PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

CAPACITORS

Example

1. The Capacitance of a conductor is 1 Farad.

What do you mean by this statement ?

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2. If the earth is assumed to be a sphere of radius $6.4 \times 10^3 km$, then what will be its capacitance?

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3. If dielectric strength of air (minimum field required for ionisation of a medium) is

$3MV/m$, can a metal sphere of radius 1cm hold a charge of 1 coulomb ?

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4. Twenty seven charged water droplets each with a diameter of 2 mm and a charge of $10^{-12}C$ coalesce to form a single drop. Calculate the potential of the bigger drop.

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5. An isolated sphere has a capacitance of 50 pF. (a) Calculate its radius. (b) how much charge should be placed on it to raise its potential ot $10^4 V$?

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6. A capacitor of $20\mu F$ is charged to a potential of 10kV. Find th charge accumulated on each plate of the capacitor.

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7. When 1.0×10^{12}electrons are transferred from one conductor to another, a potential difference of $10V$ find the capacitance of the two -conductor system .

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8. What is the area of the plates of a 2 farad parallel plate air capacitor, given that the separation between the plates is 0.5 cm?

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9. Calculate the capacitance of a parallel plate capacitor having circular discs of radii $0.05m$ each. The separation between the discs is $1mm$.

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10. A parallel -plate capacitor having plate area 25.0cm^ and a separation2.00mm between the plates .the capacitor is connected to a bettery

of 12.0V.(a)find the charge on the capacitor . (b) the plate separation is decrerased to 1.00 mm. Find the extra charge given by the bettery to the positive plate.

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11. A spherical capacitor has an inner sphere of radius 9 cm and an outer sphere of radius 10 cm. the outer sphere is earthed and the inner sphere is charged. What is the capacitance of the capacitor?

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12. The thickness of air layer between two coating of a spherical capacitor is 2cm. The capacitor has same capacitance as the sphere of 1.2m diameter. Find the radii of its surfaces.

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13. Assuming an expression for the potential of an isolated conductor, show that the capacitance of such a sphere will be increased

by a factor n, if it is enclosed within an earthed concentric sphere, the ration of the spheres being $\frac{n}{n-1}$.

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14. A cylindrical capacitor has two co-axial cylinders of length 15 cm and radil 1.5 and 1.4 cm.The outer cylinder is earthed and inner cylinder is given a charge of $3.5\mu C$. Determine the capacitance of the system and the

potential of the inner cylinder. Neglect end effects (i.e., bending of field lines at the ends.)

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15. Three resistors of $2\Omega, 3\Omega$ and 4Ω are connected in

(a) series

(b) parallel.

Find the equivalent resistance in each case.

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16. Two capacitors have a capacitance of $5\mu F$ when connected in parallel and $1.2\mu F$ when connected in series. Calculate their capacitance.

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17. Three capacitors of equal capacitance, when connected in series have net capacitance C_1, and when connected in parallel have net capacitance C_2. What is the value of C_1 / C_2?

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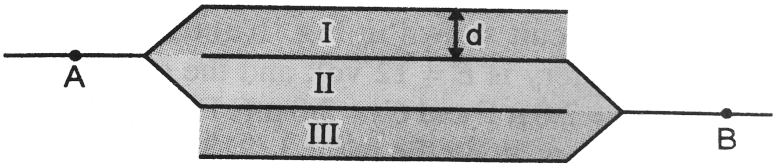
18. What is the capacitance of arrangement of 4 plates each of area A at a distance d in air in Fig.



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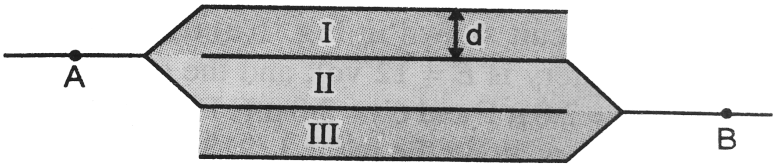
19. What is the capacitance of arrangement of 4 plates each of area A at a distance d in air in

Fig.



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20. How will you connected four capacitors, each of capacitance $1\mu F$ to obtain a net capacitance of $0.75\mu F$? Draw a diagram to show the combination

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21. Connect three capacitors of $3\mu F, 3\mu F$ and $6\mu F$ such that their equivalent capacitance is $5\mu F$.

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22. 

Calculate the capacitance of the capacitor in figure. If the equivalent capacitance of the combination between A and B is $15\mu F$.

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23. 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.

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24. Three capacitors each of capacitance 9 pF are connected in series. (a) What is the total capacitance of the combination ? (b) What is the potential difference across each capacitor if the combination is connected to a 120V supply.

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25. Three capacitors of capacitance $2pF, 3pF$ and $4pF$ are connected in parallel.

(a) what is the total capacitance of the combination ? (b) Determine the charge on each capacitor, If the combination is connected to 100V supply.

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26. A $80\mu F$ capacitor is charged by a 50V battery. The capacitor is disconnected from the battery and then connected across another uncharged $320\mu F$ capacitor. Calculate the charge on the second capacitor.

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27. In fig. $C_1 = 20\mu F, C_2 = 30\mu F$ and $C_3 = 15\mu F$ and the insulated plate of C_1 is at a potential of 90 V, one plate of C_3 being earthed. What is the potential difference between th plates of C_2 three capacitors being connected in series ?

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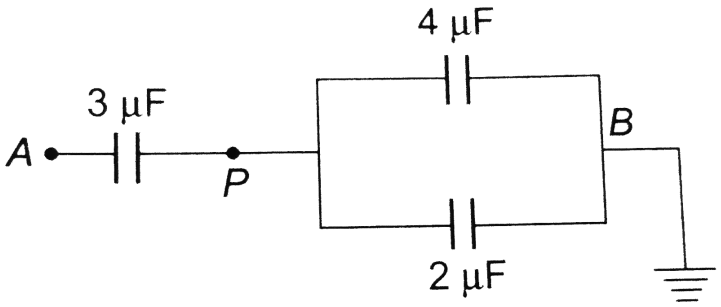
28. In the figure a potential of $+1200V$ is given to point A and point B is earthed, what is the potential at the point P ?



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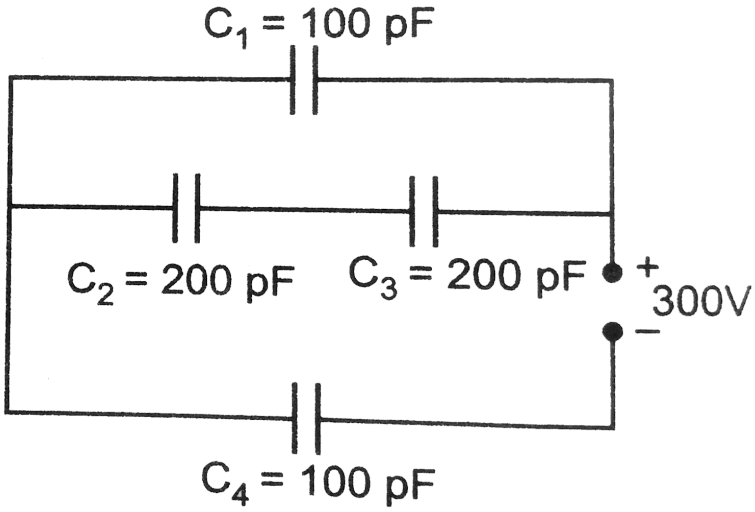
29. Obtain equivalent capacitance of the following network, Fig. For a 300V supply

determine the charge and voltage across each capacitor.



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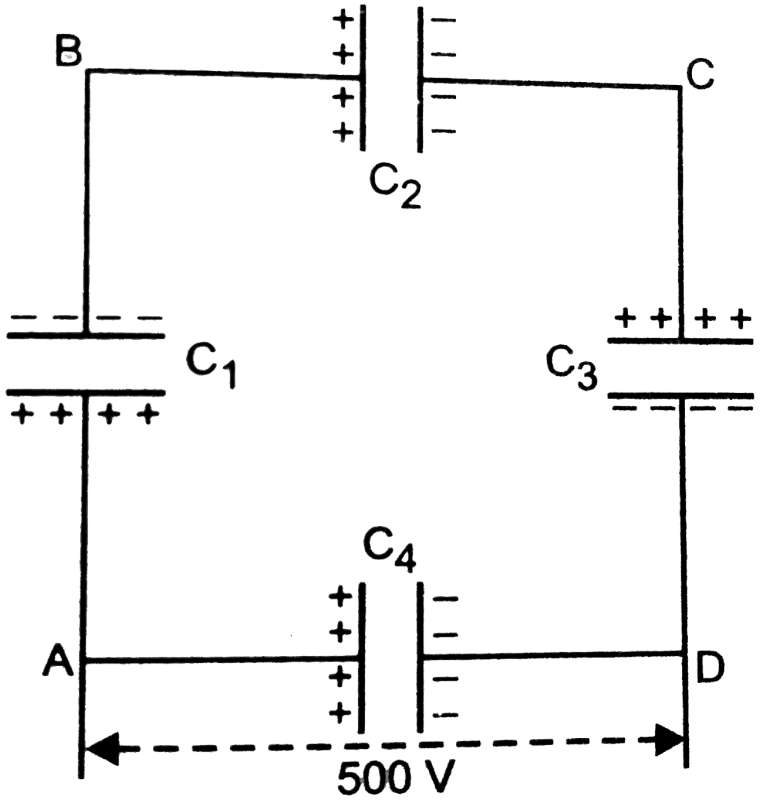
30. A network of four $10\mu F$ capcitors is connected to a 500V supply as shown in Fig. Determine the (a) equivalent capacitance of

the network and (b) charge on each capacitor.



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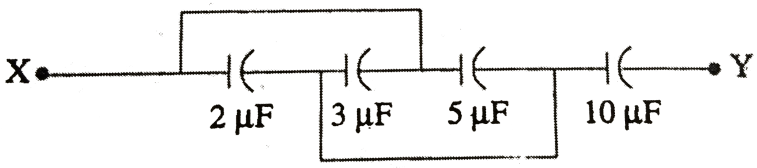

31.

Four capacitors are connected as shown in the figure. Calculate the equivalent capacitance between the point X and Y.

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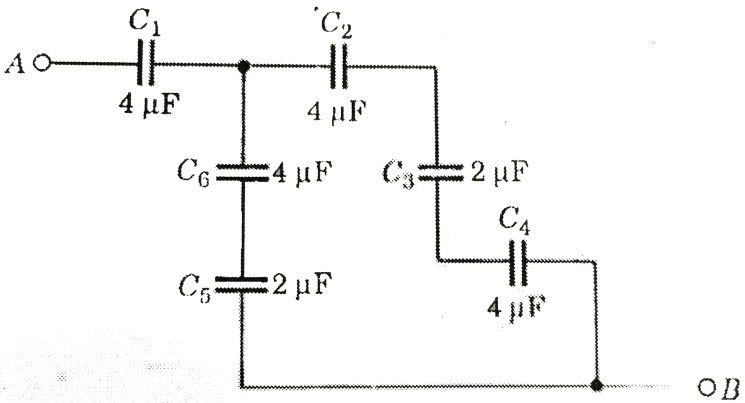
32.



Calculate the equivalent capacitance between the points A and B of the circuit given below.

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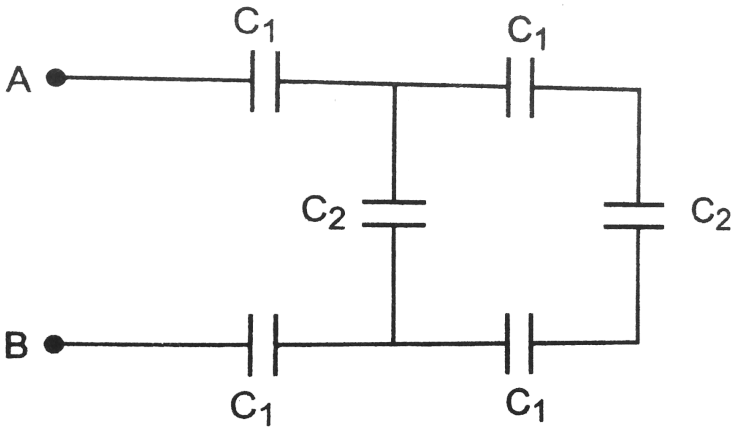
33. If $C_1 = 3pF$ and $C_2 = 2pF$, calculate the equivalent capacitance of the network shown

in Fig between points A and B.



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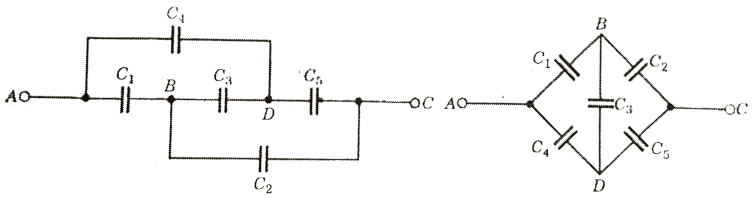
34.



Five capacitors of capacitance $10\mu F$ each are connected with each other, as shown in figure.

Calculate the total capacitance between the points A and C.

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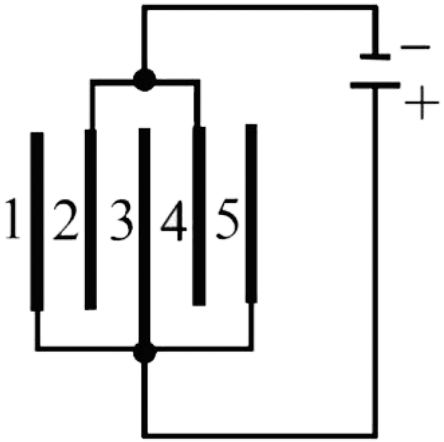
35. Five identical capacitor paltes, each of area A, are arranged such that adjacent plates are at a distance d apart, the plates are connected to a source of emf V as shown in the figure



The charge on plate 1 is .....and on plate 4 is.....

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36. Find the energy stored in a capacitor of capacitance $100\mu F$ when it is charged to a potential difference of 20 V.

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37. For flash pictures, a photographer uses a capacitor of $30\mu F$ and a charger that supplies 3×10^3V. find the charge and energy expended in joule for each flash.

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38. A $4\mu F$ capacitor is connected to another $8\mu F$ capacitor. The combination is charged at

300V. Calculate

(i) total charge on the combination

(ii). Total energy stored in the combination.

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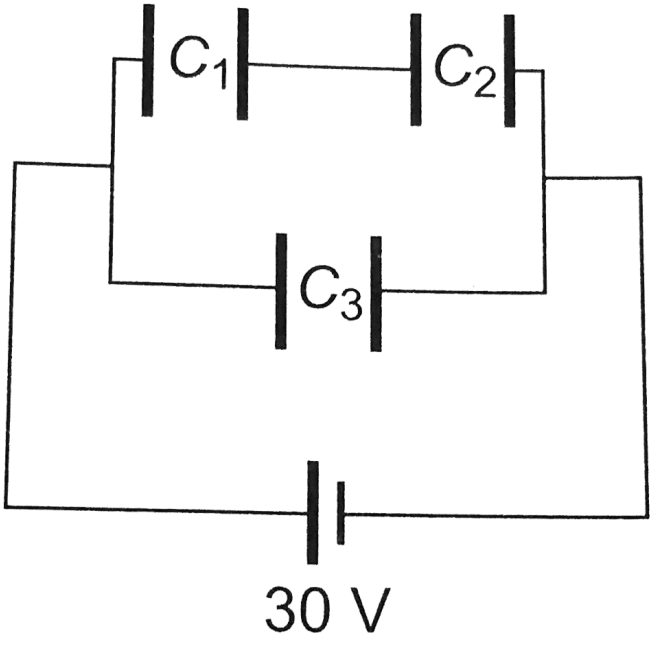
39. Two capacitors $C_1 = 3\mu F$ and $C_2 = 6\mu F$ in series, are connected in parallel to a third capacitor $C_3 = 4\mu F$. This arrangement is then connected to a battery of e.m.f., =$30V$, as shown. The energy lost by the battery in

charging the capacitors



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40. The plates of a paralllel plate capacitor have an area of $90cm^2$ each and are separated

by 2.5mm. The capacitance is charged by connecting it to a 400V supply.

(a) How much electrostatic energy is stored by the capacitor ?

(b) View this energy as stored in the electrostatic field between the plates, and obtain the energy per unit volume (u). Hence arrive at a relation between U and the magnitude of electric field E between the plates.

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

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42. An uncharged capacitor is connected to a battery. Show that half the energy supplied by the battery is lost as heat while charging the capacitor.

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43. A capacitor of $20\mu F$ is charged to 500 volts and connected in parallel ith another capacitor of $10\mu F$ and charged to 200 volts. The common potential is

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44. A $4\mu F$ capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another uncharged $2\mu F$

capacitor. How much electrostatic energy of the first capacitor is disspated in the form of heat and electromagnetic radiation ?

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45. A 900 pF capacitor is charged by 100V battery.

(a) How much electrostatic energy is strored by the capacitor ? The capacitor is disconnected from the battery and connected

to another 900 pF capacitor. How much is the electrostatic energy stored in the system ?

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46. Two capacitors are in parallel and the energy stored is 45J, when the combination is raised to potential of 3000 V. with the same two capacitors in series, the energy stored 4.05J for the same potential. What are their individual capacitances?

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47. When two charged conductors having different capacities and different potentials are joined together, show that there is always a loss of energy.

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48. A capacitor is charged to potential V_1. The power supply id disconnected and capacitor is connected in parallel to another uncharged capacitor. Calculate common potential of the

combination of capacitors. Show that total energy of the combination is less than sum of energies stored in them before they are connected.

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49. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. $\left(1pF = 10^{-12}F\right)$ What will be the capacitance if the distance between the plates is reduced by half and the space between

them is filled with a substance of dielectric constant 6 ?

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50. Find the length of the paper used in a capacitor of capacitance $2\mu F$, if the dielectric constant of the paper is 2.5 and its width and thickness are 50 mm and 0.05mm, respectively.

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51. A parallel plate capacitor is to be designed with a voltage rating 1 KV using a material of dielectrical constant 3 and dielectric strength about $10^7 Vm^{-1}$. [Dielectric strength is the maximum electric field a material can tolerate without break down, i.e, without starting to conduct electrically through partial ionisation. For safety, we should like the field never to exceed say $10\,\%$ of the dielectric strength]. What minimum area of the plates is required to have a capacitance of 50 pF ?

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52. A parallel plate capacitor with air between its plates having palte area of $6 \times 10^{-3} m^2$ and separation between them 3 mm is connected to a 100 V supply. Calculate charge on each plate of the capacitor. Explain what would happen when a 3 mm thick mica sheet (dielectric constant=6) is inserted between the plates, (i) while the voltage supply remains conected, (ii) after the supply is disconnected.

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53. Two metal plates form a parallel plate capacitor. The distance between the plates is d. A metal sheet of thickness d/2 and of the same area is indroduced between the plates. What is the ratio of the capacitances in the two cases?

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54. An ebomiote rod (K = 3), 6 mm thick is introduced between the plates of a parallel

plate capacitor of plate area $4 \times 10^{-2} m^2$ and plate separation 0.01m. Find the capacitance.

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55. The area of parallel plates of an air capacitor is $0.2m^2$ and the distance between them is $0.01m$ The potential difference between the plates, the potential difference between the plates is $3000V$. When a $0.01m$ thick sheet of an insulating material is placed between the plates, the potential difference

decrease to 1000 volt. Determine (i) capacitance of capacitance before placing the sheet (ii) charge on each plate (iii) dielectric constant of material (iv) capacitanc after placing the insulator (v) absoulate permittivity of the dielectric.

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56. A parallel plate capacitor is maintained at a certain potentail difference. When a 3mm thick slab is intorduced between the plate, in a

order to maintain the same potential difference, the distance between the plates is increased by 2.4 mm. Find the dielectric constant of the slab.

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57. The capacitance of a parallel plate capacitor is 50 pF and the distance between the plates is 4mm. It is charged to 200 V and then the charging battery is removed. Now a dielectric slab $(\kappa = 4)$ of thickness 2mm is

placed. Determine (i) final charge on each plate (ii) finial potential difference between the plates (iii) final energy is the capacitor.

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58. A parallel plate capacitor is formed by two plates, each of area $100cm^2$, separated by a distance of 1 mm. A dielectric of dielectric constant 5.0 and dielectric strength $1.9X10^7Vm^{-1}$ is filled between the plates. Find the maximum charge that can be stored

on the capacitor without causing any dielectric breakdown.

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59. A spherical capacitor has an inner sphere of radius 12 cm and an outer sphere of radius 13 cm. The outer sphere is earthed and the inner sphere is given a charge of $2.5\mu C$. The space between the concentric spheres is filled with a liquid of dielectric constant 32.

(a) Determine the capacitance of the capacitor.

(b) What is the potential of the inner sphere ?

(c) Compare the capacitance of this capacitor with that of an isolated sphere of radius 12 cm.Explain why the later is much smaller ?

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60. A cable consisting of a wire 3 mm in diameter and insulated with 3 mm thick dielectric of relative permittivity 4.5 is placed in water. Calculate the capacitance of 1 km length of the cable.

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Problem From Competitive Examinations

1. A parallel plate capacitor is maintained at a certain potentail difference. When a 3mm thick slab is intorduced between the plate, in a order to maintain the same potential difference, the distance between the plates is increased by 2.4 mm. Find the dielectric constant of the slab.

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2. A capacitor of capacitance C is fully charged by a 200 V battery. It is then discharged through a small coil of resistnace wire embedded in a thermally insulated block of specific heat $2.5 \times 10^2 Jkg^{-1}K^{-1}$ and of mass 0.1 kg. if the temperature of the block rises by 0.4 K, what is the value of C?

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3. An electric field $E_0 = 3 \times 10^4 Vm^{-1}$ is established between the plates $0.05m$ apart, of a parallel plate capacitor. After removing the charging battery, an uncharged metal plate of thickness $t = 0.1m$ is inserted between capacitor plates. Find the $p.d.$ across the capacitor, (i) before (ii) after the introduction of plates (iii) what would be the $p.d$ if a dielectric slab $(K = 2)$ were introduced of place of metal plate.

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4. A parallel plate capacitor has a capacitance of $2\mu F$. A slab of dielectric constant 5 is inserted between the plates and the capacitor is charged to $100V$ and then isolated . (a) What is the new potential diff., if the dielectric slab is removed ? (b) How much work is required to remove teh dielectric slab ?

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

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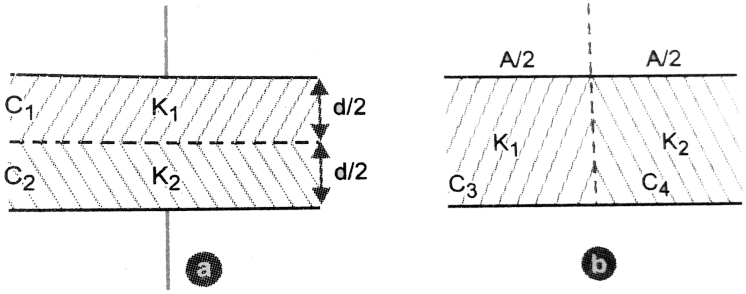
6. A capacitor is filled with two dielectrics of same dimensions, but of dielectric constants 2 and 3 respectively. Find the ratio of capacitances in the two arrangements shown in Fig.



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7. Find the capacitance of a system of three parallel plates, each of area A $metre^2$ separated by distances d_1 and d_2 metre respectively. The space between them is filled with dielectrics of relatives dielectric constants K_1 and K_2. The dielectric constant of free space is $\in_0$.

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

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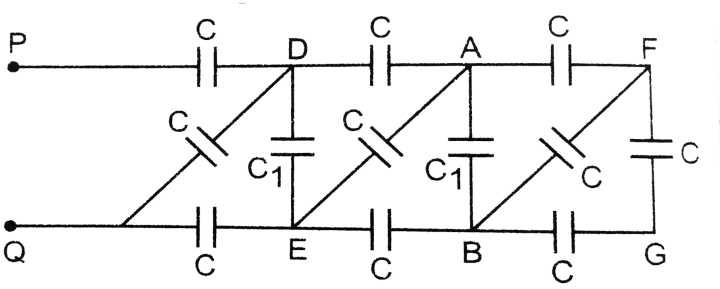
9. Find the equivalent capacitance between the points P and Q as shown in Fig. Given

$C = 18\mu F$ and $C_1 = 12\mu F$



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10. A battery of $10V$ is connected to a capacitor of capacity $0.\, lF$. The battery is now removed and this capacitor is connected to a second uncharged capacitor. If the charges are distributed equally on these two capacitors,

find the total energy stored in the two capacitors. Find the ratio of final energy to initial energy stored in capacitors.

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11. A parallel plate capacitor of plate area $0.2m^2$ and spacing 10^{-2} m is charged to 10^3 volts and is then disconnected from the battery. How much work is required if the plates are pulled apart to double the plate

spacing ? Calculate the final voltage onthe capacitor $\varepsilon_0^{-1} = 36\pi \times 10^9 VmA^{-1}s^{-1}$

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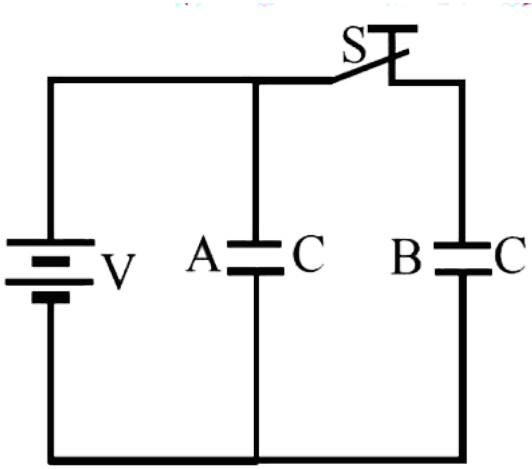
12. The figure shows two identical parallel plate capacitors connected to a battery with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant(or relative permittivity) 3. Find the ratio of the total electrostatic energy stored in

both capacitors before and after the introduction of the dielectric.



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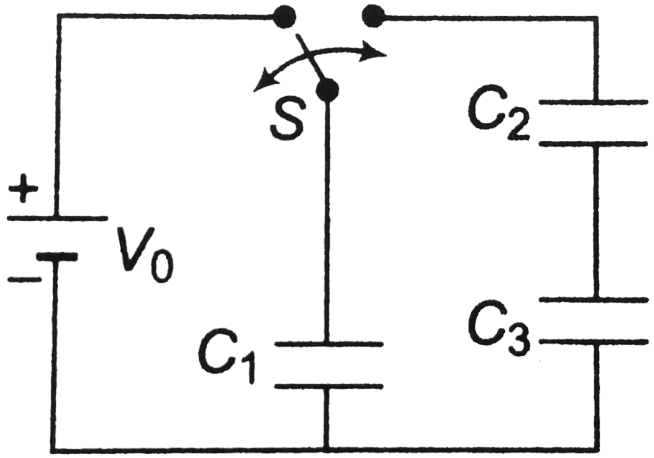
13. When switch S is thrown to the left in figure, the plates of capacitor 1 acquire a potential difference V_0. Capacitors 2 and 3 are

initially uncharged. The switch is now thrown to the right. What are the final charges q_1, q_2 and q_3 on the capacitors?



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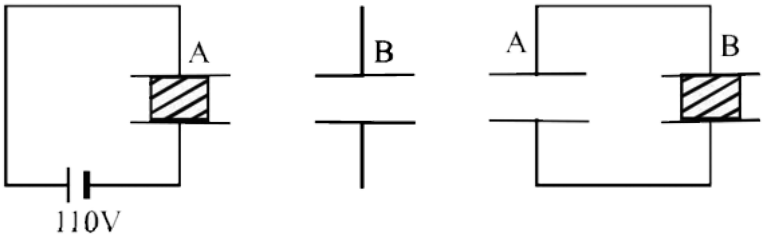
14. Two parallel plate capacitors A and B have the same separation $d = 8.85 \times 10^{-4} m$

between the plates. The plate area of A and B are $0.04m^2$ and $0.02m^2$ respectively. A slab of dielectric constant (relative permittivity) $K = 9$ has dimensions such that it can exactly fill the space between the plates of capacitor B.



(i) The dielectric slab is placed inside. A as shown in figure (a). A is then charged to a

potential difference of 110V. Calculate the capacitance of A and the energy stored in it.

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

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

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15. Two square metallic plates of $1m$ side are kept $0.01m$ apart, like a parallel plate capacitor, in air in such a way that one of their edges is perendicular, to an oil surface in a tank filled with an isulating oil. The plates are connected to a battery of e.m.f. 500 volt. The plates are then lowered vertically into the oil at a speed of $0.001m/s$. Calculate the current drawn from the battery during the process.

[di-electirc constant of oil $= 11,\ \in_0 = 8.85 \times 10^{-12} C^2/N^2m^2$]

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

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17. An electric field $E_0 = 3 \times 10^4 Vm^{-1}$ is established between the plates $0.05m$ apart, of a parallel plate capacitor. After removing the charging battery, an uncharged metal plate of thickness $t = 0.1m$ is inserted between capacitor plates. Find the $p.d.$ across the capacitor, (i) before (ii) after the introduction of plates (iii) what would be the $p.d$ if a dielectric slab $(K = 2)$ were introduced of place of metal plate.

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Problem For Self Practive

1. Capacitance of a conductor is $1\mu F$. What charge is required to raise its potential to $100V$?

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2. Find the capacitnace of a conducting sphere of radius 10 cm situated in air. How much charge is required to raise it to a potential 1000 volt?

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3. The radius of isolated conducting sphere is 1600 km. find the its capacity in microfarad.

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4. If the capacitance of a conductor carrying a charge of 8 C is 0.005 F, calculate its potential.

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5. 125 drops of water each of radius $2mm$ and carrying charge of $1nC$ are made to form a bigger drop. Find the capacitance and potential of the bigger drop.

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6. If 64 drps each charged to 220 V coalesce, what will be the potential of the bigger drop?

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7. N drops of mercury of equal radii and possessing equal charges combine to from a big drop. Compare the charge, capacitance and potential of bigger drop with the corresponding quantities of individual drops.

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8. Show that the SI unit of ε_0 may be written as farad $meter^{-1}$.

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9. A capacitor has a capacitance of $8.5\mu F$. How much charge must be removed so as to reduce the potential difference between its plates by 50V?

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10. Calculate capacitance of a parallel plate capacitor with area of each plate 1 cm^2 and separation 1 mm.

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11. A parallel plate capacitor has capacitance of $1.0F$. If the plates are $1.0mm$ apart, what is the area of the plates?

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12. A parallel plate air capacitor consists of two circular plates of diameter $8cm$. At what distance should the plates be held so as to have the same capacitance as that of a sphere of a diameter $20cm$?

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13. A parallel-plate capacitor has each plate of 6 cm diamter. If its two plates are separated by 0.05 cm of air, what should be the capacitance of the capacitor? What would be the radius of a spherical conductor having the same capacitance?

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14. A parallel plate capacitor has plates of area $200cm^2$ and separation between the plates 1.00 mm. What potential difference will be developed if a charge of 1.00 nC)(i.e., 1.00×10^{-9} C) is given to the capacitor? If the plate separation is now increased to 2.00 mm, what will be the new potential difference?

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15. A sphere of radius $0.03m$ is suspended within a hollow sphere of radius $0.05m$. If the inner sphere is charged to a potential of 1500 volt and outer sphere is earthed. Find the capacitance and the charge of the inner sphere.

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16. A cylindrical capacitor is constructed using two coaxial cylinders of the same length 10cm

of redii 2mm and for mm. (a) calculate the capacitance (b) another capacitor of the same length is constructed with cylinders of radii 4mm and 8mm. Calculate the capacitance .

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17. A charge of 20 μC is placed on the positive plante of on isolated parailel - plate capacitor of capacitance $10\mu F$ calculate the potential difference developed between the plates .

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18. A charge of $+2.0 \times 10^{-8} C$ is placed on the positive place and a charge of -$1.0 \times 10^{-8} C$ on the negative plate of a parallel- plate capacitor of capacitance $1.2 \times \left(10^{-3}\right) \mu$ F. Calculate the potential difference developed between the plates.

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19. Three capacitors each of capacitor $2 \mu F$ are connected in series. Find resultance capacity

in farad.

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20. Two capacitors have a capacitance of $5\mu F$ when connected in parallel and $1.2\mu F$ when connected in series. Calculate their capacitance.

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21. Two capacitors of equal capacitance when connected in series hae net capacitance C_1 and when connected in parallel have net capacitance C_2 what is the value of C_1 / C_2?

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22. Three capacitor of capacity 1,2 and $3\mu F$ are connecte3d such that second and third are in series and the first one in parallel. Calculate the resultant capacity.

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23. The capacities of three capacitors are in the ratio of $1:2:3$. Their equivalent capacity in parallel is greater than their equivalent capacity in series by $60/11\ pF$. Calculate their individual capacitance.

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24. Three capacitors of $3\mu F$ each are connected in series. This combination is

connected in series to another combination of three capacitors of $1\mu F$ each in parallel. Find the total capacitance.

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25. Three capacitors each of capacitance 9 pF are connected in series. (a) What is the total capacitance of the combination ? (b) What is the potential difference across each capacitor if the combination is connected to a 120V supply.

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26. Three capacitors of capacitance $2pF, 3pF$ and $4pF$ are connected in parallel. (a) what is the total capacitance of the combination ? (b) Determine the charge on each capacitor, If the combination is connected to 100V supply.

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27. How would you connectged 8, 12 and $24\mu F$ capacitors to obtain (i) minimum capacitance (ii) maximum capacitance ? If a potential difference of 100 volt is applied across the system, what would be the charges on the capacitors in each case?

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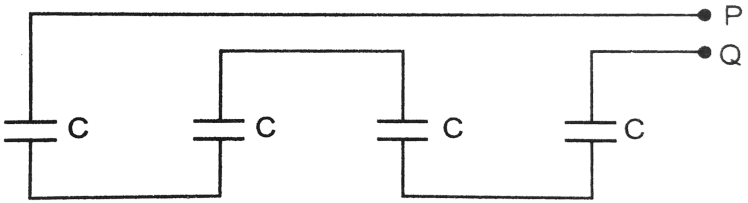
28. A combination of four identical capacitors is shown in Fig. IF resultant capacitance of the

combination between the points P and Q is $1\mu F$, calculate capacitance of each capacitor.



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29. Five capacitors are connected as shown in figure. Find the equivalent capacitance between points A and B.

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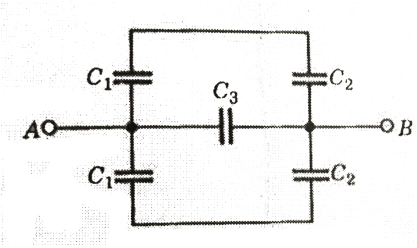
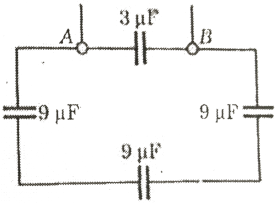
30. 



Find the equivalent capacitance of the combination shown in figure. Between the points A and B.

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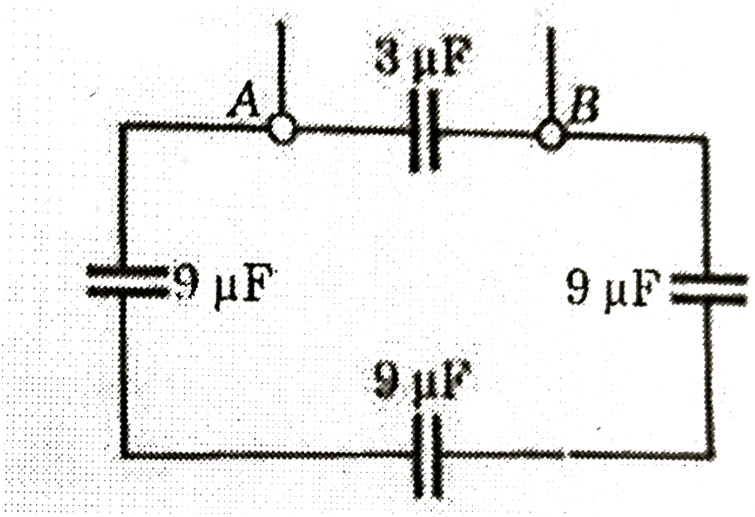
31. For the network shown in figure.



calculte the equivalent capacitance between points A and B.

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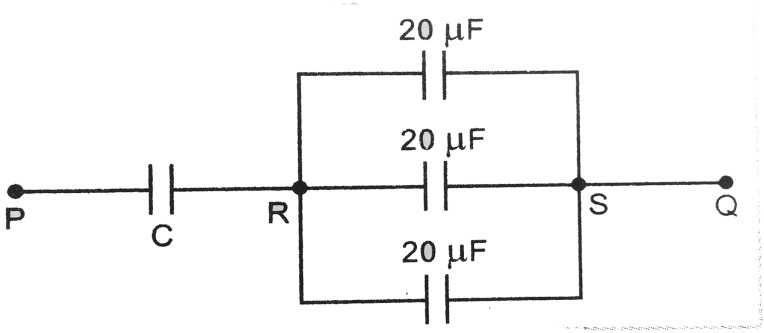
32. Calculate the capacitance of the capacitor C in Fig. The equivalent capacitance of the combination between P and Q is $30\mu F$



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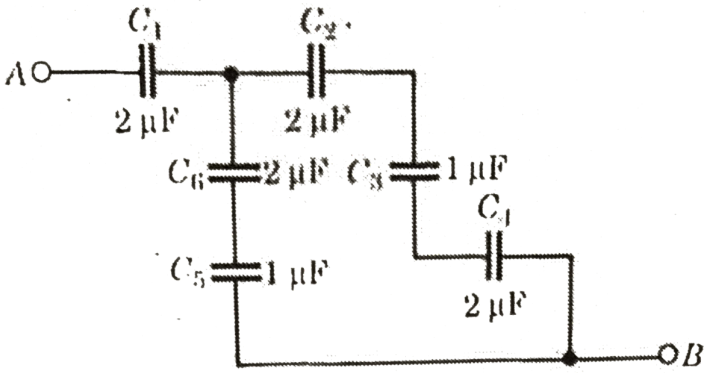

33.

Calculate the equivalent capacitance between the points A and B of the circuit shown in figuer.

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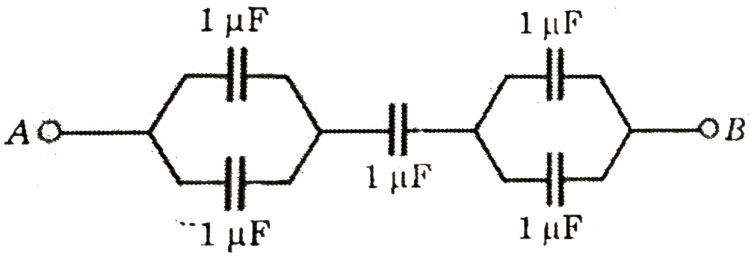

34.

Calculate the equivalent capacitance between points A and B of the combination shown in figure.

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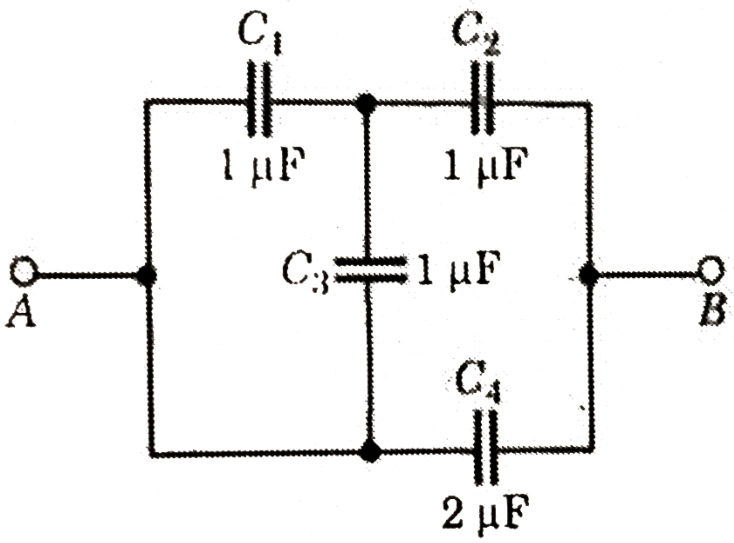

35.

Find the equivalent capacitance between points A and B for the network shown in figure.

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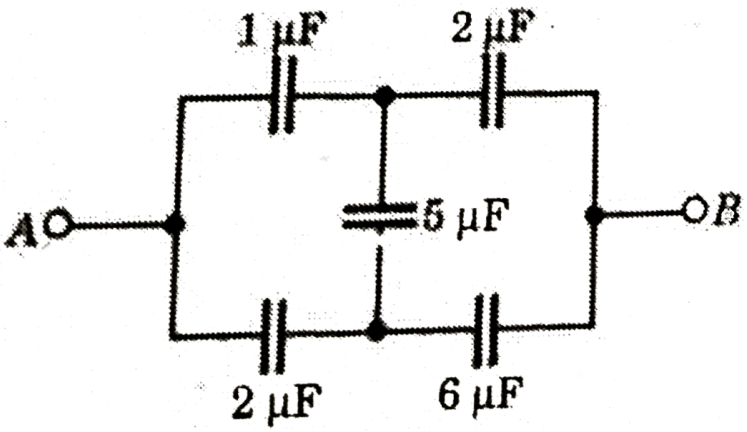

36.

find the capacitance between the points A and B of the assembly shown in figure.

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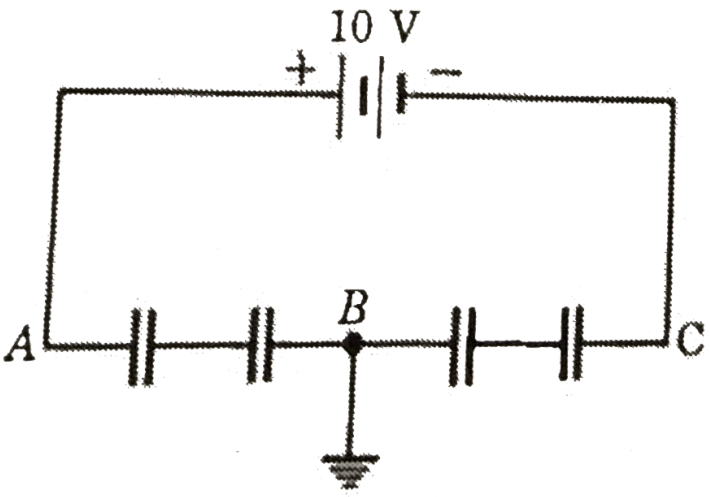

37.

Four capacitors of equal cpacitances are connected in series with a battery of 10 V, as shown in figure. The middle point B is connected to the earth. What will be the potentials of the points A and C?

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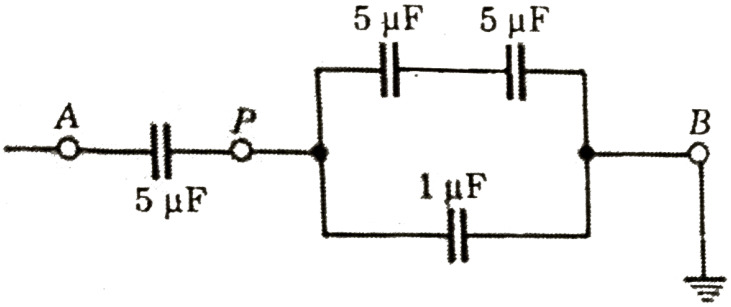

38.

In the circuit shown in figure. If point B is earthed and A is kept at 1500 V, then calculate the potential at the point P.

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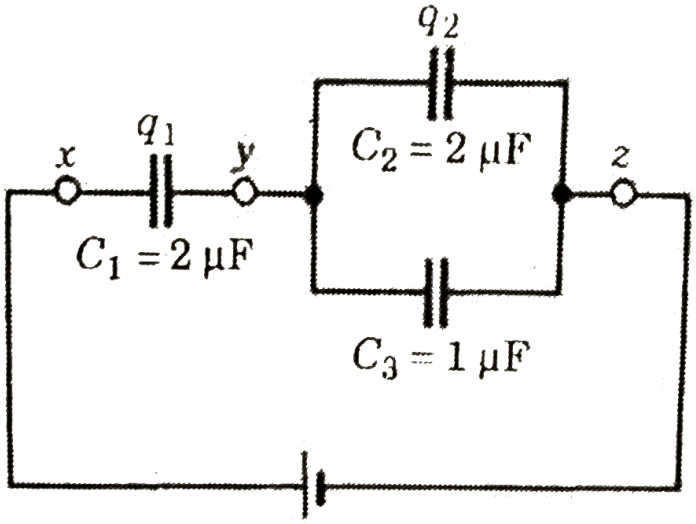

39.

find the charges on the capacitors in figure.

And the potential differences across them.

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40. A variable capacitor has n plates and the distance between two successive plates is d. determine its capacitance.

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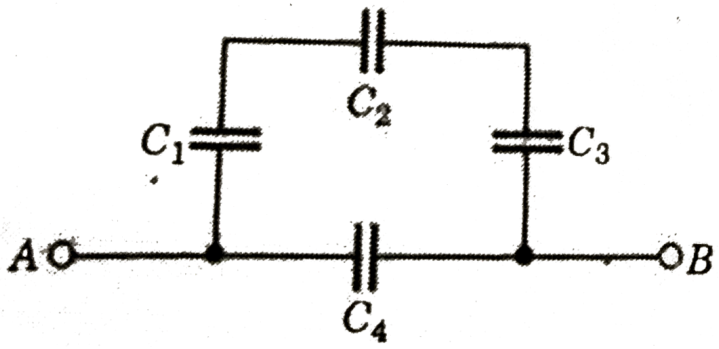

41.

In the network shown in figure. $C_1 = C_2 = C_3 = C_4 = 10\mu F.$ Find th

equivalent capacitance between the points A and B, what will be the charge on each capacitor?

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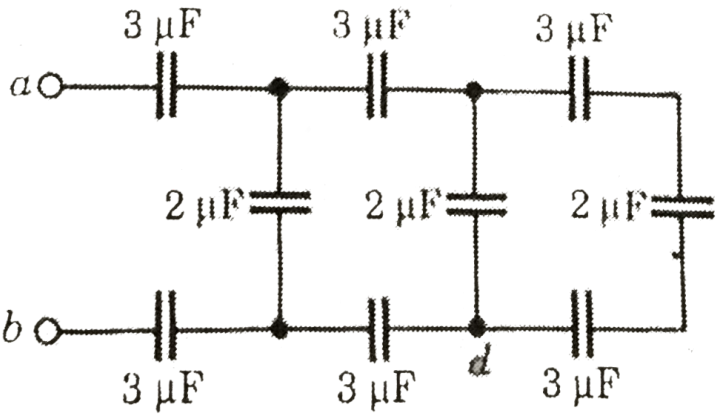
42.



For the network shown in figure. Compute.

(i). The equivalent capacitance between points

and b.

(ii). The charge on each of the capacitors nearest a and b when $V_{ab} = 900V$.

(iii). V_{cd}, when $V_{ab} = 900V$.

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43. A 12 pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor ?

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44. An electronic flash lamp has 10 capacitors, each 10 μF, connected in parallel. The lamp is operated at 100 volt. How much energy will be radiated in the flash?

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45. Find the capacitance of a capacitor having a charge of $6 \times 10^{-7} C$ and energy of $4.5 \times 10^{-4} J$

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46. Two capacitors of capacitances $4\mu F$ and $6\mu F$ are connected in series with a battery of 20 V. find the energy supplied by the battery.

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47. Two capacitors of capacitances $20.0pF$ and $50.0pF$ are connected in series with a `6.00V bettery . Find (a)the potential difference across each capacitor and (b) the energy stored in each capacitor .

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48. A capacitor charged from a 50 V d.c. supply is found to have charge of $10\mu C$.

What is the capacitance of the capacitor and how much energy is stored in it?

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49. The plates of a parallel plate capacitor have an area of $100cm^2$ each and area separated by 2.5 mm. the capacitor is charged

to 200V. Calculate the energy stored in the capacitor.

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50. A 800 pF capacitor is charged by a $100V$ battery. After sometime, the battery is disconnected. The capacitor is then connected to another $800pF$ capacitor. What is the electrostatic energy stored ?

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51. A $20\mu F$ capacitor charged to 100 V is connected in parallel to a $10\mu F$ capacitor charged to 100 V. find the loss in energy.

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52. Two insulated metallic spheres of $3\mu F$ and $5\mu F$ capacitances are charged to $300V$ and $500V$ respectively. The energy loss, when they are connected by a wire is

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53. Three capacitors of 10,15 and 30 μF are connected in series and on this combination a potential difference of 60 V is applied. Calculate the charge, potential difference and energy stored on each capacitor.

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54. Two capacitors are connected in parallel and the energy stored is 18 J, when a potential difference of 6000 V is applied across the

combination. With the same capacitors connected in series, the energy stored is 4 J from the same potential difference. what are the individual capacitances?

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55. Two capacitors of capacitances $25\mu F$ and $100\mu F$ are connected in series and are charged by a battery of 120 V. the battery is then removed. The capacitors are now separated and connected in paralle. Fiond (i)

p.d. across each capacitor (ii) energy-loss in the process.

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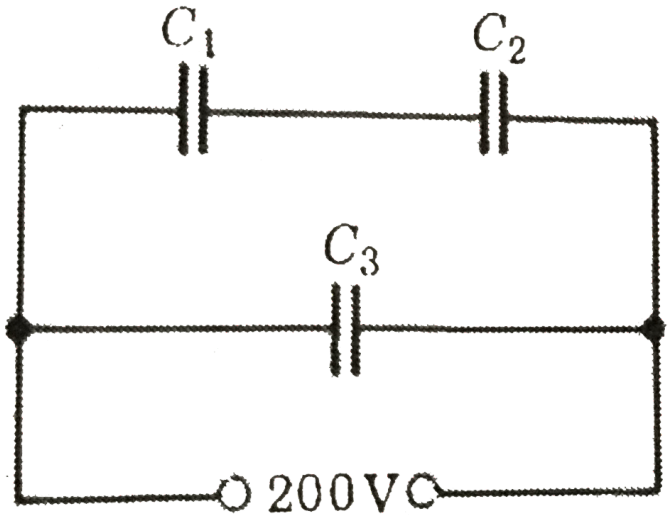
56.



In the network shown in figure. $C_1 = 2.0\mu F, C_2 = 6.0$ and $C_3 = 2.5\mu F$.

Determine (i) total capacitance, charge and energy of the system (ii) charges on separated capacitors (iii) potential differences across the separate capacitors.

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57. Two parallel plates, separated by 2 mm of air, have a capacitance of $3 \times 10^{-14} \mu F$ and are charged to a potential of 200 V. then without touching the plates, they are moved apart till the separation is 6 mm. (i) what is the

potential differene between the plates ? (ii) what is the change in energy?

A. 600 V, $6 \times 10^{-10} J$

B.

C.

D.

Answer:

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58. The radii of cahrged metallic spheres are 5 cm and 10 cm. both have a charge of 75 μC. Both the spheres are connected together with a conducting wirre. Calculate (i) the quantity of charge transferred through the wire (ii) the common potential of the spheres after connecting them.

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59. A parallel-plate capacitor having plate are $100cm^2$ and separation 1.0 mm holds a charge of $0.12\mu C$ when connected to a 120 V battery. Find the dielectric constant of the material filling the gap.

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60. Two parallel plate capacitors, each of capacitance `40 muF, are connected is series. The space between the plates of one capacitor

is filled with a dielectric material of dielectric constant K =4. Find the equivalent capacitance of the system.

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61. A parallel-plate capacitor of consists of 26 metal strips, each of $3cm \times 4cm$, separated by mica sheets of dielectric constant 6 and uniform thickness 0.2 mm. find the capacitance.

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62. A parallel-plate capacitor of capacity $0.5pF$ is to be constructed using paper sheets of thickness 0.04 mm as dielectric. Find how many circular metal foils of diameter 0.1m will have to be used. Take the dielectric constant of peper used as 4.

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63. A slab of material of dielectric constant K has the same area as the plates of a parallel

capacitor, but has a thickness $\left(\frac{3}{4}d\right)$, 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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64. Calculate the capacitance of a spherical capacitor consisting of two concentric spheres of radil 0.50m, 0.60m. The material filled in the space between the two spheres has a dielectric constant of 6.

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65. The insulated plates of a parallel plate capacitor has a charge density σ. Show that that the work done in changing the distance from d_1 to d_2 is

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