PHYSICS

BOOKS - MODERN PUBLICATION

CAPACITOR

Example

1. Assuming the earth to be a spherical conductor of radius 6400 km, calculate its caacitance. Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2 \hat{} -2$

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2. What is the area of the plates of a 2F parallel plate capacitor given that te separation between the plates is 0.5 cm ?

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3. In a parallel plate capacitor, the capacitance increases from $4\mu F$ to $80\mu F$ no introduicng a dielectric medium between the plates. What is the dielectric constant of the medium?

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4. The stratosphere acts as a conducting layer ofr the earth. If the stratosphere extends beyond 50 km from the surface

of earth, then calculate the capacitance of the spherical capacitor formed between stratosphere and earth's surface. Take radius of earth as 6,400 km.

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5. What is the effective capacitance of two conductors of capacitance $3\mu F$ and $4\mu F$, when connected in series

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6. What is the effective capacitance of two conductors of capacitance $3\mu F$ and $4\mu F$, when connected in parallel?

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7. A capacitor of capacitance $50\mu F$ is charged to a potential of 1,000 V. Calculate the energy stored in the capacitor.

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8. Can a metal sphere of radius 1 cm hold a charge of 1 C?

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9. Drops of same are charged at 220 V each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop.

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

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11. A parallel plate capacitor with air between the plates has a capacitance of 8 pF.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 5?

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

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13. A parallel plate capacitor a air between its plates having plate area of 6*10^-3 m^2 and separation between them 3 mm is connected to a 100 V battery. Explain what would happen when a 3 mm thick mica sheet (of dielectric constant = 6) were inserted between the plates, after the supply was disconnected.

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14. Calculate the capacitance of a spherical capacitor if the diameter of inner sphere is 0.2m and that of the outer sphere is 0.3m, the space between them being filled with a liquid having dielectric constant 20

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15. 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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16. Two capacitors of capacitance of $6\mu F$ and $12\mu F$ are connected in series with a battery. The voltage across the 6 muF capacitor is 2V. Compute the total battery voltage.

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17. Three capacitors of capacitance 5 4 and 3 μF respectively and connected with the first and second in series and iii in parallel with them find the capacitance of the combination

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18. The effective capacitances of two capcitros are $3\mu F$ and $16\mu F$, when they are connected in series and

parallel respectively. Compute the capacitance of each capacitor.

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19. You are given three capacitors each of capacitance $9\mu F$. In how many ways can they be combined? What will be the effective capacitance in each case?

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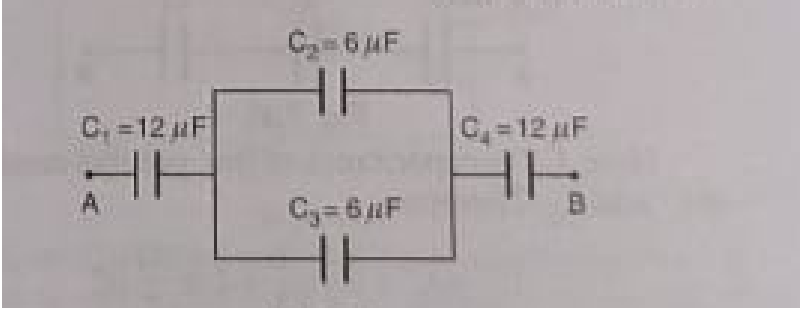
20. Find the resultant capacitance of the capacitors connected as shown in the figure.



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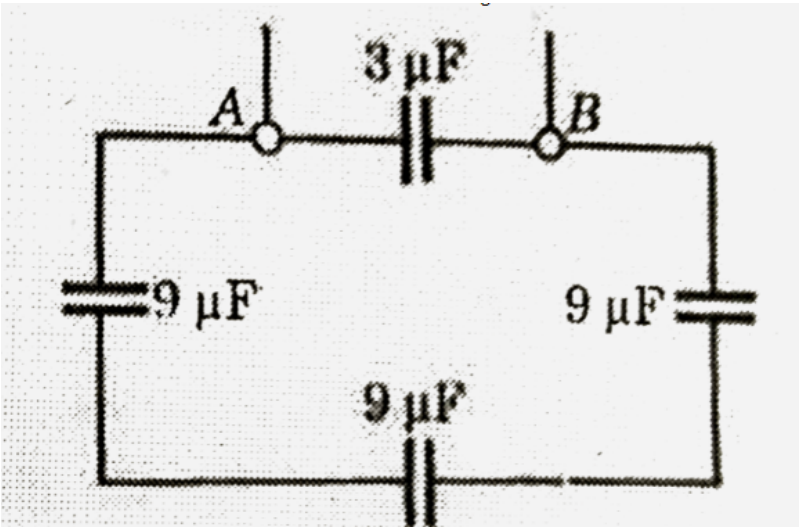
21. If $C_1 = 3pF$ and $C_2 = 2pF$, calculate the equivalent capacitance ofthe given network shown in the figure



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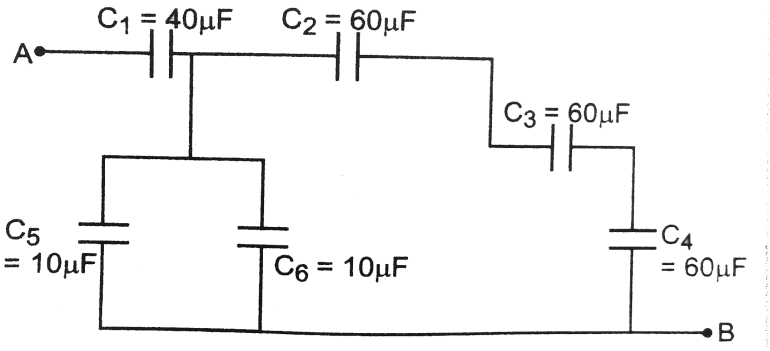
22. Find the equivalent capacitance of the combination of capacitons between the points A and B as shown in the figure. Also calcualte the total charge that flows in the circuit, when a 100 V battery is connected between the points A and B.



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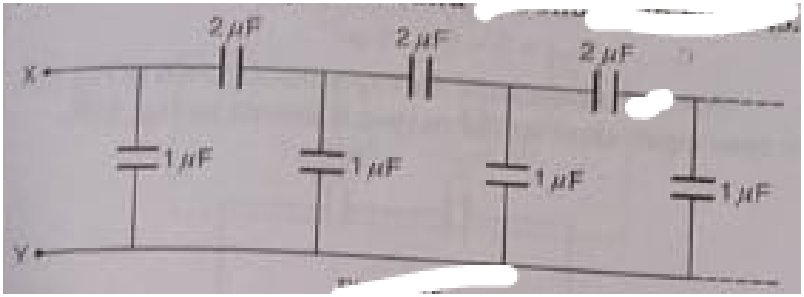
23. Find the capacitance of the infinite ladder between the points X and Y as shown in the figure.



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24. Find the effective capacitance between the terminals X and Y of the network shown in the figure

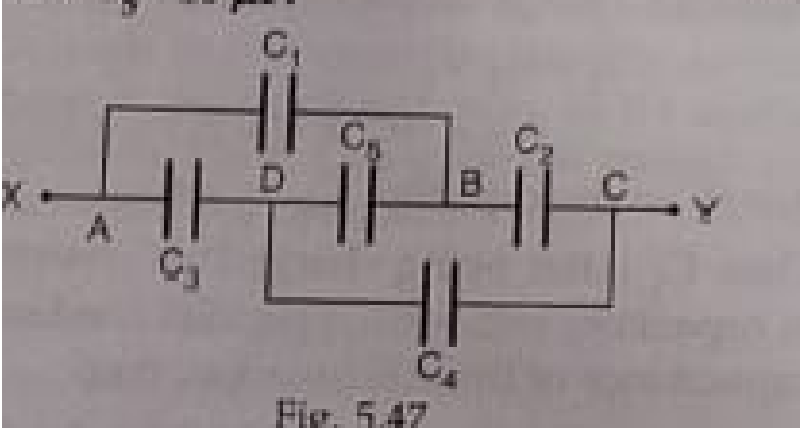

Fig. 5.47

Given that

$C_{!} = 5\mu F, _2 = 10\mu F, C_3 = 2\mu F, C_4 = 4\mu F$ and $C_5 = 10\mu F$

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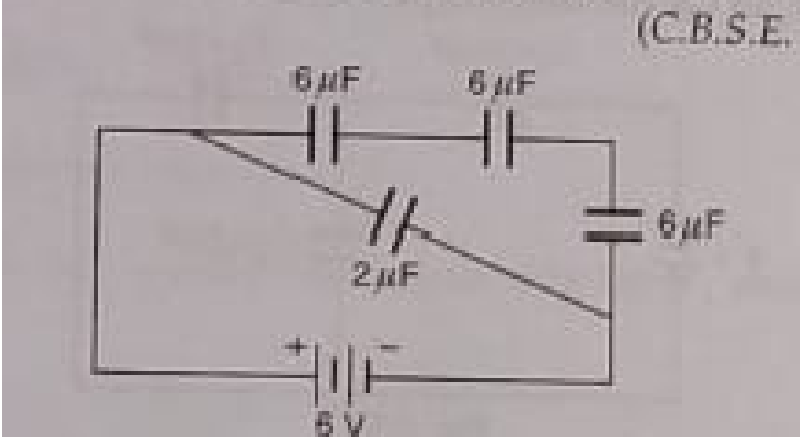
25. Four capacitors of value $6\mu F, 6\mu F, 6\mu F$ and $2\mu F$ are connected to a 6 V battery as shown in the fig



Determine the equivalent capacitance of the network

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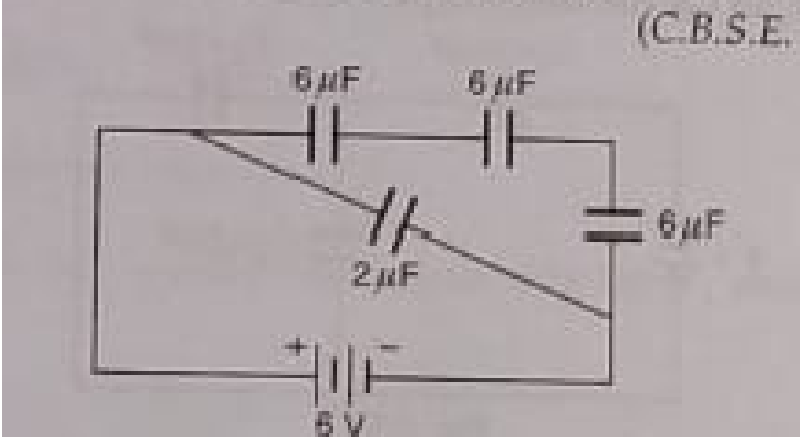
26. Four capacitors of value $6\mu F, 6\mu F, 6\mu F$ and $2\mu F$ are connected to a 6 V battery as shown in the fig



Determine the charge on each capacitor.

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27. Three capacitors C_1, C_2 and C_3 are connected to a battery of 6 V as shown in the figure

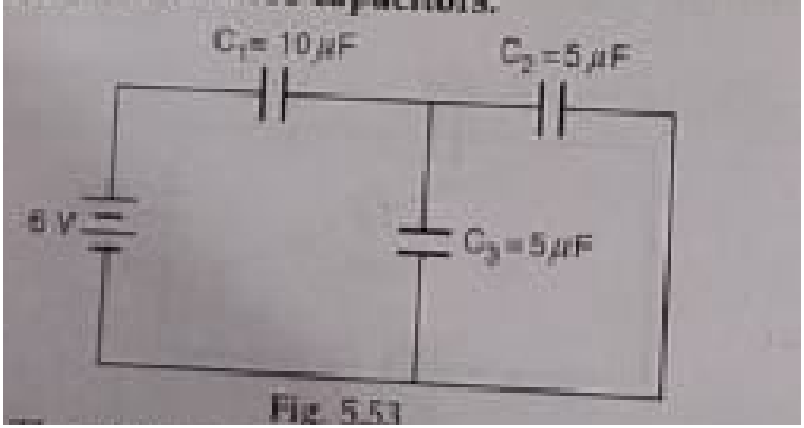

Fig. 5.53

find the charge on three capacitor

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28. A capacitor of $4\mu F$ is connected to 400 V supply. It is then disconnected and connected to an uncharged capacitor of $2\mu F$. Calculate the comon potential after the capacitors are connected together.

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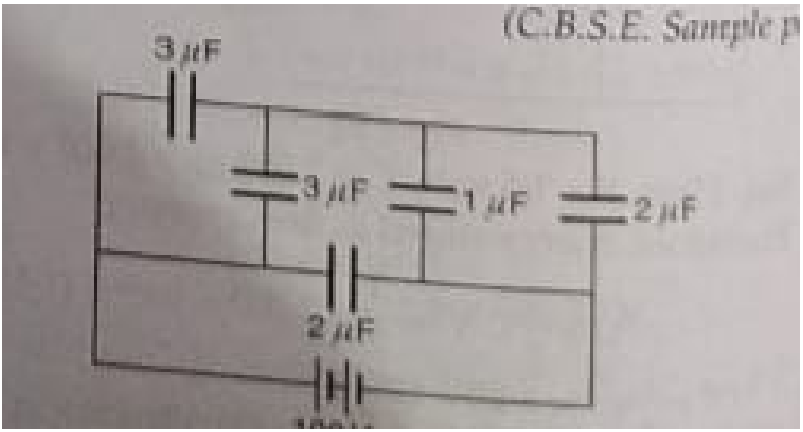
29. Show in the figure



A network of five capacitors connected to a 100 V supply. Calculate the total charge and energy stored in the network.

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30. A $10\mu F$ capacitors is charged by a 30 V d.c supply and then connected across an uncharged $50\mu F$ capacitor. Calculate (i) the final potential diff. across the combinition

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31. A $10\mu F$ capacitors is charged by a 30 V d.c supply and then connected across an uncharged $50\mu F$ capacitor. (ii) initial and final energies.

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32. A spark passes though air when the potential gradient is 3×10^6volts per metre what must be the radious of an isoated metal sphere which can be changed to a potentiial of 3 million voilts before there are sparks in the air?

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33. A radioactive source, in the form of a metallic sphere of radius $10^{-2}m$ emits β-particles at the rate of 5×10^{10} particles per second. The source is electrically insulated. How long will it take for its potential to be raised by 2V, assuming that 40% of the emittedβ-particles escape the source.

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34. 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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35. A capacitor of capacitance$C_1 = 1.0\mu F$ carrying initially a voltage V = 300 V is connected in parallel with an uncharged capacitor of capacitance $C_2 = 2.0\mu F$. Find the increment of the electric energy of this system by the moment equilibrium is reached. Explain the result obtained.

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36. A $28\mu F$ capacitor is charged to 100 V and another $2\mu F$ capacitor to 200 V. Then, they are connected in parallel. Determine the total initial and final energies. Account for the difference in two values.

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37. The capacitance of a variable radio capacitor can be cahanged from 50pF to 200pF by turning the dial from 0° to 180°. With the dial set at 180°, the capacitor is connected to a 400V battery. After cahrging, the capacitor is disconnected from the battery and dial is tuned at 0°?

(a) what is the p.d. across the capacitor when dial reads 0°?

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38. The capacitance of a variable radio capacitor can be cahanged from 50pF to 200pF by turning the dial from 0° to 180°. With the dial set at 180°, the capacitor is connected to a 400V battery. After cahrging, the capacitor is

disconnected from the battery and dial is tuned at 0° ?

(b) how much work is required to turn the dial, if friction is naglected?

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39. 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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40. 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 $0.04 m^2$ and $0.02 m^2$ 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.

A is then charged to a potential difference of 110V. Calculate the capacitance of A and the energy stored in it.

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41. 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 $0.04 m^2$ and $0.02 m^2$ 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.

A is then charged to a potential difference of 110V. Calculate the capacitance of A and the energy stored in it.

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42. 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 $0.04 m^2$ and $0.02 m^2$ 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.

A is then charged to a potential difference of 110V. Calculate the capacitance of A and the energy stored in it.

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43. Is there any electric field inside a charged conductor?

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44. Why should electrostatic field be zero inside.

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45. Why ust electrostatic field be noral to the surface at every point of a carged conductor.

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46. Distinguish between polar and non-polar dielectrics.

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47. What do you mean by dielectric polarisation?

Watch Video Solution

48. Give definition of polarisation.

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49. What are non-polar molecules and how are they polarised?

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50. What is a dielectric?

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51. How does electric field inside a dielectric decreases when it is placed in an external electric field?

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52. The dielectric constant of a conductor can be taken to be infinitely large, infinitely small or optimum. Which of the three alternatives is correct?

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53. Write down the relation between dielectric constant and electric susceptibility.

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54. what is the meant by dielectric strength of a medium?

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55. Name the physical quantity, whose unit is CV^{-1}. Is it scalar or vector?

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56. What is meant by capacitanc? Give its SI unit.

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57. Define capacitance, give its S.I unit.

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58. What is one picofarad?

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59. Name the physical quantity, whose SI unit is coulomb volt^-1

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60. Can we give any desired amount of charge to a capacitor?

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61. Why is a parallel plate capacitor named so?

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62. On what factors does the capacitance of a parallel plate capacitor with dielectric depend?

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63. Define dielectric constant of a medium in terms of capacitance of a capacitor.

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64. On inserting a dielectric between the plates of a capacitor, its capacitance is found to increase 5 times. What is the relative permittivity of the dielectric?

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65. An air capacitor is given a charge of $2\mu C$ raising its potential to 200 V. If on inserting a dielectric constant its

potential falls to 50V, what is the dielectric constant of the medium?

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66. Three capacitors, each of capacitance $2\mu F$, are connected in series. Find the resultant capacitance in farad.

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67. Three capacitors each of capacitance of $2\mu F$ are Connected in parallel across 6V battery. Find the charge in each capacitor.

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68. How much work must be done to charge a $24uF$ capacitor, when the potential difference between the plates is 500 V?

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

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70. What should be the capacitance of a capacitor capable of storing one joule of energy, when used with a 100 V d.c. supply?

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71. In what form is the energy stored in a charged capacitor?

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72. Why the Van de Graaff generator is enclosed inside an earth connected steel tank filled with air under pressure?

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73. How the leakage of charge can be minimised in Van de Graaff generator?

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74. How does a dielectric differ from an insulator?

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75. Two spheres of the same radii, one solid and other hollow are charged to the same potential, which one has greater charge?

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76. A metal of radius of 1 cm can not hold a charge of 1 coulomb. Why?

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77. Why is not possible to make a spherical conductor of capacity one farad ? Explain.

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78. N smalll drops of same size are changed to V volt each. They coalesec to form a bigger drop. Calculate the potential of the bigger drop.

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79. An uncharged insultated conductor A is brought near a charged insulated conductor B. What happens to charge and potential of B?

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80. In a parallel plate capacitor, how is the capacitance affected, when without changing the charge, the distance between the plates is doubled.

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81. In a parallel plate capacitor, how is the capacitance affected, when without changing the charge,area of the plate is halved.

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82. The graphs shows the variation of voltage V across the plates of two capacitors A and B versus increase of charge Q stored on them. Which of the two capacitors has higher capacitance? Give reason for your answer.

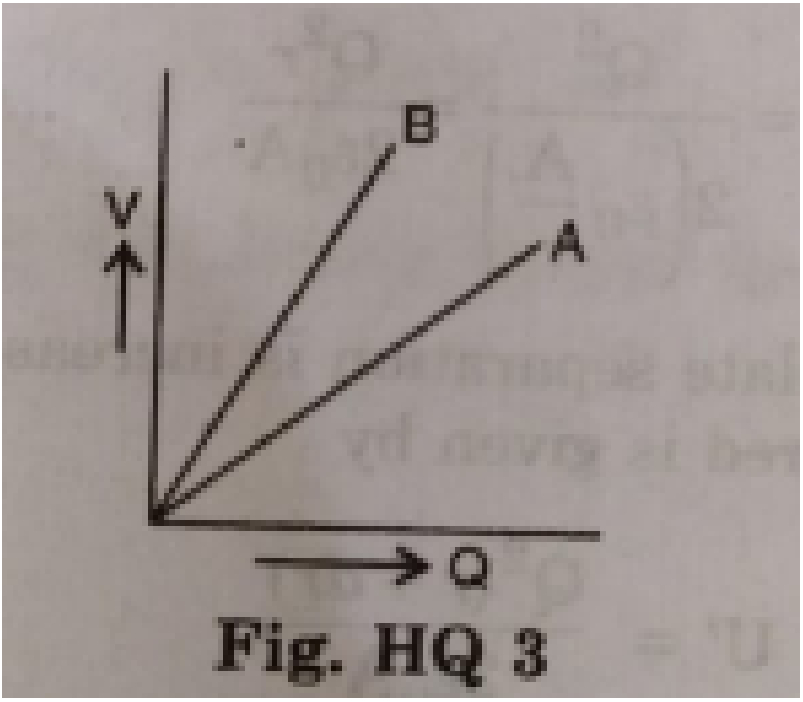

Fig. HQ 3

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83. What is function of dielectric in capacitor?

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84. What is effect of dielectric on the capacitance of a capacitor?

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85. For a given potential difference, does a capacitor store more or less charge with a dielectric than it does without a dielectric constant (K) is inserted between the two plates of capacitor. What is the new of charge stored in the capacitor?

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86. Three capacitors of equal capacitance, when connected in series, have a net capacitance of C_1 and when connected in parallel, have a capacitance of C_2 what will be the value of C_1 / C_2?

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87. Two capacitors of capacitance C_1 and C_2 and joined in series and this combination is joined in parallel with a capacitor of capacitance C_3 find the resultant capacitance.

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88. Two capacitors of capacitors $5\mu F$ and $10\mu F$ are charged to 1 volt and 13 volt respectively. What is the common potential, when they are connected in parallel.?

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89. Capacitors P,Q,R each have capacitance C.A battery can charge the capacitor P to a potential difference V,If after charging P, the battery is disconnected from it n the charged capacitor P is connected in the following separate cases to Q n R . 1 to Q in parallel,2 to R in series.Then what will be the potential difference between the plates of P in these two cases?

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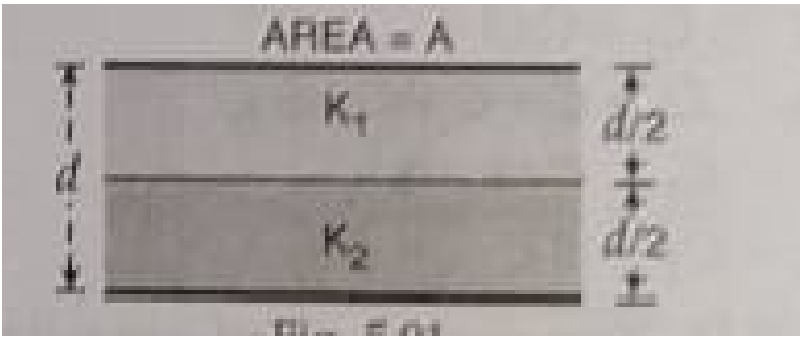
90. Two dielectric slabs of dielectric constant K_1 and K_2 are filled in between the two plates, each of area A, of the parallel plate capacitor as shown in the figure.



What will be the capacitance of the capacitor

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91. Find the ratio of the potential difference that must be applied across the parallel. and series combination of two capacitors C 1 and C 2 with their capacitances in the ratio

1:2 so that the energy stored in the two cases becomes the same.

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92. Find the ratio of the potential difference that must be applied across the parallel. and series combination of two capacitors C_1 and C_2 with their capacitances in the ratio 1:2 so that the energy stored in the two cases becomes the same.

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93. Prove that the total energy stored in a series combination of capacitors is equal to the sum of energies

stored in the individiual capacitors.

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94. Prove that the total energy stored in a parallel combination of capacitors is equal to the sum of energies stored in the individiual capacitors.

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95. If n capacitors are connected in parallel to a V volt source, then total energy of the system is:

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96. 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 in plates were to be decreased by 10% ?

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97. 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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98. A parallel plate capacitor of plate area A and plate separation d is charged to 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 magnitude of charge on each plate, the electric field between the plates (after the slab is inserted), and work done on the system, in question, in the process of inserting the slab,

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99. If a parallel plate capacitor of capacitance C is kept connected to a supply voltage V and then to just fill the space, dielectric slab is inserted between the plates. What

will be the change in the capacitance the charge, the potential difference, the electric field and the energy stored?

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100. A parallel plate capacitor of capacitance C is connected to a battery and is charged to a potential difference V. Another capacitor of capacitance 2C is ismilarly charged to a potential difference 2V. The charging battery is now disconnected and the capacitors are connected in parallel to each other in such a way that the poistive terminal of one is connected to the negative terminal of the other. The final energy of the configuration is

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101. A parallel plate capacitor is charged to a potential difference V by a d.c. source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reason how the following will change.

electric field between the plates

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102. A parallel plate capacitor is charged to a potential difference V by a d.c. source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reason how the following will change.

capacitance

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103. A parallel plate capacitor is charged to a potential difference V by a d.c. source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reason how the following will change.

energy stored in the capacitor.

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104. Is there any kind of material that when inserted between the plates of a capacitor reduces its capacitance.?

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105. Is there any kind of material that when inserted between the plates of a capacitor reduces its capacitance.?

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106. Why should circuits containing capacitor be handled cautiously, even when there is no current?

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107. State the principle of Van de Graaff generator.

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108. With the help of labelled diagram of Van-de-Graaff generator. Explain its principle, construction and working of van-de-Graaff generator.

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109. What limits maximum potential to which the hollow sphere in Van de Graaff generator can be raised?

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110. Two isolated metallic solid spheres of radii R and 2R are charged, such that both of these have same charge density. The spheres are located far away from each other and

connected by a thin conducting wire. Find the new charge density on the bigger sphere.

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111. Two identical metal plates are given poistive charges Q_1 and Q_2 Q2 is smaller than Q1 respectively. If they are now brought close together to form a parallel plate capacitor with capacitance C, the potencial difference between the plates?

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112. One use of a capacitor is for the storage of electrical energy. Briefly explain how a capacitor stores energy.

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113. A solid metal sphere of radius r has charge +Q. This charge is one the surface of the sphere but it may be considered to be a point charge at its centre. The sphere has radius 36 cm. Determine, for this sphere the capaciance the charge requried to raise the potential of the sphere form zero to $7.0 \times 10^5 V$.

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114. A solid metal sphere of radius r has charge +Q. This charge is one the surface of the sphere but it may be considered to be a point charge at its centre. Suggest, why

your calculation in (a) for the metal sphere would not apply to a plastic sphere.

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115. A solid metal sphere of radius r has charge +Q. The sphere has radius 36 cm This charge is one the surface of the sphere but it may be considered to be a point charge at its centre. A spark suddenly connects the metal sphere in to the earth, causing the potnetial of the sphere to be reduced from $7.0 \times 10^5 V \rightarrow 2.5 \times 10^5 V$. Calculate the energy dissipated in the spark.

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116. Distinguish between polar and non-polar dielectrics.

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117. What do you understand by polarisation of dielectric? Define dielectric constant in terms of electric fields.

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118. Explain, why is meant by dielectric polarisation. Hence establish the relation $K = 1 + X$

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119. What are polar and non-polar covalent bonds ?

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120. What is meant by a dielectric ? Explain how it reduces the electric field between two oppositely charged plates, if the space between them be filled with it?

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121. Find an expression for the capacity of a metallic sphere.

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122. What do you mena by electrics capacitance? Define its S.I. unit. Show that capacitance of spherical conductor is directly proportional to its radius.

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123. Show that the capacitance of an insulated spherical conductor is directly proportional to the radius of the spherical conductor.

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124. What do you mena by electrics capacitance? Define its S.I. unit. Show that capacitance of spherical conductor is

directly proportional to its radius.

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125. What is capacitor? Explain its principle.

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126. A capacitor

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127. What are the factors on which capacitance of a parallel plate capacitor depends? Also give the formula.

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128. Derive an expression for capacitance of a parallel plate capacitor.

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129. What is a parallel plate capacitor? Derive an expression for the capacitance of a parallel plate capacitor?

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130. What is a parallel plate capacitor? Derive an expression for the capacitance of a parallel plate capacitor?

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131. Derive an expression for the capacitance of a parallel plate capacitor with dielectric as the medium between the plates.

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132. Show that in parallel plate capacitor, if the medium between the plates of the capacitor is filled with insultaing substance of dielectric contant k, its capacitance increases.

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

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134. What happens to the capacitance of a capacitor, when a dielectric is introduced between its plates? Explain qualitatively.

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135. Derive an expression for the capacitance of a parallel plate capacitor. How is the capacitance affected when a conducting slab is introduced in-between its plates? Explain

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136. Explain why the capacitance of capacitor increases when dieslectric slab is inserted between plates of the capacitor.

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137. Derive a relation for the capacitance of a parallel plate capacitor having plate separation d, when a dielectric slab

of thickness t is placed between the plates.

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138. A conducting slab of thickness t is introduced without touching between the plates of a parallel plate capacitor, separated by a distance d(t

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139. Derive a relation for the capacitance of a parallel plate capacitor having plate separation d, when a dielectric slab of thickness t is placed between the plates.

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140. Derive an expression for the capacitance of a parallel plate capacitor. How is the capacitance affected when a conducting slab is introduced in-between its plates? Explain

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141. What happens to the capacitance of the capacitor, when the conducting slab wholly fills the space between the two plates? Justify the resutl.

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142. What is the resultant capacitance, when a number of capacitors are connected in series? Derive the expression for it.

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143. Calculate the total capacitance of a number of capacitors connected in parallel.

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144. Three capacitors C_1, C_2, C_3 are Connected in series. Derive an expression for the equivalent capacitance.

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145. Three capacitors of capacitance C_1, C_2 and C_3 are connected in parallel. Derive an expression for the

equivalent capacitance of the combination.

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146. Show that the effective capacitance C of a series combination of three capacitors of capactiances C_1, C_2 and C_3 is given by $C = \frac{C_1C_2C_3}{C_1C_2 + C_3 + C_3C_1}$

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147. Write expression for the capacitance of the series combination of n capacitors.

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148. Derive an expression for net capacitance of three capacitors in series Combination.

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149. A capactiro of capacitance C is being charged by connecting it across a d.c. source along with an ammeter. Will the ammeter show a momentary deflection during the process of charging? If so , how would you explain the momentary deflextion and the resulting continuity of current int he circuit? Write the expression for current inside the capcitor.

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150. Prove that the total energy stored in a parallel combination of capacitors is equal to the sum of energies stored in the individiual capacitors.

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151. Prove that energy stored in a parallel plate capacitor can be expressed by the relation $\left(\frac{Q^2}{2}C\right)$.

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152. Calculate the energy stored in a capacitor?

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153. Calculate the energy stored in a capacitor?

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154. Find an expression for the energy of a charged capacitor.

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155. Give the expression for the energy stored in a capacitor and an indicator.

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156. Find an expression for the energy of a charged capacitor.

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157. Obtain the expression for the energy stored per unit volume in a charged parallel plate capacitor.

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158. Calculate the energy stored in a capacitor?

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159. Derive an expression for energy density of a parallel plate capacitor.

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

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161. What is capacitor? Explain its principle.

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162. Derive an expression for capacitance of a parallel plate capacitor.

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163. Derive an expression for capacitance of a parallel plate capacitor.

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164. Explain how does capacity of parallel plate capacitor change on introducing a conducting slab?

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165. On what factors does the capacitance of a parallel plate capacitor with dielectric depend?

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166. What is spherical capacitor?Derive expression for its capacitance.

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167. Derive an expression for capacitance of a parallel plate capacitor.

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168. Derive an expression for net capacitance of three capacitors in series Combination.

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169. Derive expression for the total capcitane, when three capacitors of capactiances C_1, C_2 and C_3 are connected in parallel.

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170. Define capacitance of a capacitor?

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171. How does the total energy stored by the capacitor change, when the medium of air is replaced by a medium of dielectric constnat K? Explain.

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172. Deduce an expresison for the electrostatic energy stored in a capacitor of capacitance C and having charge Q. How will the energy stored and the electric field inside the capacitor be affected, when it is completely filled with a material of dielectric constant k?

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173. Give the expression for the energy stored in a capacitor and an indicator.

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174. Give the expression for the energy stored in a capacitor and an indicator.

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175. 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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176. How will the energy stored in a fully charged capacitor chanege when the separation between the plates is doubled and the dielectric medium of constant 4 is introduced between the plates ?

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177. Derive an expression for the capacitance of a parallel plate capacitor with dielectric as the medium between the plates.

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178. Derive an expression for capacitance of a parallel plate capacitor.

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179. Prove that if a conducting slab wholly fills the space between the plates, then the capacitance of a parallel plate capacitor is infinity.

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180. Derive a relation for the capacitance of a parallel plate capacitor having plate separation d, when a dielectric slab

of thickness t is placed between the plates.

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181. When an expressions for the loss of electric energy on the sharing of charge between two conductors. In what form the electric energy is dissipated ?

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182. With the help of labelled diagram of Van-de-Graaff generator. Explain its principle, construction and working of van-de-Graaff generator.

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183. State the principle of Van de Graaff generator.

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184. With the help of labelled diagram of Van-de-Graaff generator. Explain its principle, construction and working of van-de-Graaff generator.

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185. State the principle of Van de Graaff generator.

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186. State the principle of Van de Graaff generator.

Watch Video Solution

187. What limits maximum potential to which the hollow sphere in Van de Graaff generator can be raised?

Watch Video Solution

188. With the help of labelled diagram of Van-de-Graaff generator. Explain its principle, construction and working of van-de-Graaff generator.

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189. Explain with the help of labelled diagram, the construction, working and theory of ac generator. Obtain an expression for induced e.m.f.

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190. How the leakage of charge can be minimised in Van de Graaff generator?

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191. With the help of labelled diagram of Van-de-Graaff generator. Explain its principle, construction and working of van-de-Graaff generator.

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192. Explain the principle of a device that can build up high voltages of the order of a few million volts.Draw a schematic diagram and explain the working of this device. Is there any restriction on the upper limit of the high voltages set up in this machine? Explain.

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193. A small sphere of radius a carrying a positive charge q, is placed concentrically inside a larger hollowconducting sheli of radius b (bgt a). This outer shell has charge Q on it. Show that if these spheres are connected by a conducting wire, charge will always flow from the inner sphere to the

outer sphuisirrespective of the magnitude of the two charges.

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194. When electrons equal to Avogadro number are transferred from one conductor to another, a potential difference of $10^6 V$appears between them. Calculate the capacitance of the system of two conductors.

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195. A charged spherical conductor has a surface density of $0 - 07 C cm^{-2}$. When the charge is increased by 4.4C, the

surface density changes by $0.084 C cm^{-2}$. Find the initial charge and capacitance of the spherical conductor.

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196. Drops of same are charged at 220 V each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop.

Watch Video Solution

197. Drops of same are charged at 220 V each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop.

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198. Twenty seven spherical droplets of radius 3 mm and each carrying 10^{-12} of charge are combined to form a bigger drop. Find the capacitance of the bigger drop.

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199. N smalll drops of same size are changed to V volt each. They coalesec to form a bigger drop. Calculate the potential of the bigger drop.

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200. The radii of two charged metallic sphers are 5 cm and 10 cm, Each has a charge of $75\mu C$. They are connected by a

conducting wire. Calculate common potential of the spheres after connecting.

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201. The radii of two charged metallic sphers are 5 cm and 10 cm, Each has a charge of $75\mu C$. They are connected by a conducting wire. Calculate amount of charge trnasferred.

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202. At what distance should the two plates each of surface are $0.2m \times 0.1m$ of an air capacitor be placed in order to have the same capacitance as a spherical conductor of radius 0-5 m?

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203. An air capacitor has plates of 6 cm diameter. At what distance should the plates be placed so as to have the same capacitance as a sphere of diameter of 90 cm?

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204. A parallel plate capacitor has each plate of 0.06 m diameter separated by 0.05 cm of air. What is the capacitance of the capacitor? What would be the radius of a sphere having the same caapcitance?

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205. A parallel plate capacitor has two plates of sides 0.055 m and 0.04 m of air. Their distance apart is 0.7 mm. The dielectric constant of the medium in between is 4. Find the capacitance of the capacitor.

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206. A parallel plate capacitor thas plates of are $0.02m^2$ and separation between the plates 1 mm. What potential difference will be developed, if a charge of 1nC is given to the capacitor ? If the plate separation is now increased to 2 mm, what will be the new potential difference?

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207. When a slab of inslulating material 4 mm thick is inroduced between the plates of a parallel plate capacitor, it is found that the distance between the plates has to be increased by 3.2 mm to restore the capacity to its original value. Calculate dielectric constant of the material.

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208. 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. What is the potential of the inner sphere?

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209. 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. What is the potential of the inner sphere?

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210. The inner and outer radii of a coaxial cable are 0.1 mm and 0.6 mm respectivley.If the core material has dielectric constant 12, calculate the capacitance per metre of the cable.

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211. Two spheres of radii 2cm and 7 cm are connected together. What is the total capacitance of thecombination?

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212. Three capacitors of capacitances $2\mu F, 3\mu F$ and $4\mu F$ are connected in sereis. What is the total capacitance of the combination?

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213. Three capacitors of capacitances 2 pF, 3 pF and 4 pF are connected in parallel. What is the total capacitance of the

combination?

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214. The capacitor of three are in the ratio 1:2:3. Their equivalent capacitance in parallel is grater than their equivalent capacitance in series by $60/11\mu F$. Calculate their individual capacitances.

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215. Three capacitors of capacitances 1,3 and 6 microfarad and connected so that the second and the thrid are in series and the first is in parallel with them. Calculate the capacitance of the combination.

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216. Three capacitors, each of cpacitance $6\mu F$ are connected together in sereis and are also connected in series with three capacitros of values $2\mu F, 4\mu F$ and $2\mu F$, which are grouped together in parallel. Calculate the total combined capacitance.

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217. Two capacitors A and B of capacitance $4\mu f$ and $2\mu F$ respectivley are connected in series with a battery of e.m.f. 100 V. The connections are broken and the like terminanls of the capacitors are then joined. Find the final charge on each capacitor.

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218. A conductor has a charge of $0.5\mu C$ and at potential of 20 v. Another uncharged conductor, whose capacity is $0.015\mu F$ is momentarily connected to the first and then separated. Calculate the charges carried by each after contact and what is the value of the common potential.

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219. An air capacitor has an area of $1,000cm^2$ and the two plates are 4 mm apart. It is connected in series with another capacitor having a plate ares of $20cm^2$, the plates being separated by a dielectric 0.1 mm thick having dielectric constant o 2.5 . If the potential difference across the second

capacitor is 100 V, find the voltage applied across the series combination.

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220. A 900 pF (PiCo farad) capacitor is charged by 100 V (Volt) battery How much electrostatic energy is stored by the capacitor ?

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221. Two insulated spherical conductors of radii 5.0 cm and 10.0 cm are charged to potentials of 600 V and 300 V respectively. Calculate the total energy of the system.

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222. A capacitor charged form a 50 V d.c. supply is found to have a charge of $10\mu C$. What is the capacitance of the capacitor and how much energy is stored in it?

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223. A capacitor with a capacitane of $50\mu F$ is connected to 200V, if the distance between its plates is halved, what will be the potential between the plates and what will be the change in energy stored in it?

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224. If the distance between the plates of a parallel plate $200\mu F$ capacitor charged to 400 V is halved. Calculate the change in energy stored in it.

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225. If the distance between the plates of a parallel plate $200\mu F$ capacitor charged to 400 V is halved. Calculate the change in energy stored in it.

Watch Video Solution

226. The plates of a parallel plate capacitor are $50m^2$ and one mm apart apart what is tis capacitance?

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227. The plates of a parallel plate capacitor are $50m^2$ and one mm apart apart when it is connected to a 45 V battery, what is the charge on either plate and the energy stored in it?

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228. The plates of a parallel plate capacitor are $50m^2$ and one mm apart apart when it is connected to a 45 V battery what is the electric field between the plates?

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229. A 400 pf capacitor is charged by a 100 V battery. How much electrostaic energy is stored by the capacitor ? The capacitor is disconnected from the battery and connected to antoher 400 pF capacitor. What is the electrostatic energy stored by the system?

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230. A capacitor carring a charge equal to $2\mu C$ up to a potential 100 V is put into contact with another capacitor carrying a charge of 1.5μC up to a potential of 60 V. What is the resulting potential, the charge carried by each, the total energy before and after connection?

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231. Two capacitors are in parallel and the energy strored is 45 J, when the combination is raised to a potential of 3,000 V. With the same two capacitors in series, the energy is 4.05 J for the same potential. What are their capacitannces?

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232. A variable capacitor is kept connected to a 10 V battery, if the capacitance of the capcitor is changed from $7\mu F$ to $3\mu F$, what is the change in the energy?

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

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234. A $5\mu F$ capacitor is charged fully by a 220 V supply. It is then disconnected from the supply and is connected in series to another uncharged $2.5\mu F$capacitor . If the energy change during the charge redistribution is X//100 J` Find the value of X to the nearest interger.

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235. 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 lost in the form of heat and electromagnetic radiation?

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236. Two capacitors of 25 mu F and 100 mu F are connected in series to a source of 120 V. Keeping their charges uncharged, they are separated and connected in parallel to eachother. Find out

(i) pot. Diff. between the plates of each capacitor.

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237. Two capacitors of 25 mu F and 100 mu F are connected in series to a source of 120 V. Keeping their charges uncharged, they are separated and connected in parallel to eachother. Find out

(ii) energy loss in the process.

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238. A 400 pf capacitor is charged by a 100 V battery. How much electrostaic energy is stored by the capacitor ? The capacitor is disconnected from the battery and connected to antoher 400 pF capacitor. What is the electrostatic energy stored by the system?

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239. An air capacitor of capacitance $2\mu F$ is charged to a potential 200 V. What is the energy stored in it? If a medium of dielectric constant 2 is inserted between its plates and the potentials is raised again to the same value, what is the amount of energy, it would store?

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240. A parallel capacitor has capacitance $20\mu F$. A potential difference of 220 V is applied across it. Calculate the charge on the plates and energy stored in the capacitor. If a dieletric slab of dielectric constant 5 is introduced between its plates, calculate the new value of potential difference and the energy stored.

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241. A parallel plate capacitor with plate separation 5 mm is charged by a battery. It is found that on introducing a mica sheet 2 mm thick, while keeping the battery connections intact, the capactor draws 25% more charge from the battery than before. Find the dielectric constant of mica.

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242. A parallel plate capacitor a air between its plates having plate area of 6*10^-3 m^2 and separation between them 3 mm is connected to a 100 V battery. Explain what would happen when a 3 mm thick mica sheet (of dielectric

constant = 6) were inserted between the plates, while the voltage supply remained connected.

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243. A parallel plate capacitor a air between its plates having plate area of 6*10^-3 m^2 and separation between them 3 mm is connected to a 100 V battery. Explain what would happen when a 3 mm thick mica sheet (of dielectric constant = 6) were inserted between the plates, after the supply was disconnected.

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244. On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved and a dielectric medium of k = 10 is introduced between the plates, without disconnectign the d.c. source. Explain, using the suitable expressions, how the capacitance

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245. On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved and a dielectric medium of k = 10 is introduced between the plates, without disconnectign the d.c. source. Explain, using the suitable expressions, how the electric field

Watch Video Solution

246. On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved and a dielectric medium of k = 10 is introduced between the plates, without disconnectign the d.c. source. Explain, using the suitable expressions, how the energy density of the capacity of change.

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247. A parallel plate capacitor has a capacitance of $2\mu F$. A slab of dielectric constant 5 is inserted between the plates and the capaitor is charged to 100 V and then isolated. What is the new potential difference, if the dielectric slab is removed?

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248. A parallel plate capacitor has a capacitance of $2\mu F$. A slab of dielectric constant 5 is inserted between the plates and the capaitor is charged to 100 V and then isolated. How much work is required to remove the dielectric slab?

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249. In a Van de Graaff type generator a spherical metal shell is to be a $15 \times 10^6 V$ electrode. The dielectric strength of the gas surrounding the electrode is $5 \times 10^7 Vm^{-1}$. What is the minimum radius of the spherical shell required? (You will learn from this exercise why one cannot build an

electrostatic generator using a very small shell which requires a small charge to acquire a high potential.)

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250. Find the capacitance of a system of three parallel plates each of area A $metres^2$ separated by distane d_1 and d_2 metre respectively. The space between them is filled with dielectris of relative constants ε_1 and ε_2. The permittivity of free space is ε 0 The equivalent capacitance of the system is:

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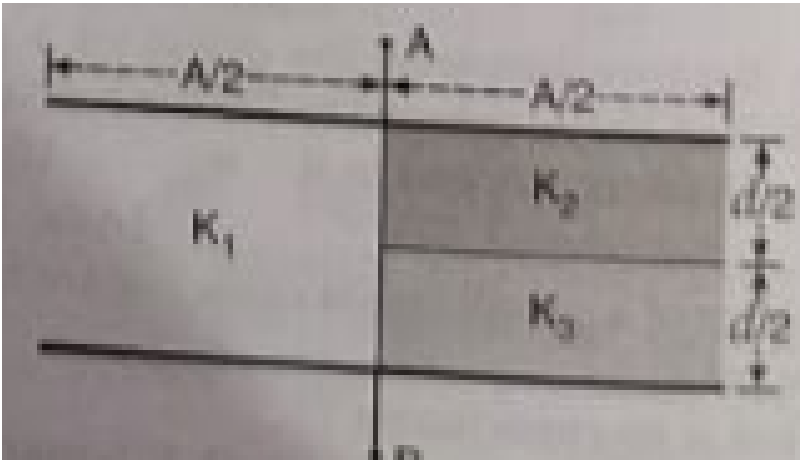
251. A parallel plate capacitor is constructed using three different dielectric materials as show in the figure



The parallel plates across which a potential difference is applied are of area A $= 1cm^2$ and are separated by a distance d = 2 mm. If $k_1 = 4, K_2 = 2, k_3 = 6$, find the capacitance across the points A and B.

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252. Find the capacitance of a system of three parallel plates each of area A $metres^2$ separated by distane d_1 and d_2 metre respectively. The space between them is filled with dielectris of relative constants ε_1 and ε_2. The permittivity of free space is ε 0 The equivalent capacitance of the system is:

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253. The radii of two charged metallic sphers are 5 cm and 10 cm, Each has a charge of $75\mu C$. They are connected by a conducting wire. Calculate amount of charge trnasferred.

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254. At what distance should the two plates each of surface are $0.2m \times 0.1m$ of an air capacitor be placed in order to have the same capacitance as a spherical conductor of radius 0-5 m?

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255. An air capacitor has plates of 6 cm diameter. At what distance should the plates be placed so as to have the same capacitance as a sphere of diameter of 90 cm?

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256. A parallel plate capacitor has each plate of 0.06 m diameter separated by 0.05 cm of air. What is the

capacitance of the capacitor? What would be the radius of a sphere having the same caapcitance?

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257. A parallel plate capacitor has two plates of sides 0.055 m and 0.04 m of air. Their distance apart is 0.7 mm. The dielectric constant of the medium in between is 4. Find the capacitance of the capacitor.

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258. A parallel plate capacitor thas plates of are $0.02m^2$ and separation between the plates 1 mm. What potential difference will be developed, if a charge of 1nC is given to

the capacitor ? If the plate separation is now increased to 2 mm, what will be the new potential difference?

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259. When a slab of inslulating material 4 mm thick is inroduced between the plates of a parallel plate capacitor, it is found that the distance between the plates has to be increased by 3.2 mm to restore the capacity to its original value. Calculate dielectric constant of the material.

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260. A spherical capacitor has an inner sphere of radius 10 cm and outer sphere of radius 12 cm . The outer sphere is

earthed and the inner sphere is given a charge of 5 mu C . Find its capacitance.

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261. A spherical capacitor has an outer sphere of radius 0.15m and the inner sphere of diameter 0.2m The outer sphere is earthed and the inner shere is given charge of 6 muC. The space between the concentric spheres is filled with a material of dielectric constant 6. Calculate capacitacne and potential of inner sphere.

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262. The inner and outer radii of a coaxial cable are 0.1 mm and 0.6 mm respectivley.If the core material has dielectric constant 12, calculate the capacitance per metre of the cable.

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