_2 is open. Then K_1 is opened and K_2 is closed. If q_1, and q_2' are charges on C_1 and C_2 and V_1 are the voltages respectively, then



A. Charge on C_1 gets redistributed such that $V_1 = V_2$

B. Charge on C_1 gets redistributed such that $Q_1 = Q_2$

C. charge on C_1 gets redistributed such that $C_1V_1 + C_2V_2 = C_1E$

D. Charge on C_1 gets redistributed such that $Q_1 + Q_2 = C_1E$

Answer: (A, C, D)

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57. Two capacitors C_1 and C_2 are charged to same potential V, but with opposite polarity as shown in the figure. The switches S_1 and S_2 are then closed

A. PDs across. Two capacitors are the same and is given by $\frac{(C_1 - C_2)V}{(C_1 + C_2)}$

B. PDs across two capacitors are the same and is given by $\frac{C_1 V}{(C_1 + C_2)}$

C. Ratio of final energy to initial energy of the system is $\left(\frac{(C_1 - C_2)}{(C_1 + C_2)}\right)^2$

D. Ratio of final energy to initial energy of the system is $\left(\frac{(C_1)}{(C_1 + C_2)^2}\right)$

Answer: (A, C)

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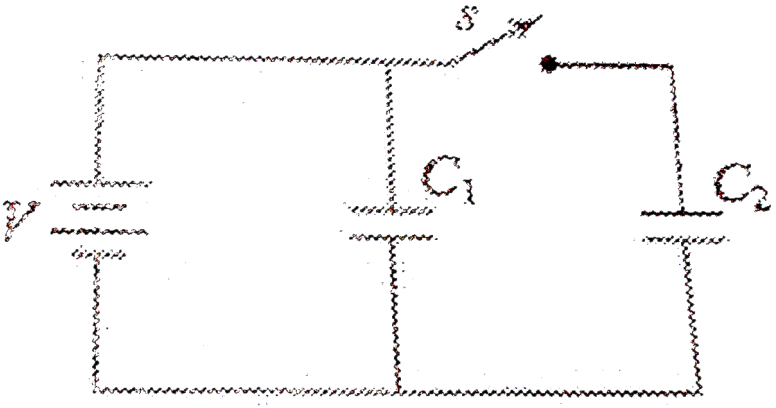
58. Two capacitors of equal capacitance $(C_1 = C_2)$ are as shown in the figure. Initially, while the swithc is open (as shown) one of the capacitors is uncharged and the other carries charge Q_0. The energy stored in the charged capacitor is U_0. Sometime after the switch is closed, the capacitors $C_1 \text{and} C_2$ carry charged $Q_1 \text{and} Q_2$ respectively, the energy stored in the capacitors are $U_1 \text{and} U_2$ respectively. Which of the following expression is correct?



A. $Q_0 = \frac{1}{2}(Q_1 + Q_2)$

B. $U_0 = U_1 + U_2$

C. $Q_0 = \frac{1}{2}\left(\frac{U_1}{Q_1} + \frac{U_2}{Q_2}\right)$

D. $Q = Q_2$

Answer: (A, D)

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