PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

CAPACITANCE AND CAPACITOR

Examples

1. The capacitance of a spherical conductor is $1\mu F$ and the charge on it is -10C. What is its potential in air?

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2. The potential of a conductor having 40 esu of capacitance is raised by 10 esu. What is the charge on the conductor ? How much charge is to be given to another conductor, having capacitance three times that of the first conductor, to raise its potential three times that of the first one?

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3. Radius of the earth is 6400 km. Determine its capacitance in μF.

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4. A metal sphere has a diameter of 1m. What will be the amount of charge required to rate its potential by $2.7 \times 10^6 V$?

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5. Is it possible for a metal sphere of radius 1 cm to hold a charge of 1C ?

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6. The diameter of a spherical liquid drop is 2 mm and its charge is 5×10^{-6} esu.

What is the potential on its surface?

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7. The diameter of a spherical liquid drop is 2 mm and its charge is 5×10^{-6} esu.

If two such liquid drops coalesce to form a bigger drop, what will be the potential on its surface ?

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8. A conductor of capacity 4 units, charged with 100 units of positive charge is connected to another conductor of capacity 2 units, charged with 20 units of negative charge. What is the change in potential of each

conductor ? What will be the charges of each of them after connection?

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9. An insulated metallic vessel full of water is charged with a potential of 3V. Drops of water are tricking from an arifice at the bottem of the vessel. What is the amount of charge contained in each spherical drop of radius 1mm?

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10. The radii of two insulated metal spheres are 5 cm and 10 cm. They are charged up to potential of 10 esu and 15 esu, respectively. If the two shperes are connected with one another, what will be the loss of energy?

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11. A metal sphere of radius 10 cm is charged up to a potential of 80 esu. After sharing its chage with another sphere, the common potential of them becomes 20 esu. What is the radius of the second sphere ?

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12. One thousand similar electrified raindrops merge into a single one so that their total charge remains unchanged. Find the change in the total electrostatic energy of the drops, assuming that all the drops are spherical and the small drops were initially at large distances from one another.

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13. Two equally charged soap bubbles of equal volume join together to form a large bubble. If each small bubble had a potential V, find the potential of the resultant bubble.

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14. Eight spherical liquid drops join to form a large drop. Diameter of each drop is 2mm and charge 5μ statC. What is the potential on the surface of the large drop?

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15. The ratio of the capacitance of two conductors A and B is 2: 3. The conductor A gains a certain amount of charge and shares it with B. Compare the initial energy of A with the total energy of A and B.

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16. Each of 27 identical mercury drops is charged to a potential of 10V. If the drops coalesce to form a big drop, what will be its potential? Calculate the ratio of the energy of the big drop to that of a small drop.

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17. Charges of $10^{-2}C$ and $5 \times 10^{-2}C$ are put on two metal spheres of radii 1 cm and 2 cm respectively. If they are connected with a metal wire, what will be the final charge on the smaller sphere ?

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18. The capacitance and potential, respectively, of a conductor A are 10 unit 50 unit, those of another conductor B are, respectively, 5 unit and 65 unit. Find out the charges on the two conductors after they are connected by a conductiong wire.

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19. A spherical liquid drop of capacitance $1\mu F$ breaks into 8 drops of the same radius. What is the capacitance of each of these smaller drops?

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20. Two isolated metallic solid spheres fo radii R and 2R are charged in such a way that both of these have same charge density σ. The spheres are placed far away from each other and are connected by a thin conducting wire. Find the new charge density on the bigger sphere.

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21. The area of each plate of a parallel plate glass capacitor is $314cm^2$. Its plates are separated by a distance 1 cm. What will be the radius of a sphere having a capacitance equal to that of this capacitor ? [k of glass=8]

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22. The area of each plate of a parallel plate capacitor is 22 cm^2 and the plates are kept separated by a paraffin paper of thickness 1mm. Specific inductive capacity of paraffin paper is 2. What are the capacitance of the capacitor and the surface density of charge under a potential difference of 330V?

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23. The distance between the two plates of a parallel plate air capacitor is d. A piece of metal of thickness $\frac{d}{2}$ and of area equal to that of the plates is inserted

between the plates. Compare the capacitances in the two cases.

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24. The conducting plates of a parallel plate capacitor are separated by 2 cm from each other. A dielectric slab (k =5) of thickness 1 cm is inserted between the two plates. The distance between the plates is now so changed that the capacitance of the capacitor remains the same. What will be the new distance between the plates?

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25. Surface area of each plate of a parallel plate capacitor is 50 cm^2. They are separated by 2mm in air. It is connected with a 100V power supply. Now a dielectric (k =5) is inserted between its two paltes. What will happen

If the voltage source remains connected?

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26. Surface area of each plate of a parallel plate capacitor is 50 cm^2. They are separated by 2mm in air. It is connected with a 100V power supply. Now a dielectric (k =5) is inserted between its two plates. What will happen

If the voltage source is absent during this insertion?

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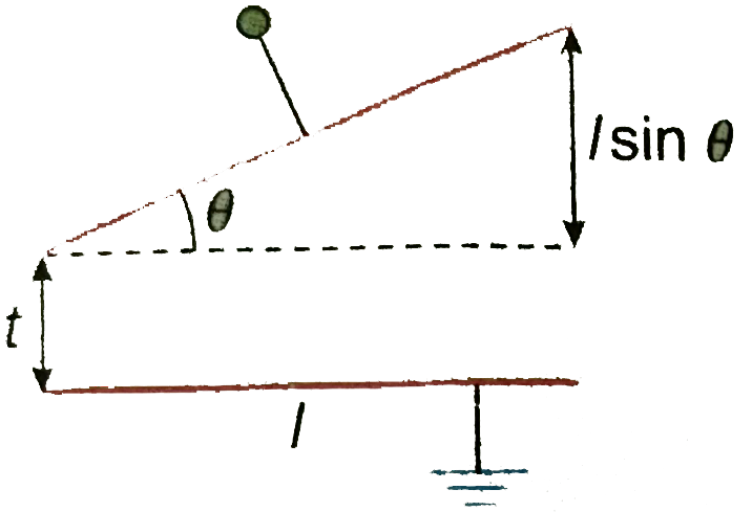
27. Each of the two square plates of a capacitor has sides of length l. The angle θ between the two plates is very small. If the medium between the plates is air and the minimum distance between them is t, determine the capacitance of the capacitor.



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28. A parallel plate air capacitor has a capacitance of 2pF. Now, the separation between the plates is doubled, and the space is filled with wax. If the capacitance rises to 6pF, what is the dielectric constant of wax?

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29. The area of each plate of a parallel plate capacitor is A = $600cm^2$ and their separation is d = 2.0 mm. The capacitor is connected to a 200 V dc source. Find out the uniform electric field between the plates in SI unit?

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30. The area of each plate of a parallel plate capacitor is A = $600cm^2$ and their separation is d = 2.0 mm. The capacitor is connected to a 200 V dc source. Find out the surface density of charge on any plate. Given, $\in_0 = 8.85 \times 10^{-12} F \cdot m^{-1}$.

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31. The potential of a capacitor increases from zero to 150 V when a charge of 10 esu is imparted to it. What will be the energy stored in the capacitor?

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32. Find out the energy content in a volume of $1cm^3$ around a point, situated in the electric field of a point charge of 10C, at a distance of 2 m in air from the position of the point charge. Given, $\in_0 = 8.85 \times 10^{-12} F \cdot m^{-1}$.

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33. Estimate the percentange change of the energy stored in a parallel plate capacitor, if the separation between its plates is reduced by 10%, keeping the voltage of the charging source unchanged?

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34. A 900pF capacitor is charged to 100V by a battery. How much energy is stored in the capacitor?

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35. The capacitance of a parallel plate air capacitor is C. The capacitor is immesed half way into an oil of dielectric constant 1.6 with the plates perpendicular to the surface of the oil. What will be the capacitance of this capacitor?

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36. A condenser is composed of 21 circular plates placed one after the other. The diameter of each plate is 10 cm. The consecutive plates are separated by 0.2 mm thick mica sheets of dielectric constant 6. If the alternate circular plates are connected, calculate the capacitance of the condenser in μF.

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37. A condenser is composed of 200 circular tin plates placed one after the other. The consecutive plates are separated by 0.5 mm thick mica sheets of dielectric constant 6. If the alternate tin plates are connected and

the capacitance of the entire condenser is $0.4\mu F$, what is the radius of each tin plate?

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38. The equivalent capacitance of the parallel and the series combinations of two capacitors are $5\mu F$ and $1.2\mu F$, respectively. Calculate the capacitances of each capacitor.

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39. Two capacitors of capacitances $20\mu F$ and $60\mu F$ are connceted in series. If potential difference between the

two ends of the combination is 40 V, calculate the terminal potential differences of each capacitor?

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40. A charged condenser is made to share its charge with an uncharged condenser of twice its capacitance. Find the sum of the energy of the two condensers?

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41. A spherical drop of water carries a charge of $10 \times 10^{-12} C$ and has a potential of 100V at its surface. What is the radius of the drop ?

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42. A spherical drop of water carries a charge of $10 \times 10^{-12} C$ and has a potential of 100 V at its surface. If eight such charged drops combine to form a single drop, what will be the potential at the surface of the new drop?

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43. Three plates of the same size form a system of capacitors. Each plate has an area α. The intermediate distances between the plates are d_1 and d_2, respectively. The space between the first two plates is

occupied by a dielectric of constant k_1 and that between the second and third plates by a dielectric of constant k_2 . Calculate the capacitance of the system.

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44. The capacitance of a parallel plate air capacitor is 9pF. The separation between the plates is d. The intermidate space is filled up by two dielectric media. The widths of them are $\frac{d}{3}$ and $\frac{2d}{3}$, and their dielectric constants are 3 and 6, respectively. Find the capacitance of the parallel plate capacitor?

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45. Three capacitors having capacitances $1\mu F, 2\mu F$ and $3\mu F$ are joined in series. A potential difference of 1100 V is applied to the combination. Find the charge and potential difference across each capacitor.

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46. Two capacitors having capacitances $0.1\mu F$ and $0.01\mu F$ are joined in series. A potential difference of 22V is applied to the combination. If the capacitors are now joined in parallel, what will be the change in stored energy?

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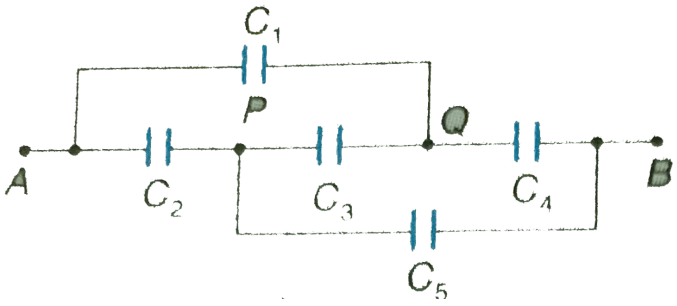
47. Five capacitors have been arranged in a circuit. Capacitance of each capacitor is C. Determine the effective capacitance between the points A and B.



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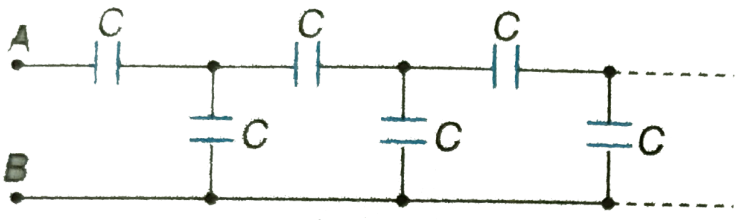
48. Show that the equivalent capacitance of an infinite circuit formed by the repetation of a similar loop made of two similar capacitors, each of capacitance

$C = (\sqrt{5}+1)\mu F, \quad \text{is} \quad 2\mu F.$



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49. Twelve capacitors, each of capacitance $10\mu F$, are inserted at the sides of a cube made of conducting wires. Determine the equivalent capacitance between A and B.

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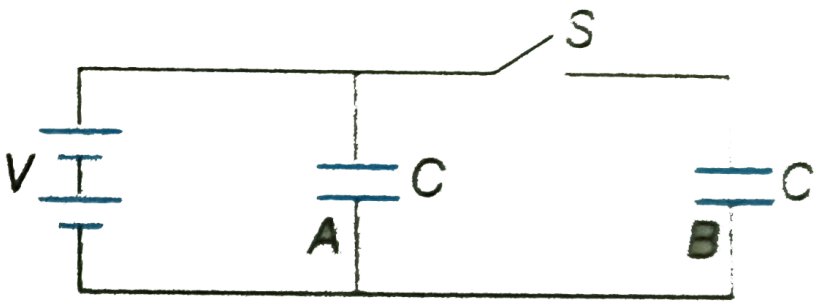
50. In Fig. 4.30, two identical parallel plate air capacitors are connected to a battery. At first the key S is closed and then it is opend. The space between the two capacitors are now filled up with a dielectric, having dielectric constant 3. Determine the ratio of the energy stored in the two capacitors before and after insertion of the dielectric?



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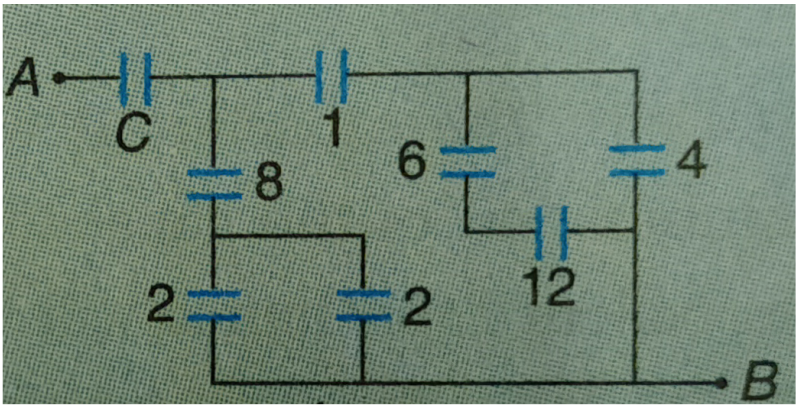
51. Determine the capacitance of the capacitor C in Fig.4.31 when the equivalent capacitance between A and B is $1\mu F$. The unit of all the capacitances is μF



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52. Three capacitors A,B,C are connected in such a way that their equivalent capacitance is equal to the capacitance of B. The capacitances of A and B are $10\mu F$ and $30\mu F$

respectively and $C \neq 0$. Determine three possible values of C and also show how the capacitors are to be connected in the three cases.

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53. 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. What is the potential difference across the capacitors now?

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54. A potential difference of 20V is applied across a parallel combination of three identical capacitors. If the total charge in the combination be 30C, determine the capacitance of each capacitor. What will be the charge in the series combination of these three capacitors with the same potential difference?

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55. The capacitance of a parallel plate air capacitor is C. Now, half the areas of its plates are vertically dipped in an oil of dielectric constant 1.6. What would be its capacitance?

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56. Each of the plates of a parallel plate capacitor is a circular disc of radius 5 cm. Find out its capacitance if the separation between the plates is 1 mm.

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57. A $2\mu F$ capacitor is charged to a potential of 20V. Another $3\mu F$ uncharged capacitor is connected in parallel with the first capacitor. What would be the terminal potential difference of the combination? Find out the charges on the two capacitors?

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58. A $20\mu F$ capacitor is charged to a potential of 20V and is then connected to an uncharged $10\mu F$ capacitor. Find out the common potential and the ratio of the energies stored in the two capacitors.

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59. How should three capacitors of capacitances $3\mu F, 3\mu F$ and $6\mu F$, be connected to get an equivalent capacitance of $5\mu F$?

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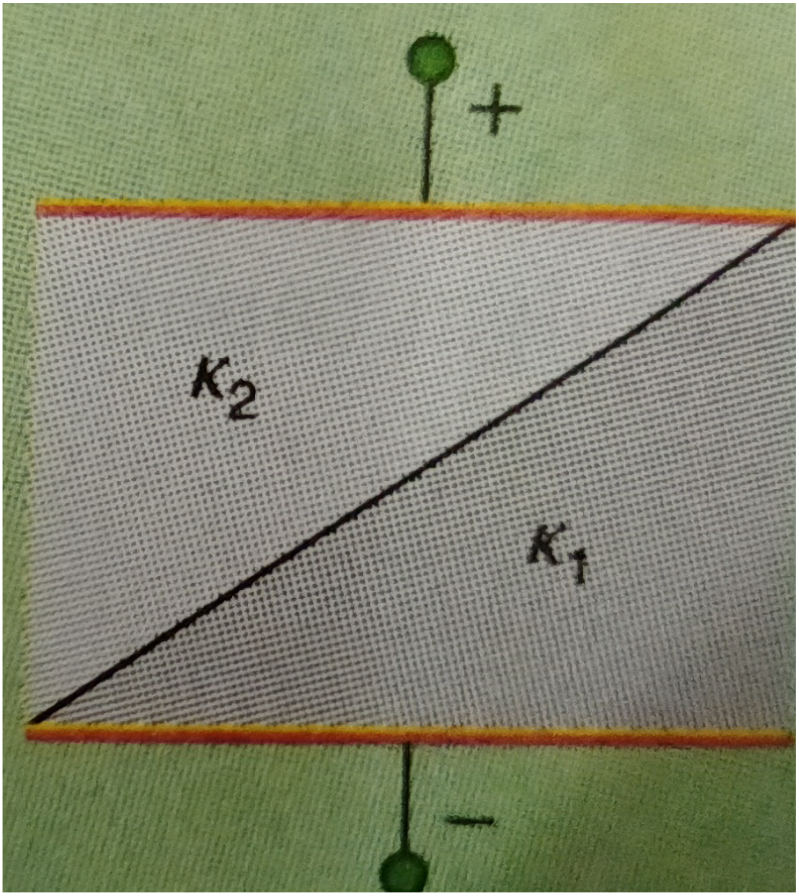
60. The capacitance of a parallel plate capacitor with plate area A and separation s is C. The space between the plates is filled with two wedges of dielectric constants k_1 and k_2 as shown in figure. Find the capacitance of the resultant capacitor.



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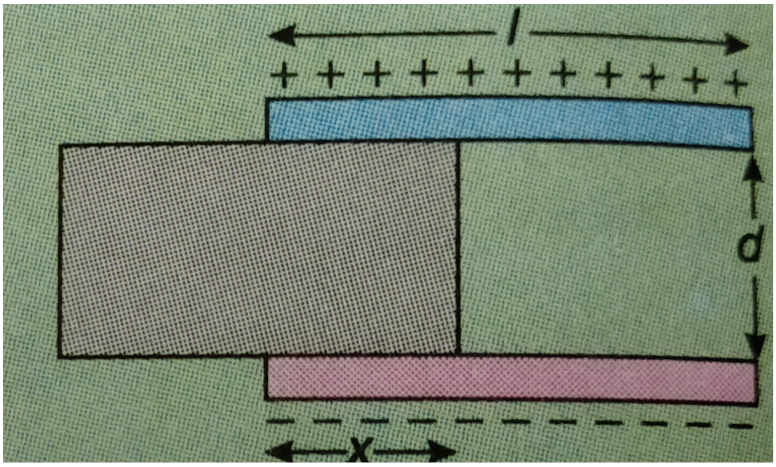
61. Consider a parallel plate capacitor of plate separation d. Each plate has the length l and the width a. A dielectric slab of permittivily $\in$ and thickness d, is partially inserted between the plates. The plates are kept at a constant potential differenc V. If x is the length of the dielectric slab within the plates, determine the force exerted on the slab.



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62. A parallel plate capacitor of capacitances C is connected to a battery to charge it to a potential V. Similarly, another capacitor of capacitance 2C is charged to a potential 2V. Now the batteries are removed, and the two capacitors are connected in parallel by joining the positive plate to one with the negative plate of the other. Find out the final energy of the system.

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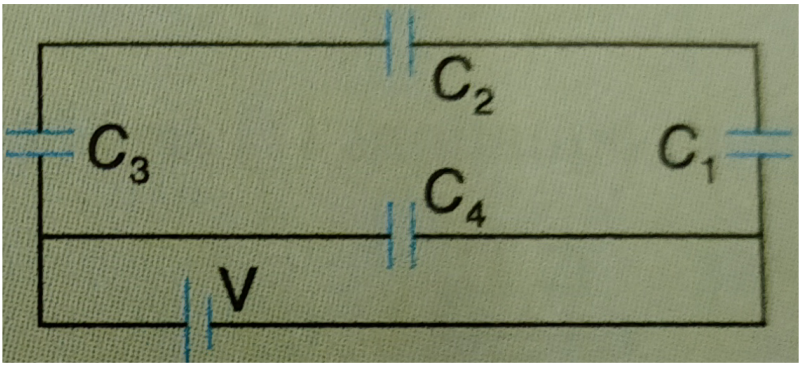
63. In the circuit of figure, the values of the capacitances of the four capacitors are $C_1 = C, C_2 = 2C, C_3 = 3C$ and $C_4 = 4C$. Find out the

ratio between the charges on C_2 and C_4.



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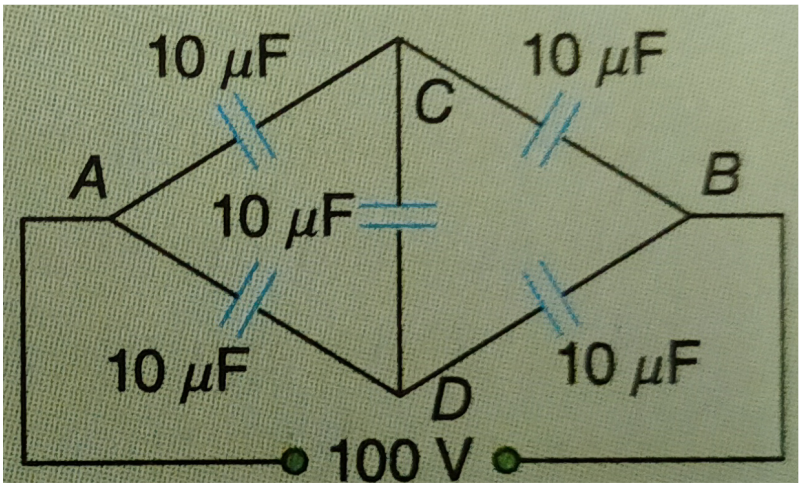
64. Five capacitors, each of capacitance $10\mu F$, form a network as shown in the Fig.4.38. The network is connected to a 100V dc supply. Calculate the equivalent capacitance between A and B, and the charge accumulated in the

network.



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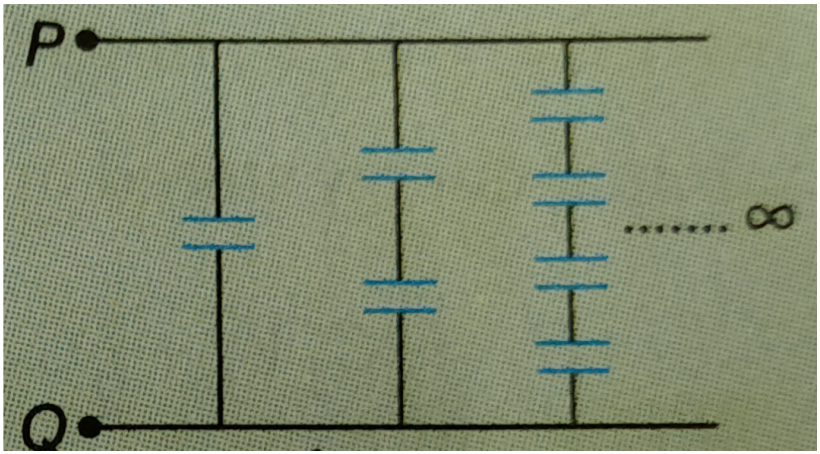
65. In the network of Fig.4.39., the capacitance of each capacitor is $1\mu F$. Determine the equivalent capacitance

between P and Q.



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66. A 0.1F capacitor is charged by a 10V battery. After disconnecting the battery, this charged capacitor is connected with an uncharged capacitor. If the charge is equally shared between the two, then what will be the

energy stored in the two capacitors? Compare this energy with the energy stored initially in the first capacitor.

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67. The equivalent capacitance of two capacitors connceted in series and in parallel are C_s and C_p respectively. Determine the capacitance of each capacitor?

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Section Related Questions

1. What do you mean by the capacitance of a conductor?

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2. What are the units of capacitance in CGS and in SI?

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3. Establish the relation between CGS and SI units of capacitance?

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4. On what factors does the capacitance of a conductor depend?

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5. 'The capacity of a conductor is 1 farad." What is meant by this ?

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6. Prove that, in CGS system, the capacitance of a conducting sphere is numerically equal to its radius.

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7. What is mean by the energy of a charged conductor ?

Watch Video Solution

8. Find an expression for the energy stored in a charged conductor?

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9. What is a capacitor?

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10. What is the potential of a capacitor?

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11. Define capacitance of a capacitor?

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12. A conductor is marked $0.04\mu F = 400V$ on its body. What does it stand for?

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13. What do you mean by charging and discharging of a capacitor?

Watch Video Solution

14. What is a dielectric ?

Watch Video Solution

15. What is a polar substance ? Give examples.

Watch Video Solution

16. What is a non-polar substance ? Give examples.

Watch Video Solution

17. Explain what you mean by electric polarisation.

Watch Video Solution

18. What do you mean by dielectric constant of a dielectric?

Watch Video Solution

19. The dielectric constant of glass is 8.5. Explain.

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20. Distance between the two plates of a parallel plate capacitor, each having area A, in vecuum is D. Calculate its capacitance.

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Watch Video Solution

21. Write down the expression for energy stored in a charged capacitor.

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22. Establish the expression for the energy density at any point in an electric field.

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23. A few capacitors are joined in series. Find the equivalent capacitance of the combination.

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24. A few capacitors are joined in parallel. Find the equivalent capacitance of the combination.

Watch Video Solution

25. Show that the equivalent capacitance for a series combination of capacitors is always less than even the least capacitance in the series.

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26. Write short notes :

Mica capacitor. State the uses.

Watch Video Solution

27. Write short notes :

Paper capacitor. State the uses.

Watch Video Solution

28. Write short notes :

Variable air capacitor. State the uses.

Watch Video Solution

29. Write short notes :

Electrolytic capacitor. State the uses.

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30. Explain the working principle of a Van de Graaff generator. State its uses.

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Higher Order Thinking Skill

1. What is meant by $1\mu F$ capacitance of a capacitor?

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2. What is meant by the statement that the dielectric constant of water is 80?

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3. Two conductor have equal amounts of the same type of charge. Can there be a difference of potential between them?

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4. Two copper spheres have the same radius. One of them is hollow and the other is solid. If they are charged to same potential, which sphere will hold a greater amount of charge?

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5. What are the advantages of using a solid insulator as a dielectric of a capacitor?

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6. Is it possible to charge a capacitor to any high potential at will?

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7. The potential of the plate A of a parallel plate capacitor is zero and the its other plate B is maintained at a potential $+V$. How does the potential vary from point to point between these plates? Neglect the end effect.

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8. The dielectric constant of water is very high. Yet why is water not used as a dielectric in a capacitor?

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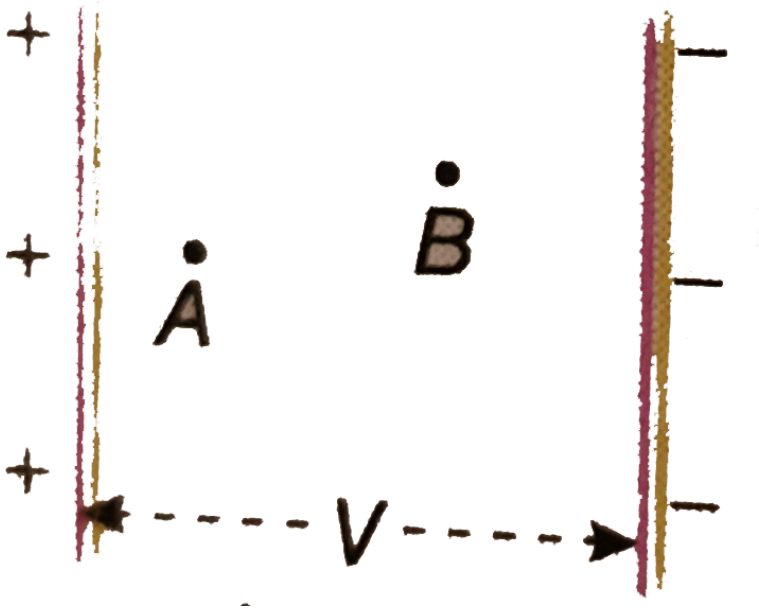
9. Two protons A and B are placed in between the two plates of a parallel plate capacitor charged to a potential difference V as shown in the fig.4.46. Are the forces on the two protons equal?



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10. If a soap bubble be electrified, will its shape be changed? If so, how will the potential of the bubble change?

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11. A capacitor is charged with a battery and then disconnected. A dielectric slab is then inserted between the plates. How are the

Charge.

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12. A capacitor is charged with a battery and then disconnected. A dielectric slab is then inserted between the plates. How are the

Capacitance.

Watch Video Solution

13. A capacitor is charged with a battery and then disconnected. A dielectric slab is then inserted between the plates. How are the

Potential difference.

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14. A capacitor is charged with a battery and then disconnected. A dielectric slab is then inserted between the plates. How are the

The stored energy related to the capacitor affected?

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15. A conductor is charged by a battery and then disconnected.How are the capacitance, potential difference and stored energy related to the capacitor affected if

The distance between the plates is decreased.

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16. A capacitor is charged by a battery and then disconnected.How are the capacitance, potential difference and stored energy related to the capacitor affected if

The plates are connected by a metallic wire?

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17. A mica slab of thickness equal to the distance between the two plates of a parallel plate air capacitor is inserted in the space between the plates. Explain the changes in capacitance in the following case,

When the mica slab is inserted partially.

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18. A mica slab of thickness equal to the distance between the two plates of a parallel plate air capacitor is inserted in the space between the plates. Explain the changes in capacitance in the following case,

When the space between the plates of the capacitor is totally filled by the mica slab.

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19. A parallel plate air capacitor is connected to a battery. Its charge, potential difference, electric field and the stored energy between the plates are Q_0, V_0, E_0 and U_0 respectively. Keeping the battery connection uncharged, the capacitor is completely filled with a dielectric material.

The charge, potential difference, electric field and energy stored become Q,V,E and U respectively. Which of the following is correct?

$Q > Q_0$.

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20. A parallel plate air capacitor is connected to a battery. Its charge, potential difference, electric field and the stored energy between the plates are Q_0, V_0, E_0 and U_0 respectively. Keeping the battery connection uncharged, the capacitor is completely filled with a dielectric material. The charge, potential difference, electric field and energy stored become Q,V,E and U respectively. Which of the

following is correct?

$V > V_0$.

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21. A parallel plate air capacitor is connected to a battery. Its charge, potential difference, electric field and the stored energy between the plates are Q_0, V_0, E_0 and U_0 respectively. Keeping the battery connection uncharged, the capacitor is completely filled with a dielectric material. The charge, potential difference, electric field and energy stored become Q,V,E and U respectively. Which of the following is correct?

$E > E_0$.

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22. A parallel plate air capacitor is connected to a battery. Its charge, potential difference, electric field and the stored energy between the plates are Q_0, V_0, E_0 and U_0 respectively. Keeping the battery connection uncharged, the capacitor is completely filled with a dielectric material. The charge, potential difference, electric field and energy stored become Q,V,E and U respectively. Which of the following is correct?

$U > U_0$.

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23. If an uncharged capacitor is connected to a battery, then show that half of the energy supplied by the battery to charge the capacitor is dissipated as heat.

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24. What is the force of attraction between the two plates of a parallel plate capacitor? Assume that, area of each plate of the capacitor is A and one plate is charged with +Q and the other with -Q.

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25. What will be the change in the capacitance of a parallel plate air capacitor if

A dielectric slab.

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26. What will be the change in the capacitance of a parallel plate air capacitor if

A conducting slab fills the space between the plates of the capacitor?

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27. Can a single conductor be treated as a capacitor? Which is the second plate in the case?

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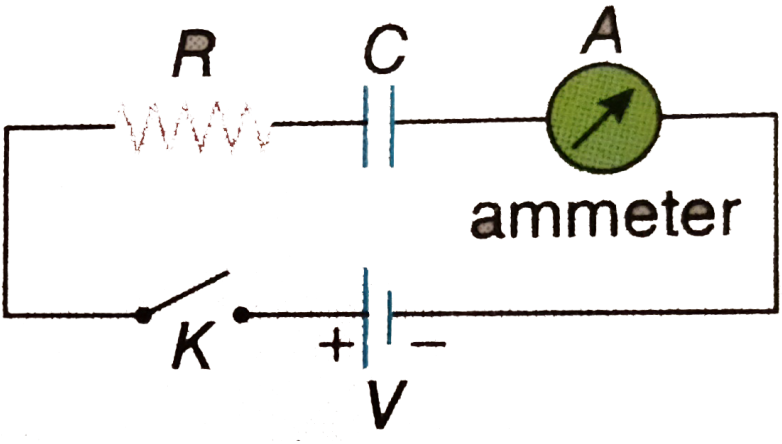
28. In the circuit shown in Fig.4.48, the ammeter shows a deflection as soon as the circuit is closed. But after a while the pointer returns to zero. Explain it.



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29. Why is the spherical surface of a Van de Graaff generator made very smooth?

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30. Why is the case of a Van de Graaff generator filled with some gas at a high pressure?

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31. Why is it difficult to construct a conductor of capacitance 1F ?

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32. The graph shown here, shows the variation of the total energy (E) stored in a capacitor against the value of the capacitance (C) itself. Which of the two the charge on the capacitance or the potential used to charge it is kept constant for this graph?

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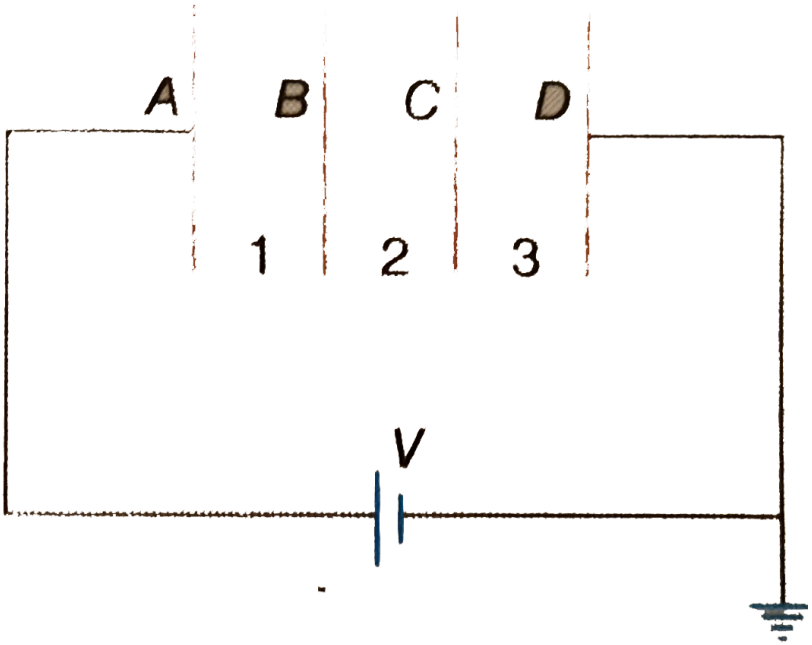
33. A,B,C,D are four simillar metallic parallel plates, equally separated by distance d and connected to a cell of emf V.

Write the potentials of the plates A, B, C and D.



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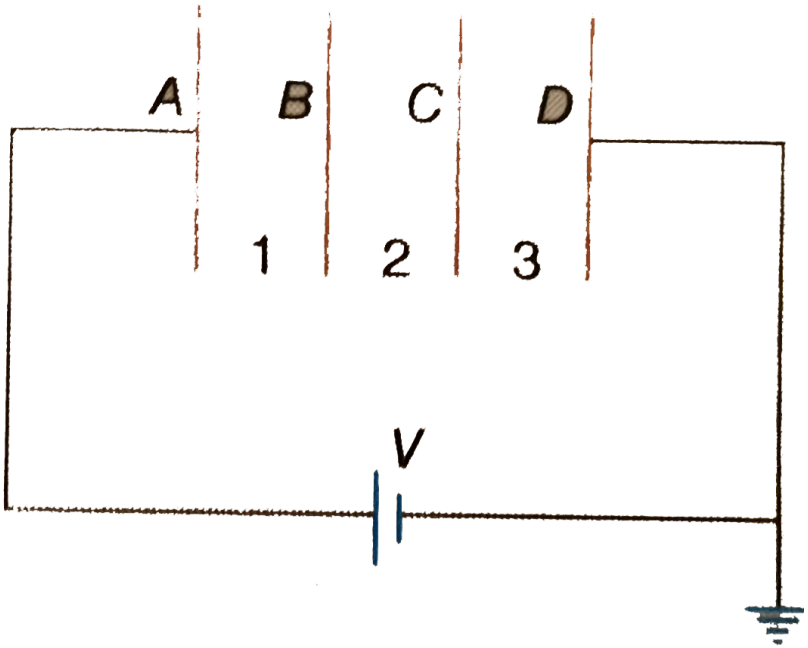
34. A,B,C,D are four simillar metallic parallel plates, equally separated by distance d and connected to a cell of emf V.

If plates B and C are connected by a wire then what will be

the potentials of the plates?



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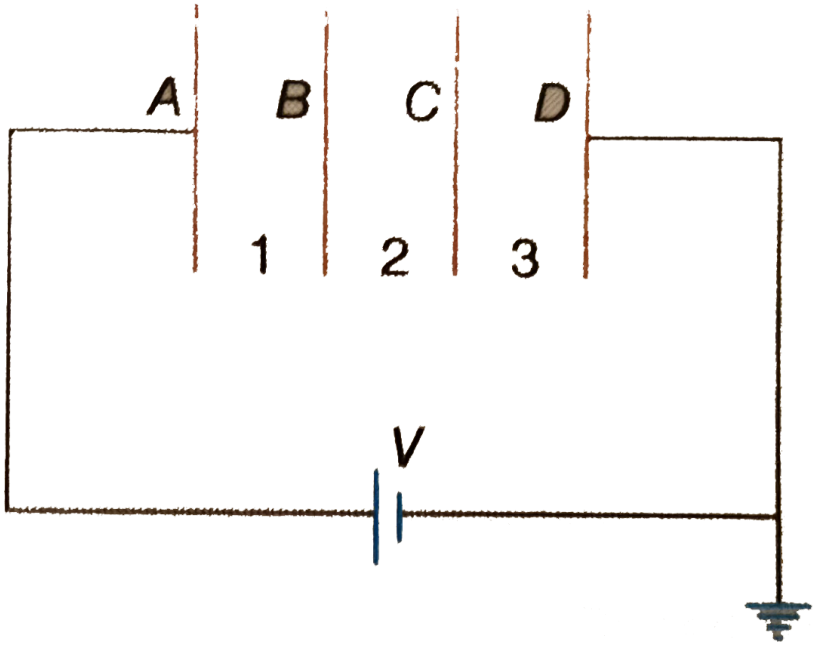
35. A,B,C,D are four simillar metallic parallel plates, equally separated by distance d and connected to a cell of emf V. How will the electric field change in the spacing between

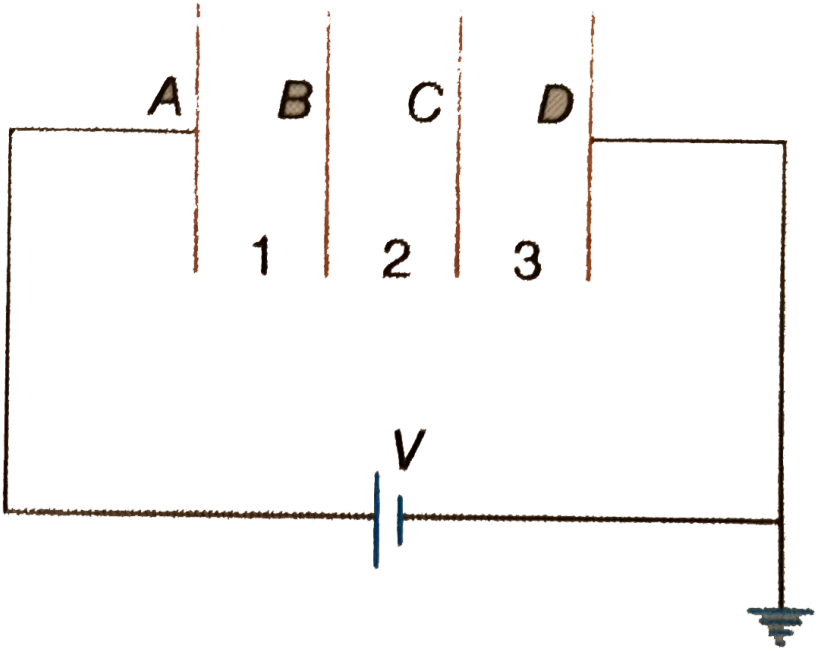
the plates ?



View Text Solution

36. A,B,C,D are four simillar metallic parallel plates, equally separated by distance d and connected to a cell of emf V.

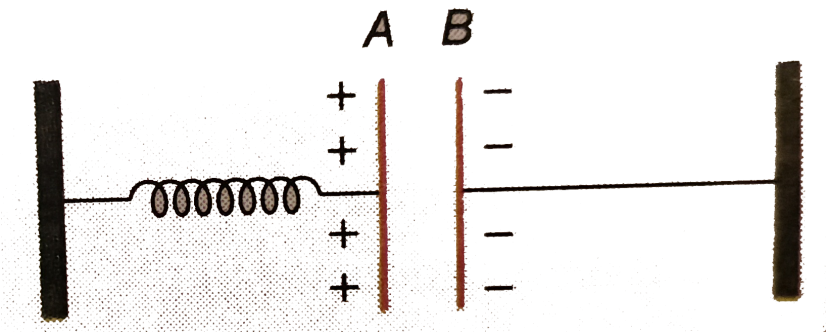
Will the charges on the plates A and D change ?



View Text Solution

37. The plate A of a parallel plate capacitor is connected to a spring of force constant k and can move, while the plate B is fixed. The arrangement is held between two rigid

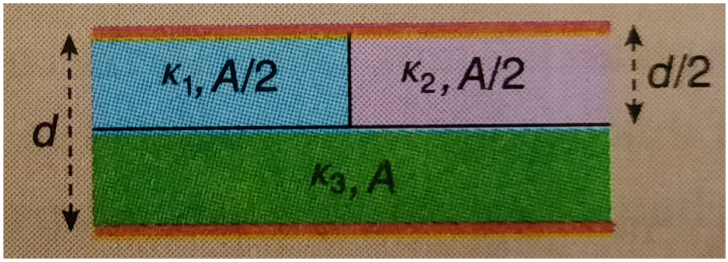
supports. If a charge +q is placed on plate A and -q on plate B, by how much does the spring elongate?



View Text Solution

38. A parallel plate capacitor of area A, plate separation d and capacitance C is filled with three different dielectric materials having dielectric constants k_1, k_2 and k_3 as shown in figure. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then what

will be its dielectric constant?



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39. Two identical metal plates are positively charged to Q_1 and $Q_2(Q_2 < Q_1)$. If they are brough near each other to form a parallel plate capacitor of capacitance C, then what will be the potential differences between the plates?

View Text Solution

Ncert Textbook Questions

1. In a parallel plate capaacitor with air between the plates, each plate has an area of $6 \times 10^{-3} m^2$ and the distance between the plates is 3mm. Calculate the capacitance of the capacitor. If this capacitor is connected to a 100V supply, what is the charge on each plate of the capacitor?

Watch Video Solution

2. Explain what would happen if in the capacitor in Q.1, a 3mm thick mica sheet were inserted between the plates while the voltage supply remained connected.

View Text Solution

3. A 600 pF capacitor is charged by a 200V supply. It is then discoconnected from the supply and is connected to another uncharged 600 pF capacitor. How much electrostatic energy is lost in the process?

Watch Video Solution

4. An electric technician requires a capacitance of $2\mu F$ in a circuit across a potential difference of 1kV. A large number of $1\mu F$ capacitors are available to him each of which can withstand a potential difference of not more than 400V. Suggest a possible arrangement that requires the minimum number of capacitors.

Watch Video Solution

5. The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 5.5 mm. The capacitor is charged by connecting it to a 400 V supply.

How cuch electrostatic energy is stored by the capacitor?

Watch Video Solution

6. The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 2.5 mm. The capacitor is charged by connecting it to a 400 V supply.

View this energy as stored in the electrostatic field

between the plates and obtain the energy per unit volume (u).

Watch Video Solution

7. The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 5.5 mm. The capacitor is charged by connecting it to a 400 V supply.

Arrive at a relation between u and the magnitude of electric field between the two plates.

Watch Video Solution

8. Show that the force on each plate of a parallel plate capacitor has a magnitude equal to $\frac{1}{2}QE$, where Q is the charge on the capacitor and E is the magnitude of electric field between the plates. Explain the origin of the factor $\frac{1}{2}$.

View Text Solution

9. What meaning would you give to the capacitance of a single plate conductor?

Watch Video Solution

10. Guess a possible reason why water has a much greater dielectric constant (= 80) than say, mica (=6).

View Text Solution

11. In a Van de Graaff generator a spherical metal shell in to be a $15 \times 10^6 V$ electrode. The dielectric strength of the gas surrounding the electrode is $5 \times 10^7 V \cdot m^{-1}$. What is the minimum radius of the spherical shell required?

Watch Video Solution

12. One evening a man fixes a two metre high insulating slab carrying on its top a large aluminimum sheet of area $1m^2$ outside his house. Will he get an electric shock if he touches the metal sheet next morning?

View Text Solution

Multiple Choice Questions

1. A solid spere and a hollow sphere of the same diameter are charged to the same potential. Then

A. The charge on the hollow sphere will be greater

B. Both the spheres will have the same charge

C. only the hollow sphere will be charged

D. the solid sphere will have a greater amount of charge

Answer: B

View Text Solution

2. 64 water drops coalesce to form a big drop. If each small drop has capacitance $C,$ potential V and charge $Q,$ what will be the capacitance of the new drop?

A. C

B. 4C

C. 16C

D. 64C

Answer: B

Watch Video Solution

3. If the radius of a conducting sphere is 1m, its capacitance in farad will be

A. 10^{-3}

B. 10^{-6}

C. 9×10^{-9}

D. 1.1×10^{-10}

Answer: D

Watch Video Solution

4. n small drops of the same size of the same size are charged to V volt each. They coalesce to form a big drop.

The potential of the big drop will be

A. $n^{\frac{1}{3}}V$

B. $n^{\frac{2}{3}}V$

C. $n^{\frac{3}{2}}V$

D. n^3V

Answer: B

Watch Video Solution

5. A conducting sphere of radius 10 cm is kept in a medium of dielectric constant 8. Its capacitance is

A. 80 esu

B. 10 esu

C. $\frac{1}{9} \times 10^{-10} F$

D. 80F

Answer: A

Watch Video Solution

6. When two charged conductors are joined by a thin conducting wire, charge flows from one to the orhter, until

A. Charges on them become equal

B. their capacitances become equal

C. their potentials become equal

D. energy stored in them becomes equal

Answer: C

Watch Video Solution

7. Two conducting spheres of radii r_1 and r_2 are connected by a thin conducting wire.Some amount of charges is given to the system. The charge will be shared between them in such a way that the ratio between the surface densities of charge on the spheres is equal to

A. $\frac{r_1}{r_2}$

B. $\frac{r_2}{r_1}$

C. $\frac{r_1^2}{r_2^2}$

D. $\frac{r_2^2}{r_1^2}$

Answer: B

8. When a capacitor is connected to a dc battery,

A. no current flows through the circuit

B. current flows through the circuit for sometime, but eventually stops

C. current grows up and reaches a maximum value when the capacitor is fully charged

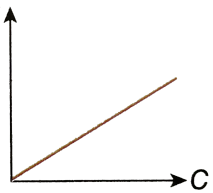
D. current reverses its direction alternately due to charging and discharging of the capacitor

Answer: B

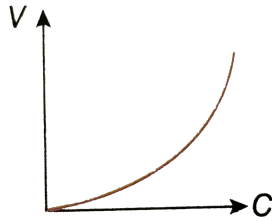
Watch Video Solution

9. A few capacitors are equally charged. Which of the figures shows the nature of variation of the potential difference V between their plates with their capacitances C?

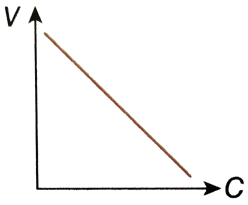
A.



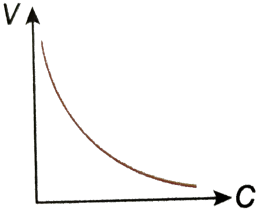
B.



C.



D.



Answer: D

View Text Solution

10. A parallel plate capacitor is charged and then disconnected from the battery. If the plates of the

capacitor are moved farther apart

A. the charge on the capacitor will increase

B. the potential difference between the two plates will increase

C. the capacitance will increase

D. the electrostatic energy stored in the capacitor will decrease

Answer: B

Watch Video Solution

11. The capacity of a parallel plate capacitor is proportional to power n of the distance between the plates. The value of n is

A. 1

B. 2

C. -1

D. -2

Answer: C

Watch Video Solution

12. The capacitance of a parallel plate capacitor depends on

A. the thickness of the plates

B. the charge accumulated on the plates

C. the potential difference between the two plates

D. the distance between the two plates

Answer: D

Watch Video Solution

13. The separation between the two plates of a parallel plate capacitor is d. A metal plate of equal area and of thickness $\frac{d}{2}$ is inserted between the two plates. The ratio of the capacitances after and before this insertion is

A. $2:1$

B. $\sqrt{2}:1$

C. $1:\sqrt{2}$

D. $1:2$

Answer: A

Watch Video Solution

14. A parallel plate air capacitor is connected to a battery, and is then disconnected. Now the intermediate space is filled up with a medium of specific inductive capacity k. The potential difference between the plates will change by a factor of

A. k^2

B. k

C. $\frac{1}{k}$

D. $\frac{1}{k^2}$

Answer: C

Watch Video Solution

15. A parallel plate capacitor with oil(K=2) has a capacitance C. If the oil is removed, then the capacity of the capacitor becomes

A. $\sqrt{2}C$

B. $2C$

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

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

Answer: D

Watch Video Solution

16. A parallel plate capacitor has a capacitance of $100\mu F$. The plates are at a distance d apart. A slab of thickness $t(t = d)$ and dielectric constant 5 is introduced between the parallel plates. Then capacitance can be,

A. $50\mu F$

B. $100\mu F$

C. $200\mu F$

D. $500\mu F$

Answer: C

Watch Video Solution

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

A. V

B. $V + \frac{Q}{C}$

C. $V + \frac{Q}{2C}$

D. none

Answer: C

Watch Video Solution

18. A combination is formed by connecting alternately n number of equidistant parallel pltes. If C be the capacitance for any two consecutive plates, then the capacitance of the whose system will be

A. C

B. nC

C. $(n-1)C$

D. $(n+1)C$

Answer: C

View Text Solution

19. Two capacitors of capacitances C_1 and C_2, are connected in parallel. A charge q given to the combination is distributed between the two. The ratio between this charges on the two capacitors is

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

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

C. $\frac{C_1C_2}{1}$

D. $\frac{1}{C_1C_2}$

Answer: A

Watch Video Solution

20. The equivalent capacitors is C_1 when four capacitors of equal capacitance are connected in series. In their parallel connection, the equivalent capacitance becomes C_2. The raito $\frac{C_1}{C_2}$ will be

A. $\frac{1}{4}$

B. $\frac{1}{16}$

C. $\frac{1}{8}$

D. $\frac{1}{12}$

Answer: B

Watch Video Solution

21. Three capacitors connected in series have an effective capacitance of $2\mu F$. If one of the capacitors is removed, the effective capacitance becomes $3\mu F$. The capacitance of the capacitor that is removed is

A. $1\mu F$

B. $\frac{3}{2}\mu F$

C. $\frac{2}{3}\mu F$

D. $6\mu F$

Answer: D

Watch Video Solution

22. In a charged capacitor, energy is

A. equally shared between the positive and the negative plates

B. stored in one plate when the other is grounded

C. stored in the electric field between the two plates

D. discharged if one of the plates is gorunded

Answer: C

Watch Video Solution

23. A parallel plate capacitor, with a slab of dielectric constant k between its plates, has a capacitance C. It is charged to a potential V. Now the dielectric slab is first brought out of the capacitor and is then introduced again. The work done in this process will be

A. $(k-1)\frac{CV^2}{2}$

B. $\frac{CV^2(k-1)}{k}$

C. $(k-1)CV^2$

D. 0

Answer: D

View Text Solution

24. The work done to charge a capacitor of capacitance $100\mu F$ with $8 \times 10^{-18} C$ will be

A. $32 \times 10^{-32} J$

B. $16 \times 10^{-32} J$

C. $3.2 \times 10^{-26} J$

D. $4 \times 10^{-10} J$

Answer: A

Watch Video Solution

25. A battery continues to charge a parallel plate capacitor until the potential difference between its plates becomes equal to the battery. The ratio of the energy stored in the capacitor to the work done by the battery will be

A. 1

B. $\frac{2}{1}$

C. $\frac{1}{2}$

D. $\frac{1}{4}$

Answer: C

Watch Video Solution

26. The space between the plates of a parallel plate air capacitor is filled with a material of dielectric constant k, keeping the plates connected to a certain external battery. The energy stored in this capacitor will change by a factor of

A. k^2

B. k

C. $\frac{1}{k}$

D. $\frac{1}{k^2}$

Answer: B

View Text Solution

27. A parallel plate capacitor is connected to a battery. The plates are pulled apart with a uniform speed. If x is the separation between the plates, the time rate of change of electrostatic energy of capacitor is proportional to

A. x^{-2}

B. x

C. x^{-1}

D. x^{2}

Answer: A

View Text Solution

28. If the potential difference between the plates of a capacitor is increased by 20%, the energy stored in the capacitor increase by exactly

A. $20\ \%$

B. $22\ \%$

C. $40\ \%$

D. $44\ \%$

Answer: D

 Watch Video Solution

29. If the distance between the plates of a parallel plate capacitor is doubled while the battery is kept connected, then

A. the charge stored in the capacitor will be doubled

B. the battery will absorb some amount of energy

C. the electric field between the two plates will be halved

D. work will be done by an external agent on the two plates

Answer: C

Watch Video Solution

Very Short Answer Type Questions

1. What is the name of the physical quantity whose unit is coulomb $\cdot$ volt $^{-1}$?

Watch Video Solution

2. Wht is the radius of a conducting sphere of capacitance $10\mu F$?

Watch Video Solution

3. Two copper spheres of the same radius, one of them being hollow and the other solid, are charged to the same

potential. Which of them does contain a greater amount of charge?

View Text Solution

4. If a charged soap bubble expands, what will be the change in its potential?

Watch Video Solution

5. What is the unit of dielectric constant?

Watch Video Solution

6. The radius of the earth is 6400 km. Its capacitance in microfarad is.....

Watch Video Solution

7. The surface area of a conducting sphere is $10.18cm^2$. If it is placed in air, what will be its capacitance in picofarad?

Watch Video Solution

8. n small drops of the same size are initially at the same potential. They coalesce to form a big drop. What is the ratio of the capacitance of this big drop to that of any of this small drops?

Watch Video Solution

9. Two conductors of capacitance C_1 and C_2 are connected by a conducting wire. Some amount of charge is given to the system. How is the ratio of charges acquired by the conductors related to their capacitances?

Watch Video Solution

10. Two conductors, of capacitances C_1 and C_2, initially have charges q_1 and q_2 are at potentials V_1 and V_2, respectively. They are now connected by a thin conducting wire.What quantity the net energy loss of the system would be propotional to?

Watch Video Solution

11. Two spheres of radii r and 2r have charges 2q and q on them, respectively. If they are connected by a copper wire, what will be the amount of charge flowing through the wire?

Watch Video Solution

12. A capacitor is marked as $0.05\mu F - 200V$. What is the maximum charge it can accumulate without being damaged?

Watch Video Solution

13. What is the dielectric constant of conducting materials?

Watch Video Solution

14. What happens when the space between the two plates of a capacitor is filled with a conducting material?

Watch Video Solution

15. What is the permittivity of mica if its dielectric constant is 5.4?

Watch Video Solution

16. What is the unit of the permittivity of vacuum, $\in_0$?

Watch Video Solution

17. Write down the dimensional formula of $\in_0$.

Watch Video Solution

18. Is the permittivity of any medium greater or less than that of vaccum?

Watch Video Solution

19. If a dielectric is placed in an electric field, what change of the intensity of the electric field takes place inside the dielectric?

Watch Video Solution

20. The intensity of the electric field in a dielectric decreases due to.....

Watch Video Solution

21. The space between the two plates of a parallel plate air capacitor is filled with an insulator. What will be the nature of change of its capacitance?

Watch Video Solution

22. The space between the two plates of an isolated charged parallel plate air capacitor is filled with an insulator. What will be the nature of change of the charge accumulation?

View Text Solution

23. A metal plate of negligible thickness is introduced between the two plates of a parallel plate air capacitor. The capacitance will.....

Watch Video Solution

24. The distance between the two plates of an isolated charged parallel plate air capacitor is increased. The potential difference between the plates will.....

Watch Video Solution

25. The space between the plates of a capacitor is filled up with a liquid of specific inductive capacity k. The capacitance will change by a factor of.....

Watch Video Solution

26. In a parallel plate capacitor, the capacitance increases from $4\mu F$ to $80\mu F$ when a dielectric medium is

introduced between the plates. What is the dielectric constant of the medium?

Watch Video Solution

27. What will be the effect on the capacity of a parallel plate capacitor when the area of each plate is doubled and the distance between them is also doubled?

Watch Video Solution

28. The distance between the plates of a parallel plate capacitor is d. A metal plate of thickness $\frac{d}{2}$ is placed

between the plates. What will be its effect on the capacitance of the system?

Watch Video Solution

29. Two protons A and B are placed between two parallel plates having a potential difference V are shown in the fig.4.71. Will these protons exparience equal or unequal forces?

View Text Solution

30. How can a capacitance of $10\mu F$ be designed from a few supplied $2\mu F$ capacitors?

Watch Video Solution

31. How can two capacitors be connected so that the charges on them are equal?

Watch Video Solution

32. How can two capacitors be connected so that the potential differences between their plates are equal?

Watch Video Solution

33. A combination is formed by connecting alternately n number of equidistant parallel plates. The capacitance between any two consecutive plates is C. What will be equivalent capacitance of the combination?

Watch Video Solution

34. Two charged conductors, each of which being effectively a capacitor, are connected by a conducting by a conducting wire. Which type of combination of capacitors is this series or parallel?

View Text Solution

35. Three capacitors of equal capacitance, when connected in series, have a net capacitance C_1. When connected in parallel, they have a net capacitance C_2. What is the value of $\frac{C_1}{C_2}$?

Watch Video Solution

36. Two plates of an isolated charged capacitor are connected by a copper wire. What will happen to the energy stored in the capacitor?

Watch Video Solution

37. The separation between the two plates of an isolated charged parallel plate air capacitor is d. The capacitor stores an energy U. Now a metal plate of thickness $\frac{d}{2}$ and of area equal to that of the capacitor plates is introduced in the intermediate space. What will be the energy stored in the capacitor?

Watch Video Solution

38. The separation between the two of an isolated charged parallel plate air capacitor is d. The capacitor stores an energy U. Now an insulating plate of thickness $\frac{d}{2}$, of dielectric constant k, and of area equal to that of the

capacitor plates is introduced in the intermediate space. What will be energy stored in the capacitor?

Watch Video Solution

39. n capacitors, each of capacity C, are connected in parallel and to a source of V volt. Will be the energy stored in the arrangement?

Watch Video Solution

40. n capacitors, each of capacity C, are connected in series and to a source of V volt. What will be the energy stored in the arrangement?

Watch Video Solution

Short Answer Type Questions I

1. What do you mean by the statement, 'the capacitance of a capacitor is 5 cm'?

Watch Video Solution

2. The capacitance of a conductor is $9\mu F$. Explain the statement with reference to charge and potential.

Watch Video Solution

3. Two conductors have equal quantity of charge of the same nature. Can there be any difference in potential between them?

Watch Video Solution

4. Show that if some quantity of charge be given to one of two spherical conductors connected to each other, the surface densities of charge on them are inversely proportional to their radii.

Watch Video Solution

5. What do you mean by the statement, 'the capacitance of a capacitor is $1\mu F$?

Watch Video Solution

6. What do you mean by the statement,'the dielectric constant of water is 80'?

Watch Video Solution

7. The dielectric constant of water is very high. Yet why is water not used as a dielectric in a capacitor?

Watch Video Solution

8. Why does the dipole moment of a non-polar molecule become zero?

Watch Video Solution

9. Prove that the equivalent capacitance of two capacitors of the same capacitance connected in parallel is four times the equivalent capacitance when they are connected in series.

Watch Video Solution

Short Answer Type Questions Ii

1. After charging a capacitor, the battery is disconnected. Now a dielectric material is introduced between its two plates. What would be the nature of change of its charge, capacitance, potential difference, electric field, energy stored?

Watch Video Solution

2. After charging a capacitor, the battery is disconnected. What would be the nature of change of its capacitance, potential difference between the plates, and energy stored if

the distance between the two plates decreases.

Watch Video Solution

3. After charging a capacitor, the battery is disconnected. What would be the nature of change of its capacitance, potential difference between the plates, and energy stored if

the two plates are connected by a conducting wire?

Watch Video Solution

4. A mica sheet has a thickness equal to the separation between the two plates of a parallel plate air capacitor. How would the capacitance change if the mica sheet

is partially introduced in the space between the plates.

Watch Video Solution

5. A mica sheet has a thickness equal to the separation between the two plates of a parallel plate air capacitor. How would the capacitance change if the mica sheet occupies the whole intermediate space?

Watch Video Solution

6. A parallel plate air capacitor, connected to a battery, has charge Q_0, potential difference between its plates V_0, electric field E_0 and energy stored U_0. Now the intermediate space is completely filled with a dielectric, keeping the battery still connected. Then the quantities become Q, V, E and U, respectively. Which of the following

statements are correct

$Q > Q_0$.

Watch Video Solution

7. A parallel plate air capacitor, connected to a battery, has charge Q_0, potential difference between its plates V_0, electric field E_0 and energy stored U_0. Now the intermediate space is completely filled with a dielectric, keeping the battery still connected. Then the quantities become Q, V, E and U, respectively. Which of the following statements are correct

$V > V_0$.

Watch Video Solution

8. A parallel plate air capacitor, connected to a battery, has charge Q_0, potential difference between its plates V_0, electric field E_0 and energy stored U_0. Now the intermediate space is completely filled with a dielectric, keeping the battery still connected. Then the quantities become Q, V, E and U, respectively. Which of the following statements are correct

$E > E_0$.

Watch Video Solution

9. A parallel plate air capacitor, connected to a battery, has charge Q_0, potential difference between its plates V_0, electric field E_0 and energy stored U_0. Now the

intermediate space is completely filled with a dielectric, keeping the battery still connected. Then the quantities become Q, V, E and U, respectively. Which of the following statements are correct

$U > U_0$?

Watch Video Solution

10. A parallel plate air capacitor of plate separation d is charged to a potential difference $\triangle V$. A slab of thickness d and dielectric constant k is introduced between the plates while the battery remains connected.

Find the ratio of energy stored in the capacitor after and before the introduction of the dielectric slab.

Watch Video Solution

11. A parallel plate air capacitor of plate separation d is charged to a potential difference $\triangle V$. A slab of thickness d and dielectric constant k is introduced between the plates while the battery remains connected.

What happens to the charge on the capacitor?

Watch Video Solution

12. A parallel plate capacitor is charged and then disconnected from the source. If the distance between its plates is doubled, explain how the following will change:

Electric field between the plates.

Watch Video Solution

Watch Video Solution

13. A parallel plate capacitor is charged and then disconnected from the source. If the distance between its plates is doubled, explain how the following will change: Capacitance.

Watch Video Solution

14. A parallel plate capacitor is charged and then disconnected from the source. If the distance between its plates is doubled, explain how the following will change: Energy stored in the capacitor.

Watch Video Solution

15. A parallel plate capacitor is charged to a potential V and is then disconnected from the source. When the distance between the two plates is d, the electric field intensity is E . If the distance between the plates is doubled, what would be the change is this electric field intensity?

Watch Video Solution

Problem Set I

1. The potential of a conducting sphere increases from 500 V to 1500 V when it is given a charge of $15 \times 10^{-9} C$. Determine the radius of the sphere.

Watch Video Solution

2. The capacitance of a conducting sphere is $10\mu F$. It is charged with $-2 \times 10^{-6} C$. What is its potential in air?

Watch Video Solution

3. To increase the potential of a conductor by 500 V , a charge of $5 \times 10^{-8} C$. Is given. What is the capacitance of the conductor?

Watch Video Solution

4. Each of 125 water drops of radius 0.9 mm is at a potential of 10 V. If they coalesce to form a bigger drop, what will be its capacitance and potential?

Watch Video Solution

5. Two spheres of radii 2 cm and 8 cm are charged equally with an amount of $10^{-10}C$. If they are connected by a thin copper wire, what amount of charge will flow through this wire.

Watch Video Solution

6. A sphere of radius 8 cm is charged with $10^{-8}C$. It is then connected to an uncharged sphere and its potential becomes 720 V. Determine the radius of the second sphere and its capacitance.

Watch Video Solution

7. The radii of two spheres are 10 cm and 40 cm , and their potentials are 40 V and 10 V, respectively. What will be their common potential if they are connected by a conducting wire?

Watch Video Solution

8. Two capacitors, each of capacitance C, are at potentials V_1 and V_2, respectively. Their negative plates are initially connected, Now , when the positive plates are also connected, find out the loss of energy of the system.

Watch Video Solution

9. A $4\mu F$ capacitor is connected to a 400 V supply. It is then disconncected from the supply and connected to an uncharged $2\mu F$ capacitor. Find out the common potential attained by the two capacitors.

Watch Video Solution

10. Two charges of $+40$ esu and -35 esu separated by a distance of 10 cm, exert 4 dyn force on each other. Determine the dielectric constant of the medium.

Watch Video Solution

11. The area of each plate of a parallel plate capacitor is $500cm^2$. The intermediate space of thickness 0.0075 cm is filled with mica of dielectric constant 6.5. Calculate the capacitance of the capacitor in μF.

Watch Video Solution

12. The diameter of each of plate of a parallel plate air capacitor is 0.06 m. What should be the distance between its plates, so that its capacitance becomes equal to that of a sphere of diameter 0.1 m?

Watch Video Solution

13. A parallel plate air capacitor has a capacitance of $1\mu F$. The surface area of each is A and their separation is d. A sheet of dielectric(k=1. 6) completely in the intervening space of the capacitor. What will be its capacitance now?

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14. Two parallel air capacitors have their plate areas $100cm^2$ and $500cm^2$, respectively. If they have the same charge and potential, and the distance between the plates of the first capacitor is 0.5 mm, what is the distance between the plates of the second capacitor?

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15. Two dielectric slabs of dielectric constants k_1 and k_2 fill up the space between the plates, each of area A, of a capacitor as shown in fig.4.74. What will be the capacitance of this capacitor?

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16. Compare the equivalent capacitances of two capacitors of capacitances 5 unit and 4 unit connected in parallel and in series, respectively.

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17. Find out the equivalent capacitance between P and Q for the connection shown in Fig. 4.75.

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18. Two capacitors of capacitances $0.5\mu F$ and $0.75\mu F$ are connected in parallel. A potential difference of 600 V is applied to this combination. What are the charges on the two capacitors? Now, the two capacitors are connected in series and the same potential difference is applied. Find out the charges on the capacitors in this case.

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19. An adequate number of circular metal plates of diameter 0.2 m and a set of circular paper discs of the same diameter and of thickness 5×10^{-5} m are supplied. The dielectric constant of paper is 4. What is the minimum

number of metal plates to be used to design a capacitor of equlvalent capacitance $1\mu F$?

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20. The capacitances of three capacitors are in the ratio of $1:2:3$. The difference in the equivalent capacitances for their series and parallel combinations is $6\mu F$. What are the capacitances of the capacitors?

Watch Video Solution

21. Three capacitors, each of $3\mu F$, are connected in series, This combination is in series with another combination of

three $1\mu F$ capacitors connected in parallel. Calculate the equivalent capacitance of the network.

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22. Find out the energy stored in the combination of capacitors shown in Fig. 4.79.

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23. The area of a parallel plate capacitor is 1 m^2 and the separation between its two plates is $10^{-4}m$. The intermediate space is filled with a material of dielectric

constant 7. A certain amount of charge raises its potential to 300 V. Determine the energy stored in the capacitor.

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24. The radius of a sphere is 1 m and its potential is 30 V. What is its energy?

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25. Net capacitance of three identical capacitors in series is $2\mu F$.

What will be their net capacitance if connected in parallel?

Watch Video Solution

26. Net capacitance of three identical capacitors in series is $2\mu F$.

Find the ratio of the energy stored in the two configurations if they are both connected to the same source.

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27. Keeping the voltage of the charging source constant, what would be the percentage change in the energy stored in a parallel plate capacitor if the separation between its plates is decreased by 10%?

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28. If the distance between the plates of an isolated parallel plate $200\mu F$ capacitor, charged to 400 V, is halved, calulate the change in the energy stored in it.

Watch Video Solution

29. Three identical capacitors C_1, C_2 and C_3, of capacitance $6\mu F$ each are connected to a 12 V battery as shown in Fig. 4.80. Find the

Charge on each capacitor,

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30. Three identical capacitors C_1, C_2 and C_3, of capacitance $6\mu F$ each are connected to a 12 V battery as shown in Fig. 4.80. Find the

Energy stored in the network of capacitors.

View Text Solution

31. Fig. 4.81 shows a network of five capacitors connected to a 100 V supply. Calculate the total charge and the energy stored in the network.

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32. A capacitor is charged through a potential difference of 200 V, when a charge of 0.1 C is stored in it. How much energy will it release when it is discharged?

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33. What should be the capacitance of a capacitor capable of storing one joule of energy when used with a 100 V dc supply?

Watch Video Solution

Problem Set Ii

1. The diameter of a spherical liquid drop is 2 mm and it has $10^{-15}C$ of charge.

What is the potential on its surface?

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2. The diameter of a spherical liquid drop is 2 mm and it has $10^{-15}C$ of charge.

If two such liquid drops coalesce to form a bigger drop, what will be the potential on the surface of this drop?

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3. A dielectric slab, of dielectric constant k, is introduced between the two plates of a parallel plate air capacitor. As a result, the capacitance per unit area of the capacitor becomes double the previous value. Show that, $K = \frac{2x}{2x - d}$' where x =separation between the two plates of the capacitor, and d = thickness of the dielectric slab.

Watch Video Solution

4. The separation between the plates of a parallel plate capacitor is t, and the intervening space is filled with glass, of dielectric constant 6. Now, the separation between the plates is increased by t. How would the charge on the capacitor and the potential difference between its plates

charge, if

The plates remain connected with the charging battery

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5. The separation between the plates of a parallel plate capacitor is t, and the intervening space is filled with glass, of dielectric constant 6. Now, the separation between the plates is increased by t. How would the charge on the capacitor and the potential difference between its plates charge, if

The battery is disconnected before increasing the separation between the plates?

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6. A slab of material of dielectric constant k has the same area as the plates of parallel plate capacitor, but has a thickness $\frac{3}{4}d$, where d is the separation of the plates. How is the capacitance changed when the slab is inserted between the plates?

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7. Two capacitors of capacitances $1\mu F$ and $5\mu F$ are connected in series and then to a 10 V battery. Now, after disconnecting the battery, the capacitors are connected in parallel so that their positive plates are joined at a point and the negative plates at another point. What are the charges on the capacitors?

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8. Two capacitors A and B have capacitances of $1\mu F$ and $2\mu F$ respectively. They are charged by a 12 V battery. If they are now connected in parallel, what would be their potential difference between plates,

The positive plate of A is connected to the positive plate of B

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9. Two capacitors A and B have capacitances of $1\mu F$ and $2\mu F$ respectively. They are charged by a 12 V battery. If they are now connected in parallel, what would be their

potential difference between plates,

The positive plate of A is connected to the negative plate of B?

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10. The capacitances of two capacitors are $2\mu F$ and $8\mu F$. They are connected in series and a potential difference of 100 V is applied across the combination. What are

The total charge of the combination

Watch Video Solution

11. The capacitances of two capacitors are $2\mu F$ and $8\mu F$. They are connected in series and a potential difference of 100 V is applied across the combination. What are

Charges on both the capacitors, and

Watch Video Solution

12. The capacitances of two capacitors are $2\mu F$ and $8\mu F$. They are connected in series and a potential difference of 100 V is applied across the combination. What are

The potential differences across the two capacitors?

Watch Video Solution

13. A capacitor of capacitance $2\mu F$ is charged with 20 V potential. Another uncharged capacitor of capacitance $3\mu F$ is connected parallely with the first capacitor. What will be the potential difference at the two ends of the combination? Calculate the amounts of charge of the capacitors.

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14. The capacitance of a conductor is 2 pF and its potential is 100 V. When it is connected to an uncharged conductor, the potential becomes 8V. What is the capacitance of the second conductor? What are the charges on them?

Watch Video Solution

15. The equivatent capacitance between A and B for the combination of Fig. 4.82 is $4\mu F$.

Calculate the charges on the two capacitors if a 12 V battery is connected across the terminals A and B.

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16. The equivatent capacitance between A and B for the combination of Fig. 4.82 is $4\mu F$.

What will be the potential drops across the two capacitros?

View Text Solution

17. A network of four $10\mu F$ capacitors is connected to a 500 V supply, as shown in Fig. 4.83. Determine the

Charge on each capacitor.

View Text Solution

18. Two parallel plates of area 100 cm^2 are given equal and opposite charges of $10^{-7}C$. The space between the plates is filled with a dielectric material, and the electric field within the dielectric is 3.3×10^5 V. m^{-1}.

What is the dielectric constant of the dielectric?

Watch Video Solution

19. Two parallel plates of area 100 cm^2 are given equal and opposite charges of $10^{-7}C$. The space between the plates is filled with a dielectric material, and the electric field within the dielectric is 3.3×10^5 V. m^{-1}.

What is the total induced charge density on either face of the dielectric?

Watch Video Solution

20. The distance between the two plates of a parallel plate air capacitor is 3mm, and the radius of earch plate is 9 cm. It is given a charge of $10^{-7}C$ with a battery. Determine the

energy stored in the capacitor. What will be the values of energy stored if a slab of dielectric constant 4 is introduced between the two plates

Keeping the battery connected

Watch Video Solution

21. The distance between the two plates of a parallel plate air capacitor is 3mm, and the radius of earch plate is 9 cm. It is given a charge of $10^{-7}C$ with a battery. Determine the energy stored in the capacitor. What will be the values of energy stored if a slab of dielectric constant 4 is introduced between the two plates

After removing the battery?

Watch Video Solution

22. The separation between the plates, each having an area of $1m^2$, of a parallel plate capacitor is 0.01 cm. The medium in the intervening space has a dielectric constant of 7. The capacitor is charged to a potential of 300 V. Determine the energy stored in it.

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23. The separation between the two plates, each having an area of $100\pi^2 cm^2$, of a parallel plate capacitor is 1 cm. The dielectric constant of the intervening medium is 2. If the surface density of charge on either plate is $10^{-2} Cm^{-2}$, what is its energy?

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24. A parallel plate $300\mu F$ capacitor is charged to 200 V, and is then disconnected from the source. If the distance between its plates is halved, what will be the potential difference between the plates and the change in energy stored in it?

Watch Video Solution

25. A 900 pF capacitor is charged by a 100 V battery.

How much electrostatic energy is stored in the capacitor?

Watch Video Solution

26. A 900 pF capacitor is charged by a 100 V battery. The capacitor is disconnected from the battery and is then connected to another 900 pF capacitor. What is the electrostatic energy stored by the system?

Watch Video Solution

27. Find the relation of the potential differences that must be applied across the parallel and series combinations of two identical capacitors so that the energies stored in these two cases become the same.

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28. A $10\mu F$ capacitor is charged by a 30 V dc supply and then connected across an uncharged $50\mu F$ capacitor. Calculate

The final potential difference across the combination.

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29. A $10\mu F$ capacitor is charged by a 30 V dc supply and then connected across an uncharged $50\mu F$ capacitor. Calculate

The initial and final energies.

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Hots Numerical Problems

1. If the intensity of an electric field is $3 \times 10^6 V \cdot m^{-1}$ or more, electric discharge takes place in air. What maximum potential can be applied on a sphere of diameter 5 m? What maximum charge can it retain?

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2. A charged sphere of radius r shares its charge with an uncharged sphere of radius r_1. Show that the ratio between the initial and the final energies of the two spheres is $(r + r_1)$:r.

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3. Two metal spheres, each of mass I g and radius 5 mm, are placed on a smooth horizontal insulated surface. The separation between their centres is 15 cm. Now , one sphere is charged to a potential of 500 V and the other to 1000 V. What are the velocities of the balls when the distance between their centres becomes 30 cm due to repulsion?

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4. n number of identical drops combine to form a big drop. If E be the energy of each small drop, then what is the energy of this bigger drop?

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5. A parallel plate capacitor of capacitance $1\mu F$ is to be formed with the insertion of mica plates, each of thickness 0.5 mm, between two consecutive metal plates. How many metal plates, each of radius 2 cm, are to be used? The metal plates are altermately connected among themselves.

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6. A potential difference V is applied across a parallel combination of n identical capacitors. Then they are connected in series in such a way that no loss of charge

takes place. Now what is the potential difference across this combination?

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7. The ratio of the capacitances of three capacitors is 2 : 3 : 5. The equivalent capacitance of their parallel combination is greater than that of their series combination by $18\frac{2}{31}\mu F$. Determine the capacitances of the three capacitors.

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8. If a capacitor is used under a potential difference of 1200 V to store an energy of 24 watt-hour, what will be its capacitance?

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9. A $40\mu F$ capacitor in a medical instrument (defibrillator) is charged to 3000 V. The energy stored in this capacitor is delivered to a patient's body through a 2 millisecond pulse. How much power is delivered to the patient?

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10. Find out the charge on the $2\mu F$ capacitor in the circuit shown in Fig. 4.89.

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11. A $5\mu F$ capacitor is charged by a 100 V supply. It is then disconnected from the supply and is connected to an uncharged $3\mu F$ capacitor. How much electrostatic energy of the first capacitor is lost, in the form of heat and electromagnetic radiation, in the process of attaining the final steady situation?

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12. Find the ratio of the potential difference that just be applied across the parallel and series combination of two capacitors C_1 and C_2 with their capacitances in the ration 1:3, so that the energy stored in two cases, becomes the same.

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13. The capacitor is made of a flat plate of area A and a second plate having a stair like structure as shown in the figure. The area of each stair is $\frac{A}{3}$ and height b. The height of the flat plate from the nearest stair is d. Calculate the capacitance of this capacitor.

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14. A capacitor of capacitance $6\mu F$ is charged to a potential equal to 150 V. Its potential falls to 90 V, when another capacitor is connected to it. Find the capcitance of the second capacitor and the amount of energy lost due to the connection.

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15. In the given picture, the capacitor plates are rigidly clamped in the laboratory and connected to a battery. Length and width of each plate are l and a respectively. The dielectric experiences an attractive force due to the non-

uniform electric field between the capacitor plates at the edge of the dielectric. Calculate the value of weight W of the block for which the dielectric will stay in equilibrium. Here all the surfaces are frictionless.

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16. Five capacitors are connected as the figures shows with a battery of emf 30V. The capacitance of the capacitors are $C_1 = C_2 = C_3 = C = 0.11nF, C_4 = 0.05nF, C_5 = 0.11nF$. Find the charge of each capacitor.

View Text Solution

17. The plates of a parallel plate capacitor are 5mm apart and $2m^2$ in area. The plates are in vacuum. A potential difference of 10000 V is applied across the capacitor. Compute

Capacitance

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18. The plates of a parallel plate capacitor are 5mm apart and $2m^2$ in area. The plates are in vacuum. A potential difference of 10000 V is applied across the capacitor. Compute

The charge on each plate

Watch Video Solution

19. The plates of a parallel plate capacitor are 5mm apart and $2m^2$ in area. The plates are in vacuum. A potential difference of 10000 V is applied across the capacitor. Compute

The electric field in the space between them.

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Assertion Reason Type

1. Statement I: Two capacitance of same capacity are first connected in parallel and then in series. The ratio of equivalent capacitances in two cases is 2 :1.

Statement II: The eqivalent capacitance is less than any of capacitances in series.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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2. Statement I: If the distance between the parallel plates of a capacitor is halved and dielectric constant is made three times the capacitance becomes 6 times.

Statement II: Capacitance of the capacitor does not depend on the nature of the material of the plates of the capacitor.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: B

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3. Statement I: Larger the sphere, larger is its capacity and smaller the sphere, smaller is its capacity.

Statement II: Capacitance of a spherical conductor is directly proportional to its radius.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

4. Statement I: Dielectric has no significance in a parallel plate capacitor.

Statement II: Dielectric is an insulator which can be easily polarised on the application of electric field.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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5. Statement I: The force with which one plate of a parallel plate capacitor is attracted towards the other plate is equal to square of surface charge density per $\in$ per unit area.

Statement II: Total amount of charge resides on unit surface area is known as surface charge density.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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6. Statement I: The capacity of a conductor, under given circumstances, remains constant irrespective of the charge present on it.

Statement II: Capacity depends on size and shape of conductor and also on the surrounding medium.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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7. Statement I: A dielectric slab is inserted between the plates of an isolated charged capacitor. The charge on the capacitor will remain the same.

Statement II: Charge on an isolated system is conserved.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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8. Statement I: The potential energy of a capacitor is obtained at the cost of chemical energy from the battery used for charging the capacitor.

Statement II: In battery potential energy is converted to chemical energy.

A. Statement I is true, statement II is ture, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is ture, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: C

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Multiple Correct Answer Type

1. A parallel plate capacitor is charged and the charging battery is disconnected. If the plates of the capacitor are moved further apart by means of insulating handles. Then

A. the charge on the capacitor increases

B. the voltage across the plates increases

C. the capacitance of the capacitor increases

D. the electrostatic energy stored in the capacitor increases

Answer: B::D

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2. A parallel plate capacitor of plate area A and plate separation d is charged to a potential difference V and then the battery is disconnected. A slab of dielectric constant k is then inserted between the plates of the capacitor so as to fill the space between the plates. If Q, E

and W denote respectively the charge on each plate, the electric field between the plates and the work done in the process of inserting the slab, then

A. $Q = \frac{\in_0 AV}{d}$

B. $Q = \frac{\in_0 kAV}{d}$

C. $E = \frac{V}{kd}$

D. $W = \frac{\in_0 AV^2}{2d}\left(1 - \frac{1}{k}\right)$

Answer: A::C::D

Watch Video Solution

3. A dielectric slab of thickness d is inserted in a parallel plate capacitor whose negetive plate is at x=0 and positive

plate is at x=3d. The slab is equidistant from the plates. The capacitor is given some charge by connecting it to a batterey. As x goes from 0 to 3d,

A. the magnitude of electric field remains the same

B. the direction of electric field remains the same

C. the electric potential increases continuously

D. the electric potential increases at first, then decreases and again increases

Answer: B::C

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4. A parallel plate capacitor is connected to a battery. A metal sheet of negligible thickness is placed between the plates. The sheet remains parallel to the plates of the capacitor. Then

A. the battery will supply same charge

B. the capacitance will increase

C. the potential difference between the plates will increase

D. equal and opposite charges will appear on the two faces of the metal plate

Answer: B::D

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Watch Video Solution

Matrix Match Type

1. A capacitor of capacitance C is charged to a potential V. Now, it is connected to a battery of emf E as shwon in fig.4.100. Based on this information match the entries of column I with entries of column II in the following table.

View Text Solution

2. Mathematical expressions of some physical quantities and their corresponding units are given in column I and

column II respectively.

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3. 

View Text Solution

4. Match column I with column II.

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5. In the figure, area of each plate is A. Match the following.

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Comprehension Type

1. A capacitor C_1 of capacitance $5\mu F$ is charged to a potetntial of 100V and another capacitor C_2 of capacitance $8\mu F$ is charged to 50V. The positive and negative plates are mutually connected.

The final potential of the combination of the two capacitance will be

A. $\frac{500}{3}V$

B. $\frac{900}{13}V$

C. $150V$

D. $50V$

Answer: B

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2. A capacitor C_1 of capacitance $5\mu F$ is charged to a potetntial of 100V and another capacitor C_2 of capacitance $8\mu F$ is charged to 50V. The positive and negative plates are mutually connected.

Amount of charge of the capacitor C_1 after combination will be

A. $\frac{4500}{13}\mu C$

B. $\frac{7200}{13}\mu C$

C. $\frac{2700}{13}\mu C$

D. $\frac{11700}{3}\mu C$

Answer: A

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3. A capacitor C_1 of capacitance $5\mu F$ is charged to a potetntial of 100V and another capacitor C_2 of capacitance $8\mu F$ is charged to 50V. The positive and negative plates

are mutually connected.

Amount of charge of the capacitor C_2 after combination will be

A. $4500\mu C$

B. $7200\mu C$

C. $\frac{4500}{13}\mu C$

D. $\frac{7200}{13}\mu C$

Answer: D

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4. A capacitor C_1 of capacitance $5\mu F$ is charged to a potetntial of 100V and another capacitor C_2 of capacitance

$8\mu F$ is charged to 50V. The positive and negative plates are mutually connected.

Energy loss will be

A. $3.11 \times 10^{-13} J$

B. $35 \times 10^{-2} J$

C. $3.9 \times 10^{-13} J$

D. $7.8 \times 10^{-5} J$

Answer: C

View Text Solution

5. A parallel plate capacitor of plate area $0.2m^2$ and spacing 10^{-2} is charged to $10^3 V$ and is then disconnected

from the battery.

If the plates are pulled apart to double the plates spacing capacitance of the capacitor will be

A. $44.25pF$

B. $88.5pF$

C. $120.45pF$

D. $22.12pF$

Answer: B

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6. A parallel plate capacitor of plate area $0.2m^2$ and spacing 10^{-2} is charged to 10^3V and is then disconnected

from the battery.

Amount of work required to double the plate spacing is

A. $8.85 \times 10^{-5} J$

B. $17.7 \times 10^{-5} J$

C. $4.42 \times 10^{-5} J$

D. $26.55 \times 10^{-7} J$

Answer: A

Watch Video Solution

7. A parallel plate capacitor of plate area $0.2m^2$ and spacing 10^{-2} is charged to $10^3 V$ and is then disconnected from the battery.

If the plates are pulled apart to double the plates spacing

Final voltage of the capacitor will be

A. $10^3 V$

B. $4 \times 10^3 V$

C. $2 \times 10^3 V$

D. $10^6 V$

Answer: C

Watch Video Solution

8. A spherical drop of water carries a charge of $10 \times 10^{-12} C$ and his a potential of 100V at its surface.

Radius of the drop will be

A. $9 \times 10^{-3} m$

B. $9 \times 10^{-5} m$

C. $9 \times 10^{-2} m$

D. $9 \times 10^{-4} m$

Answer: D

Watch Video Solution

9. A spherical drop of water carries a charge of $10 \times 10^{-12} C$ and his a potential of 100V at its surface.

If eight such charged drops as mentioned above, combine to form a single drop, the potential at the surface of the new drop will be

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

B. $400V$

C. $200V$

D. $300V$

Answer: B

Watch Video Solution

Intger Answer Type

1. The area of parallel capacitor with air as dielectric medium is $125.6cm^2$ and the separation between the two plates of the capacitor is 2 cm. What will be the radius of a

sphere having its capacitane equal to that of the parallel plate capacitor?

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2. When a slab of insulating material 4 mm thick is introduced between the plates of a parallel plate capacitor, it is found that the distance between the paltes has to be increased by 3.5 mm in order to restore the conductor capacity to its original value. What is the dielectric constant of the insulating meterial?

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1. The capacitance of a capacitor is C. Find out how much work will have to be done to charge the capacitor with an amount of positive charge Q.

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2. Two capacitors of capacitances $5\mu F$ and $10\mu F$ are charged to 16V and 10V respectively. Find what will be the common potential when they are connected in parallel to each other.

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3. What is understood by capacitance of a capacitor? A 900pF capacitor is charged to 100V by a battery. How much energy is stored in the capacitor?

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4. A glass slab if introduced between the plates of a parallel plate capacitor. Does the capacitances of the capacitor increase, decrease or remain unchanged?

Watch Video Solution

5. 64 identical water dorps coalesce to form a larger drop. If the nature and amount of charge be the same for all the

drops, calculate the potential, capacitance and stored energy of the larger drop.

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6. A capacitor of capacitance C_1 is charged up to potential V and then connected in parallel to an uncharged capacitor or capacitance C_2. The final potential difference across each capacitor will be

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

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

C. $\left(1 + \frac{C_2}{C_1}\right) V$

D. $\left(1 - \frac{C_2}{C_1}\right) V$

Answer: B

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7. Deduce an expression for the potential energy stored in a parallel plate capacitor.

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8. Two capacitors of capacitance C_1 and C_2 are connected in parallel. If a charge q is given to the assembly, the charge gets shared. The ratio of the charge on the capacitor C_1 to the charge on C_2 is

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

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

C. C_1C_2

D. $\frac{1}{C_1C_2}$

Answer: A

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9. 64 small water drops each of capacitance C and charge q coalesce to form a larger spherical drop. The charge and capacitance of the larger drop is

A. $64q, C$

B. $16q, 4C$

C. $64q, 4C$

D. $16q, C$

Answer: C

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Examination Archive With Solutions Wbjee

1. Three capacitors, $3\mu F, 6\mu F$ and $6\mu F$ are connected in series to a source of 120V. The potential difference, in volts, across the $3\mu F$ capacitor will be

A. 24

B. 30

C. 40

D. 60

Answer: D

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2. Consider two concentric spherical metal shells of radii r_1 and r_2 $(r_2 > r_1)$. If the outer shell has a charge q and the inner one is grounded, the charge on the inner shell is

A. $-\frac{r_2}{r_1}q$

B. zero

C. $-\frac{r_1}{r_2}q$

D. $-q$

Answer: C

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3. A parallel plate capacitor is charged and then disconnected from the charging battery. If the plates are now moved farther apart by pulling at them by means of insulating handles, then

A. the energy stored in the capacitor decreases

B. the capacitance of the capacitor increases

C. the charge in the capacitor decreases

D. the voltage across the capacitor increases

Answer: D

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4. A $5\mu F$ capacitor is connected in series with a $10\mu F$ capacitor. When a 300 volt potential difference is applied across this combination, the total energy stored in the capacitors is

A. $15J$

B. $1.5J$

C. $0.15J$

D. $0.10J$

Answer: C

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5. An $1\mu F$ capacitor C is connected to a battery of 10V through a resistance $1M\Omega$. The voltage across C after 1 second is approximately

A. $56V$

B. $7.8V$

C. $6.3V$

D. $10V$

Answer: C

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6. Three capacitors of capacitance $1.0\mu F, 2.0\mu F$ and $5.0\mu F$ are connected in series to a 10V source. The potential difference across the $2.0\mu F$ capacitor is

A. $\frac{100}{17}V$

B. $\frac{20}{17}V$

C. $\frac{50}{17}V$

D. $10V$

Answer: C

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7. An electric bulb, a capacitor, a battery and a switch are all in series in a circuit. How does the intensity of light vary when the switch is turned on?

A. Continuoes to increase gradually

B. Gradually increases for some time and then becomes steady

C. Sharply rises initially and then gradually decreases

D. Gradually increases for some time and then gradually decreases

Answer: C

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8. The insulated plates of a charged parallel plate capacitor are approaching each other due to electrostatic attraction. Assuming no other force to be operative and no radiation taking place, which of the following graphs approximately shows the variation with time (t) of the potential difference (V) between the plates?

A. 

B. 

C. 

D. 

Answer: A

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Examination Archive With Solutions Jee Main

1. A parallel plate capacitor is made of two circular plates separated by a distance of 5mm and with a dielectric of dielectric constant 2.2 between them. When the electric

field in the dielectric is $3 \times 10^4 \frac{V}{m}$, the charge density of the positive plate will be close to

A. $6 \times 10^4 \frac{C}{m^2}$

B. $6 \times 10^{-7} \frac{C}{m^2}$

C. $3 \times 10^{-7} \frac{C}{m^2}$

D. $3 \times 10^4 \frac{C}{m^2}$

Answer: B

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2. A capacitance of $2.0 \mu F$ is required in an electrical circuit across a potential differences of 1.0 kV. A large number of $1 \mu F$ capacitors are available which can withstand a

potential differences of not more than 300V. The minimum number of capacitors required to achieve this is

A. 2

B. 16

C. 24

D. 32

Answer: D

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3. A parallel plate capacitor of capacitance 90 pF is connected to a battery of emf 20V. If a dielectric material of

dielectric constant $k = \frac{5}{3}$ is inserted between the plates, the magnitude of the induced charge will be

A. 2.4 nC

B. 0.9 nC

C. 1.2 nC

D. 0.3 nC

Answer: C

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1. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant k, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

A. the potential difference between the plates decreases k times

B. the energy stored in the capacitor decreases k times

C. the change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{k}-1\right)$

D. the charge on the capacitor is not conserved

Answer: D

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Examination Archive With Solutions Neet

1. A parallel plate capacitor is to be designed, using a dielectric of dielectric constant 5, so as to have a dielectric strength of $10^9 V \cdot m^{-1}$. If the voltage rating of the capacitor is 12kV, the minimum area of each plate required to have a capacitance of 80pF is

A. $10.5 \times 10^{-6} m^2$

B. $21.7 \times 10^{-6} m^2$

C. $25.0 \times 10^{-5} m^2$

D. $12.5 \times 10^{-5} m^2$

Answer: B

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2. The electrostatic force between the metal plates of an isotated parallel plate capacitor C having a charge Q and area A, is

A. proportional to the square root of the distance between the plates

B. linearly proportional to the distance between the plates

C. independent of the distance between the plates

D. inversely proportional to the distance between the plates

Answer: C

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Cbse Scanner

1. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance C and having charge Q. How will the

Energy stored.

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2. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance C and having charge Q. How will the

The electric field inside the capacitor be affected when it is completely filled with a dielectric meterial of dielectric constant k?

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3. A slab of material of dielectric constant k has the same area as that of the plates of a parallel plate capacitor but has the thickness d/2, when d is the separation between the plates. Find out the expression for its capacitance

when the slab is inserted between the plates of the capacitor.

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4. A parallel plate capacitor of capacitance C is charged to a potential V. It is then connected to another uncharged capacitor having the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor.

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5. Two capacitors of capacitance $10\mu F$ and $20\mu F$ are connected in series with a 6V battery. After the capacitors are fully charged, a slab of dielectric constant k is inserted between the plates of the two capacitors. How will the following be affected after the slab is introduced?

The potential difference between the plates of the capacitors.

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6. Two capacitors of capacitance $10\mu F$ and $20\mu F$ are connected in series with a 6V battery. After the capacitors are fully charged, a slab of dielectric constant k is inserted between the plates of the two capacitors. How will the

following be affected after the slab is introduced?

The charges on the two capacitors.

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7. Two capacitors of capacitance $10\mu F$ and $20\mu F$ are connected in series with a 6V battery. After the capacitors are fully charged, a slab of dielectric constant k is inserted between the plates of the two capacitors. How will the following be affected after the slab is introduced?

The electric field energy stored in the capacitors.

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8. A capacitor of capacitance C is charged fully by connecting it to a battery of emf B. It is then disconnected from the battery. If the separation between the plates of the capacitor is now doubled, how will the following change ?

charge stored by the capacitor.

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9. A capacitor of capacitance C is charged fully by connecting it to a battery of emf B. It is then disconnected from the battery. If the separation between the plates of the capacitor is now doubled, how will the following

change ?

Field strength between the plates.

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10. A capacitor of capacitance C is charged fully by connecting it to a battery of emf B. It is then disconnected from the battery. If the separation between the plates of the capacitor is now doubled, how will the following change ?

Energy stored by the capacitor.

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11. Find the equivalent capacitance beween A and B in the combination given below. Each capacitor is of $2\mu F$ capacitance.

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12. If a dc source of 7 V is connected across capacitor `0.86muF", how much charge is drawn from the source and what is the energy stored in the network?

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13. A 12 pF capacitor is connected to a 50V battery. How much electrostatic energy is stored in the capacitor? If another capacitor of 6pF is connected in series with it with the same battery connected across the combination, find the charge stored and potential difference across each capacitor.

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14. Two identical capacitors of 12 pF each are connected in series across a battery of 50 V. How much electrostatic energy is stored in the combination ? If these were connected in parallel across the same battery, how much

energy will be stored in the combination now? Also find the charge drawn from the battery in each case.

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15. Two identical parallel plate capacitors A and B are connected to a battery of V volt with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant k. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.

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Others

1. Which of the following gas can be used in Van de Graaff generator?

A. methane

B. hydrogen

C. oxygen

D. chlorine

Answer: A

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2. Van de Graaff generator is used as

A. external voltage source

B. external current source

C. electrostatic accelarator

D. none of these

Answer: C

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