PHYSICS

BOOKS - CHETANA PUBLICATION

Electrostatics

Example

1. What are conservative forces,

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2. Define:- Linear charge density

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3. Define:- Surface charge density

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4. Define:- Volume charge density

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5. What is Gauss' law and what is a Gaussian surface?

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6. Two charge of magnitudes - 4Q and + 2Q are located at points (2a, 0) and (5a, 0) respectively. What is the electric flux due to these charges through a sphere of radius 4a with its centre at the origin?

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7. A spherical Gaussian surface encloses a charge of $17.7 \times 10^{-8} C$:- Calculate the electric flux passing though the surface.

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8. A spherical Gaussian surface encloses a charge of $17.7 \times 10^{-8} C$:- If the radius of Gaussian surface is doubled, how would the flux change?

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9. Obtain an expression for electric field intensity due to uniformly charged spherical shell or hollow sphere.

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10. Two hollow concentric spheres S_1 and S_2 enclosing charges 2Q and 5Q respectively, as shown in figure:- What would be the electric

flux through S_1

'(##CHT_MK_AJI_PHY_XII_P1_C03_S01_017_Q01##)'

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11. Two hollow concentric spheres S_1 and S_2 enclosing charges 2Q and 6Q respectively, as shown in figure:- What is the ratio of electric flux through S_1, and S_2?

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12. Derive an expression for electric potential due to a point charge

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13. What is gravitational potential?

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14. What is a test charge ?

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15. Explain electrostatic potential energy.

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16. Derive an expression for potential energy due to a point charge.

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17. Derive an expression for potential energy due to a point charge.

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18. Define one joule in terms of electrostatic potential energy.

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19. Define electron volt.

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20. Explain the concept of potential.

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21. Obtain the relation between electric field and electric potential.

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22. Show that electric field intensity at any point in the electric field is equal to negative rate of change of potential with respect to distance, measured in the direction of electric intensity

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23. Define potential gradient.

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24. State the S.I. unit of potential gradient.

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25. Where is zero potential point due to point charge?

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26. Obtain dimensional formula for potential difference.

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27. Potential at a point A in space is given as $4 \times 10^5 V$:- Find the work done in bringing a charge of $3\mu C$ from infinity to the point A.

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28. Potential at a point A in space is given as $4 \times 10^5 V$:- Does the answer depend on the path along which the charge is brought?

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29. If 120 J of work is done in carrying a charge of 6 C from a place where the potential is 10 volt to another place where the potential is V, find V.

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30. Calculate the amount of energy dissipated when a charge of 200C is transferred from cloud to the ground during lighting, if

potential of the cloud is $10^6 V$ with respect to earth.

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31. An electric potential is 10V throughout the space in a sphere of radius $0.2m^3$. What is the electric field in this region?

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32. 40 J of work is done to move an electric charge of 5 C from a point where potential is 20 V to another point, where potential is V volt. Find the value of V.

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33. Two metal spheres, one of radius R and the other of radius 2 R respectively have the same surface charge density σ. They are brought in

contact and separated. What will be the new surface charge densities on them?

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34. A charge Q is kept at point A. The electric field intensity and electric potential at point B is $36NC^{-1}$ and $18JC^{-1}$. Calculate the distance AB and magnitude of charge.

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35. Derive an expression for electric potential due to a point charge

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36. Obtain an expression for electric potential due to a point charge and show graphically the variation in electric field and potential with distance.

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37. Show the variation of electric field and electric potential due to negative point charge with distance, graphically.

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38. Show the variation of electric field and electric potential due to negative point charge with distance, graphically.

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39. A wire is bent in a circle of radius 10cm. It is given a charge of $250\mu C$ which spreads on it uniformly. What is the electric potential at the centre?

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40. The electric potential at 18cm from the charge is 200V. Find the magnitude of the charge.

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41. What is electrostatic potential due to electric dipole at an equatorial point?

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42. What is the work done in moving a test charge q_0 throught a distance of 2cm along the equatorial axis of an electric dipole?

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43. Define electric dipole and electric dipole moment.

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44. Derive an expression for electric potential due to a point charge

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45. A short electric dipole h as dipole moment of $1 \times l0^{-9}$ Cm. Determine the electric potential due to the dipole at a point distance 0.3 m from the centre of the dipole situated:- on the axial line (b) on the equatorial line

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46. A short electric dipole h as dipole moment of $1 \times l0^{-9}$ Cm. Determine the electric potential due to the dipole at a point distance

0.3 m from the centre of the dipole situated:- on a line making an angle of 60° with the dipole axis.

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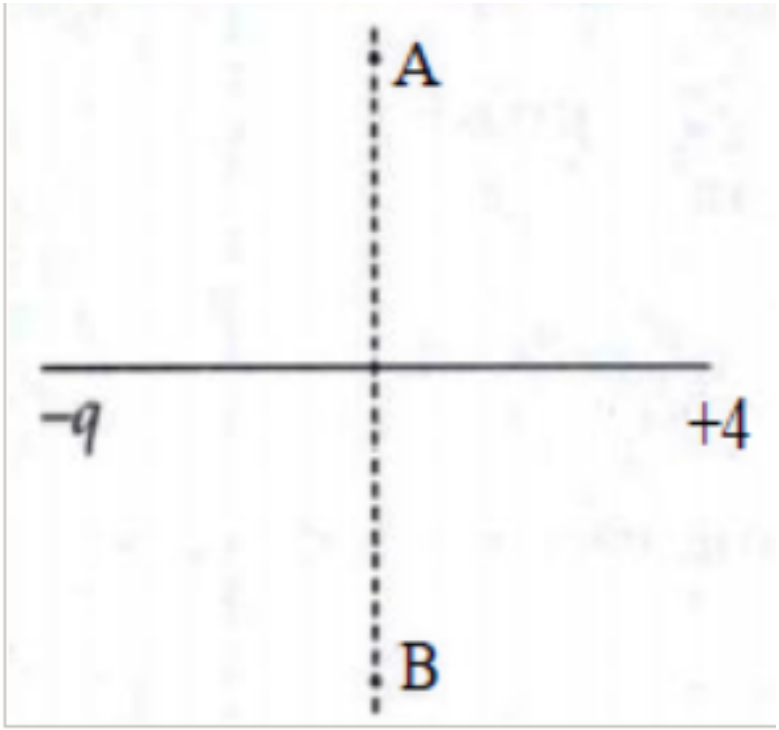
47. A change q is moved from a point A above a dipole of dipole moment p to a point B below the dipole in equatorial plane without acceleration. Find the work done in this

process.



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48. Derive an expression for electric potential due to a point charge

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49. Two charges $5 \times 10^{-8} C$ and $-3 \times 10^{-8} C$ are located 16 cm apart. At what point(s) on the line joining the two charges is the electric potential zero? Take the potential at infinity to be zero.

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50. Is electrostatic potential necessarily zero at a point where electric field strength is zero? Justify.

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51. Charges $+200\mu C$, $-150\mu C$, $+20\mu C$ and $-60\mu C$ are at the comers of a square of side 2m. Calculate electric potential at the centre of the square.

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52. A charge of $15\mu C$ is given to hollow metallic sphere of radius 0.3m. Find the potential:- at the surface of sphere

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53. A charge of $15\mu C$ is given to hollow metallic sphere of radius 0.4m. Find the potential:- at a distance 0.15m from the centre of sphere.

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54. A metal wire is bent in a circle of radius 20cm. It is given a charge of $400\mu C$ which is spread on it uniformly. Calculate the electric potential at its centre.

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55. Two point charges of magnitudes $+100\mu C$ and $-400\mu C$ are kept 30 cm apart. Find the

point of zero potential on the line joining the two charges.

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56. Two point charges of $5\mu C$ and $15\mu C$ are placed in air 20cm apart. Find the electric potential at the middle point of the line joining the two charges.

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57. No work is done in moving a test charge over an equipotential surface. Why?

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58. Can two equipotential surfaces intersect each other? Give reason.

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59. Explain the concept of equipotential surfaces.

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60. Show that electric field intensity is always normal to the equipotential surface.

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61. Explain why the electric field intensity cannot be inclined to the equipotential surface?

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62. Draw equipotential surfaces for the following:- single point charge,

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63. Draw equipotential surfaces for the following:- a uniform electricfield

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64. Draw equipotential surfaces for the following:- a dipole

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65. Draw equipotential surfaces for the following:- two identical positive charges

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66. Draw equipotential surfaces for the following:- two plane metallic plates connected to a cell

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67. Draw equipotential surfaces for the following:- charged metallic sphere and plate

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68. How much work is done in moving a $200\mu C$ charge through a distance of 0.5cm on an equipotential surface?

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69. A small particle carrying a negative charge of $1.6 \times 10^{-19} C$ is suspended in equilibrium between two horizontal metal plates 10cm apart having a potential difference of 4000V across them. FInd the mass of the particle.

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70. An infinite plane sheet of charge density $10^{7} cm^{-2}$ is held in vacuum. In this situation

how far should the two equipotential surfaces be kept, whose potential difference is 50 V?

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71. Is the electrostatic potential energy of N number of point charges is path dependent ?

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72. Under what condition, is the potential energy of two point charges zero?

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73. Two interacting like charges possesses potential energy. Explain.

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74. Define electrostatic potential energy of a system of point charges.

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75. Derive an expression for potential energy of a system of two point charges.

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76. Derive an expression for a potential energy for a system of N point charges.

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77. Two charges of magnitude 5 nC and -2 nC are placed at points (2 cm, 0, 0) and (20 cm, 0, 0) in a region of space, where there is no other external field. Find the electrostatic potential energy of the system.

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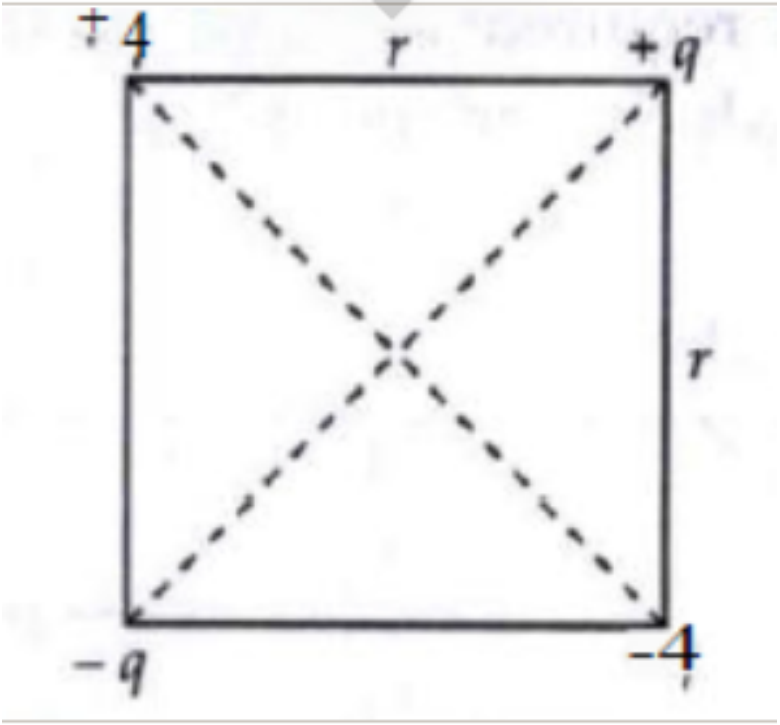
78. Calculate the electrostatic potential energy of the system of charges shown in the figure.



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79. Define the term potential energy of a charge q at a distance r in an external electric field.

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80. A charge q is at a distance r in an external electric field. Write an expression for potential energy of the charge.

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81. Derive an expression for potential energy of a single charge in an external electric field.

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82. Derive an expression for potential energy of a system of two charges in an external electric field.

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83. Two charged particles having equal charge of $3 \times 10^{-5} C$ each are brought from infinity to a separation of 30 cm. Find the increase in electrostatic potential energy during the process.

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84. Determine the electrostatic potential energy of a system consisting of two charges $-2\mu C$ and $+4\mu C$ (with no external field) placed at (-8 cm, 0, 0) and (+8 cm, 0, 0) respectively, (b) Suppose the same system of charges is now placed in an external electric field. $E = A\left(1/r^2\right)$, where $A = 8 \times 105cm^{-2}$, what would be the electrostatic potential energy of the configuration.

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85. Three charges -q, +Qand -q are placed at equal distance on straight line If the potential energy of the system of the three charges is zero, then what is the ratio of $Q:q$?

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86. An electron and a proton separated by a distance of $4 \times 10^{-9} m$, forms an electric dipole. This dipole is aligned in a uniform

electric field of $1.5 \times 10^4 N/C$. Calculate potential energy of dipole to hold it at 60° with the direction of electric field.

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87. A dipole with its charges -q and =q located at the points (0,-b,0) and (0,+b,0) is present in a uniform electric field E. The equipotential surfaces of this field are planes parallel to the YZ planes:- What is the direction of the electric field E?

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88. A dipole with its charges -q and =q located at the points (0,-b,0) and (0,+b,1) is present in a uniform electric field E. The equipotential surfaces of this field are planes parallel to the YZ planes:- How much torque would the dipole experience in this filed?

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89. The dipole moment of water molecule is $6.3 \times 10^{-30} Cm$. A sample of water contains 1021 molecules, whose dipole moments are all oriented in an electric field of strength $2.5 \times 10^5 N/C$. Calculate the work to be done to rotate the dipoles from their initial orientation θ_1 = 0 to one in which all the dipoles are perpendicular to the field, $\theta_2 = 90^\circ$.

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90. A charge $6\mu C$ is placed at the origin and another charge $-5\mu C$ is placed on the Y-axis at position A(0,6,0)m. Calculate the total electric potential at the point P whose coordinates are (8, 0, 0) m.

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91. A charge $6\mu C$ is placed at the origin and another charge $-5\mu C$ is placed on the Y-axis at position A(0,6,1)m:- Calculate the work done

to bring a proton from infinity to the point P.

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92. An electric dipole consist of two opposite charges each of magnitude $1\mu C$ separated by distance 2 cm. The dipole is placed in an external field of $10^5 N/C$. The maximum torque acting on the dipole is

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93. An electric dipole consists of two opposite charges each of magnitude $1\mu C$ separated by 2 cm. The dipole is placed in an external electric field of $10^6 N/C$. Find:- The work that the external agent will have to do in turning the dipole through 180° starting from position $\theta = 0^\circ$.

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94. Two point charges $20 \times l0^{-6} C$ and $-4 \times l0^{-6} C$ are separated by a distance of

50cm in air. Calculate the electrostatic potential energy of the system.

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95. Set up an arrangement of three point charges +q, +2q, and +2xq separated by equal finite distances so that electric potential energy of the system is zero. Find the value of x.

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96. Two point charges A and B of value $+3\mu C$ and $+2\mu C$ are kept 25cm apart in air. Calculate the work done when charge B is moved by 5cm towards A

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97. What are conductors?

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98. State the properties of conductors under electrostatic conditions.

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99. Explain electrostatic shielding (Screening).

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100. The safest way protect yourself from lightning is to be inside a car. Justify.

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101. What are free charges and bound charges?

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102. What are insulators?

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103. What are dielectric materials? Give any two examples of it.

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104. What is meant by polarization of dielectrics

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105. State the types of dielectrics hence explain each.

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106. What is the net charge on a polarized dielectric molecule.

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107. Explain polarization of a non-polar dielectric in an external electric field.

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108. Explain polarization of a polar dielectric in an external electric field.

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109. Why does a charged glass rod attract a piece of paper?

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110. What is meant by polarization of dielectrics

Watch Video Solution

111. What is dielectric strength.

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112. What is the basic purpose of using a capacitor?

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113. In which form is the energy stored in a charged capacitor?

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114. Write two applications of capacitors in electrical circuits.

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115. What is net charge on a charged capacitor?

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116. If the plates of a charged capacitor are suddenly connected to each other by a wire, what will happen?

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117. Explain a capacitor formed by two conductors and define capacitance of a capacitor.

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118. State the S.I unit and dimensional formula for capacitance.

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119. Define1farad and give the submultiples of unit farad.

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120. Explain the principle of capacitor.

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121. Explain in brief, the parallel plate capacitor.

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122. Derive anexpression for the effective capacitance of three capacitors in series.

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123. When is a series combination used?

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124. Derive an expression for the effective capacitance of three capacitors connected in parallel.

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125. When is a parallel combination used?

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126. When 10^8 electrons are transferred from one conductor to another, a potential difference of 10V appears between the conductors. Find the capacitance of the two conductors.

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127. From the figure given below, find the value of the capacitance C if the equivalent

capacitance between Aand Bis to be $1\mu F$. All other capacitors are in microfarad.

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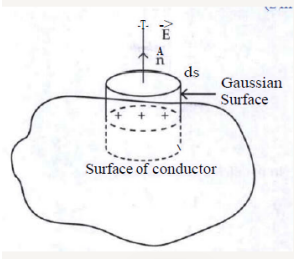
128. Show that electric field at the surface of a charges conductor is, $\overrightarrow{E} = \frac{\sigma}{E_0}\hat{n}$ where σ is the surface charge density and $\hat{n}$ is a unit vector normal to the surface in the outward direction.



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129. If the difference between the radii of the two spheres of a spherical capacitor is increased, state whether capacitance will increase or decrease?

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130. Three capacitors of $1\mu F$, 2muF and 4muF` are joined in series. How many times

will the capacity change when they are joined in parallel.

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131. Obtain an expression for capacity of an isolated spherical conductor.

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132. 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 capacitance in the ratio $1:2$, so that the energy stored in these two cases becomes the same.

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133. One hundred twenty five small liquid drops, each carrying a charge of $0.5\mu C$ and each of diameter 0.1m form a bigger drop. Calculate the potential at the surface of the bigger drop.

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134. Derive an expression for capacitance of a parallel plate capacitor without a dielectric.

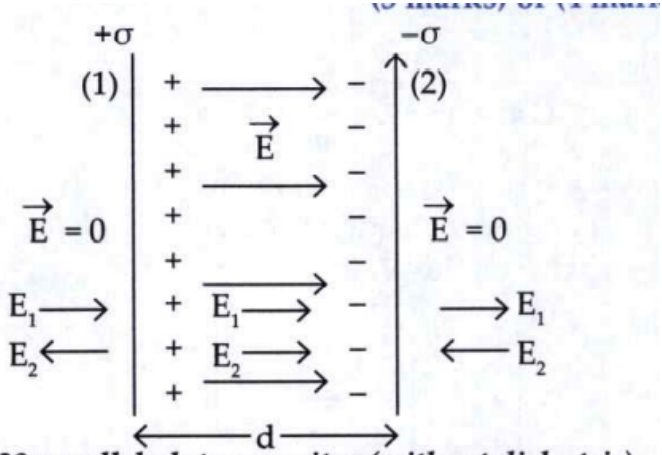

Fig 8.39 parallel plate capacitor (without dielectric)

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135. Derive an expression for capacitance of a parallel plate capacitor without a dielectric slab between the plates.

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136. Write the expression for a capacitance of a capacitor when the entire space is filled with dielectrc.

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137. Give the expression for capacitance of a capacitor when n dielectric slabs of thickness $t_1, t_2 \ldots t_n$ and dielectric constants $k_1, k_2 \ldots k_n$ respectively, fills the entire space between the plates.

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138. If the arrangement consists of n capacitors in parallel with plate areas $A_1, A_2, \ldots A_n$ and plate separation d, then

obtain the expression for capacitance of a capacitor.

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139. Calculate the capacitance of a parallel plate condenser of two plates of area $10^4 cm^2$ each separated by 4 mm thick glass sheet of k =4.

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140. A metal plate is introduced between the plates of a charged parallel plate capacitor. What is its effect on the capacitance of the capacitor?

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141. If the capacitor is filled with a conducting slab, then give the expression of capacitance.

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142. In a parallel plate capacitor with air between the plates, each plate has an area of $6 \times 10^{-3} m^2$ and the separation between the plate is 2mm:- Calculate the capacitance of the capacitor.

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143. In a parallel plate capacitor with air between the plates, each plate has an area of $6 \times 10^{-3} m^2$ and the separation between the plate is 3mm:- If this capacitor is connected to

100V supply, what would be the charge on each plate?

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144. In a parallel plate capacitor with air between the plates, each plate has an area of $6 \times 10^{-3} m^2$ and the separation between the plate is 4mm:- How would the charge on the plates be affected if a 2mm thick mica sheet of k = 6 is inserted between the plates while the voltage supply remains connected?

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145. Two plates of a parallel plate capacitor are 4 mm apart. A slab of dielectric constant 3 and thickness 3mm is introduced between the plates with the faces parallel to them. The distance between the faces is so adjusted that the capacitance of the capacitor becomes $\frac{2}{3}$ of its original value. What is the new distance between the plates ?

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146. An electric field of $3X10^4 Vm^{-1}$ is produced between the plates 0.05m apart, of a parallel plate capacitor when it is fully charged. Now an uncharged metal plate of thickness 0.01m is inserted between capacitor plates:- Find the potential difference after introduction of plates.

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147. An electric field of $3X10^4 Vm^{-1}$ is produced between the plates 0.05m apart, of a

parallel plate capacitor when it is fully charged. Now an uncharged metal plate of thickness 0.01m is inserted between capacitor plates:-What would be the potential difference if a dielectric slab (k = 3) were introduced in place of metal plate

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148. What is displacement current?

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149. A capacitor is connected to the D-C source. How do the conduction and displacement currents set up, compared with each other:- during the charging up process?

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150. A capacitor is connected to the D-C source. How do the conduction and displacement currents set up, compared with each other:- after the capacitor gets fully charged?

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151. Is the steady electric current the only source of magnetic field? justify your answer.

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152. If $\frac{d\phi_E}{dt}$ is the rate of change of electric flux, then why is the quantity $\varepsilon_0 \frac{d\phi_E}{dt}$ is called the displacement current?

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153. Explain the concept of displacement current.

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154. Derive an expression for a common potential and loss of energy when two charged capacitor are connected by conducting wires

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155. A parallel plate capacitor has an area of $4cm^2$ and a plate separation of 2mm:- Calculate its capacitance.

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156. A parallel plate capacitor has an area of $4cm^2$ and a plate separation of 3mm:- What is its capacitance if the space between the plates is filled completely with a dielectric having dielectric constant of 6.7.

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157. In a capacitor of capacitance $20\mu F$, the distance between the plates is 2 mm. If a dielectric slab of width 1 mm and dielectric constant 2 is inserted between the plates, what is the new capacitance?

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158. Derive an expression for the energy stored in a charged capacitor. Express it in different

forms.

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159. How much energy is used by the capacitor during charging which is supplied by the battery?

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160. A parallel plate air capacitor has a capacitance of $3 \times 10^{-9} F$. A slab of dielectric

constant 3 and thickness 3cm completely fills the space between the plates. The potential difference between the plates is maintained constant at 400 volt. What is the change in the energy of capacitor if the slab is removed?

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161. A spherical shell of radius b with charge Q is expanded to a radius a. Find the work done by the electrical forces in the process.

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162. Calculate the capacitance of a capacitor, required to share an energy of 10 kWh at a potential difference of $10^5 V$.

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163. A $6\mu F$ capacitor is charged by a 300 V supply. It is then disconnected from the supply and is connected to another uncharged $3\mu F$ capacitor. How much electrostatic energy of

the first capacitor is lost in the form of heat and electrostatic radiation?

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164. A capacitor has some dielectric between its plates and the capacitor is connected to a source. The battery is now disconnected and then the dielectric is removed. State whether the capacitance, the energy stored in it, the electric field, charges stored and voltage will increase, decrease or remain constant.

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165. A 500 pF capacitor is charged by a 100V supply. It is then disconnected from the supply and is connected to another uncharged 500pF capacitor. How much electrostatic energy is lost in the process?

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166. State the principle of working of Van de Graff generator. State its uses .

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167. State the uses of Van De Graff generator.

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168. Distinguish between:- Polar dielectric and non - polar dielectric

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169. Distinguish between:- Conduction current and displacement current.

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Exercise

1. Calculate the total flux coming out from a closed surface enclosing a particle $(_2^4He)$. (Given : $e = 1.6 \times l0^{-19}C$)

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2. A charge of 6q is placed at the centre of a cube of side 2cm. What is the electric flux passing through two opposite faces of the cube?

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3. Two charges - q and + q are located at points A(0,0, -a) and A(0,0, + a) respectively. How much work is done in moving a test charge from point P (7,0,0) to Q(-3,0,0)?

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4. If 20J of work is to be done in moving a charge of 100C from A to B, which of the two point is at higher potential? What is the potential difference?

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5. The electric potential at 45cm from a point charge is +100V. what is the magnitude and

sign of charge ?

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6. Two point charges $4\mu C$ and $-2\mu C$ are separated by a distance of lm in air. Calculate, on which point on the line joining the two charges, is the electric potential zero?

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7. The electric field at a point due to a point charge is $60N/C$ and the electric potential at that point is $30J/C$. Calculate the distance of the point from the charge and the magnitude of the charge.

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8. Twenty seven charged water droplets each with a diameter of 2mm and a charge of

$10^{-12}C$ coalesce to form a single drop. Calculate the potential of the bigger drop.

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9. Two point charges $+0.2\mu C$ and $0.01\mu C$ are placed 10cm apart. Calculate the work done in reducing the distance 5cm between them.

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10. The kinetic energy of a charged particle decreases by 10J as it moves from a point at a potential 300V to a point at a potential 400V. Find the charge on the particle.

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11. The capacity of a capacitor becomes $20\mu F$ when gap between the capacitor is filled completely by a dielectric slab of k = 4. What is

the capacity of a capacitor with air in between the plates?

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12. Calculate the energy stored in a capacitor of $6\mu F$ when it is charged to a potential of 240 volt.

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13. A $800\mu F$ capacitor is charged by a 100V battery. After some time, the battery is disconnected. The capacitor is then connected to another $800\mu F$ capacitor. What is the electrostatic energy stored ?

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14. Net capacitance of three identical capacitors in series is $1\mu F$. What will be their net capacitance in parallel? Find the ratio of

energy stored in two configuration if they are connected to the same source.

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15. The capacity of a parallel plate air condenser is $8\mu F$. When air is replaced by another material, its capacity becomes $16\mu F$. Calculate the dielectric constant of other material.

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16. Calculate the capacity of a sphere of radius 1000m.

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17. Two capacitors each of capacitance $5\mu F$ and a battery of emf 240 volt. Which arrangement, series or parallel, would give minimum energy? Calculate its value.

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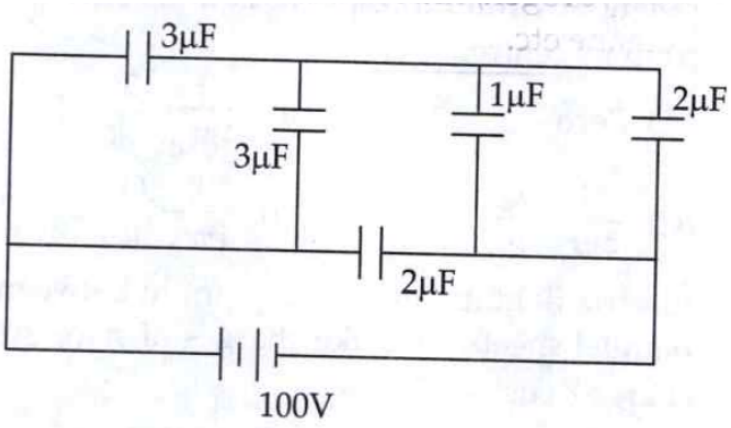
18. Figure shows a network of five capacitors connected to a 100V supply. Calculate the total charge and energy stored in the network.



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19. Net capacitance of three identical capacitors in series is $1\mu F$. What will be their

net capacitance if connected in parallel? Find the ratio of energy stored in the two configurations, if they are both connected to the same source.

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20. Capacity of a capacitor is $3\mu F$. A slab of dielectric constant 4 is inserted between the plates and capacitor is charged to 200V and then isolated. What is the new potential difference if the dielectric slab is removed?

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21. Select and write the most appropriate answer from the given alternatives each sub question:- Angle between equipotential surface and lines of force is

A. Zero

B. 90°

C. 180°

D. 45°

Answer:

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22. Theelectricfield near a conductingsurfacehaving a uniform surface charge density a is given by-

A. $sigm\frac{s}{2_{\varepsilon}}$ and is parallel to the surface

B. $\frac{\sigma}{\varepsilon_0}$ and is parallel to the surface

C. $sigm\frac{s}{2_{\varepsilon}}$ and is normal to the surface

D. $\frac{\sigma}{\varepsilon_0}$ and is normal to the surface

Answer:

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23. Two plates are 1.5 cm apart, and a potential difference of 7.5 volt is applied between them, the electric field between the plates is

A. $20N/C$

B. $50N/C$

C. $500N/C$

D. $200N/C$

Answer:

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24. Two charges +q and -q are situated at a certain distance. At the point exactly midway between them,

A. Electric field and electric potential both are zero

B. Neither electric field nor electric potential is zero.

C. Electric field is zero but electric potential is not zero.

D. Electric field is not zero but electric potential is zero.

Answer:

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25. At a certain distance from a point charge the electric potential is 200V and electric field is 200 V/m. What is this distance?

A. 10m

B. 8m

C. 0.1m

D. 0.8m

Answer:

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26. Two charged sphere of radii R_1 and R_2 have equal surface charge density. The ratio of their potential is

A. $\left(\frac{R_1}{R_2}\right)^2$

B. $\left(\frac{R_2}{R_1}\right)^2$

C. $\frac{R_2}{R_1}$

D. $\frac{R_1}{R_2}$

Answer:

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27. The electric potential V is a function of distance x in metre by V = ($10x^2$- 5x + 3) volt. Value of electric field at x = 2 is,

A. -35

B. -33

C. 45

D. 37

Answer:

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28. A parallel plate capacitor is charged and then isolated. The effect of increasing the

plate separation on charge, potential, capacitance respectively are-

A. Constant, decreases, decreases .

B. Increases, decreases, decreases.

C. Constant, decreases, increases.

D. Constant, increases, decreases.

Answer:

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29. A slab of material of dielectric constant k has the same area A as the plates of a parallel plate capacitor and has thickness $(3d/4)$, where d is separation of the plates.The charge in capacitance when the slab is inserted between the plates is

A. $C = \frac{A_{\varepsilon 0}}{d}\left(\frac{k+3}{4k}\right)$

B. $C = \frac{A_{\varepsilon 0}}{d}\left(\frac{2k}{k+3}\right)$

C. $C = \frac{A_{\varepsilon 0}}{d}\left(\frac{k+3}{2k}\right)$

D. $C = \frac{A_{\varepsilon 0}}{d}\left(\frac{4k}{k+3}\right)$

Answer:

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30. Energy stored in a capacitor and dissipated during charging a capacitor bear a ratio.

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer:

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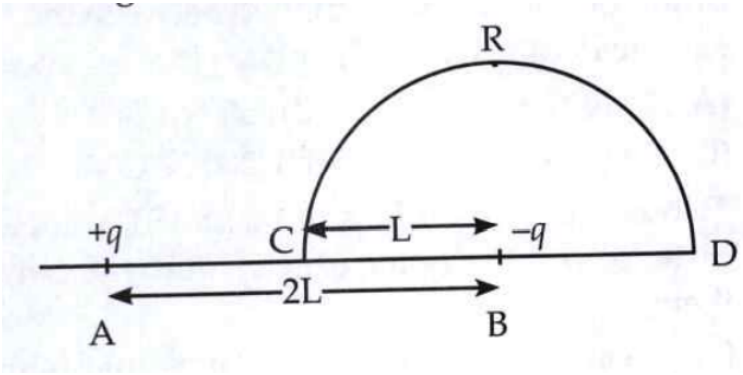
31. Charge +q and -q are placed at points A and B respectively which are distance 2L apart. C is the midpoint of A and B. The work done in moving a charge +Q along the semicircle CRD

as shown in the figure below is



A. $\frac{-qQ}{6\pi\varepsilon_0 L}$

B. $\frac{qQ}{2\pi\varepsilon_0 L}$

C. $\frac{qQ}{6\pi\varepsilon_0 L}$

D. $\frac{-qQ}{4\pi\varepsilon_0 L}$

Answer:

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32. A parallel plate capacitor has circular plates of radius 8 cm and plate separation 1mm. What will be the charge on the plates if a potential difference of 100V is applied?

A. `1.78 xx10^-8C

B. `1.78 xx10.5^-5C

C. $4.3 \times 10^{-4} C$

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

Answer:

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33. Two unlike charges of magnitude q are separated by a distance 4d. The potential at a point midway between them is

A. $\frac{1}{4\pi\varepsilon_0}.\frac{q}{d}$

B. $\frac{1}{4\pi\varepsilon_0}.\frac{2q}{d}$

C. Zero

D. $\frac{1}{4\pi\varepsilon_0}.\frac{2q}{d^2}$

Answer:

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34. What is the potential energy of the equal positive point charges of $1\mu C$ each, held 2m apart in air-

A. `-9xx10^-3 J

B. `+9xx10^-3 eV

C. zero

D. `4.5xx10^-3 J

Answer:

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35. 125 electrons are equally spaced and fixed around a circle of radius R. Relative to V = 0 at infinity, the electrostatic potential V and the electric field E at the centre C are

A. $V = 0$ and $E \neq 0$

B. V = 0 and E = 0

C. $V \neq 0$ and $E = 0$

D. $V \neq 0$ and $E \neq 0$

Answer:

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36. Two point charges of $1\mu C$ each are 10cm apart. the work done in bringing them 5cm closer is_

A. 9×10^2

B. $9J$

C. $90J$

D. $0.9J$

Answer:

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37. If an electron moves from rest, from a point at which potential is 60 volt to another point at which potential is 110 volt, then its kinetic energy in the final state will be

A. $9 \times 10^{-19} J$

B. $0.8 \times 10^{-19} J$

C. $8 \times 10^{-18} J$

D. $10 \times 10^{-18} J$

Answer:

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38. If the charges +Q and -Q are placed at the two vertices of an equilateral triangle of side l, then potential at the third vertex is

A. $\frac{1}{4\pi\varepsilon_0}\frac{2Q}{l}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{Q}{l}$

C. zero

D. $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{l}$

Answer:

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39. A hollow conducting sphere of radius R has a charge +Q on its surface. What is the electric potential within the sphere at a distance r = $R/3$ from its centre.

A. Zero

B. $\frac{1}{4\pi\varepsilon_0}\frac{3Q}{R}$

C. $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2}$

D. $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$

Answer:

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40. Electric field intensity at a point in between two parallel sheets with like charges of same surface charge densities (sigma) is

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

B. $\frac{\sigma}{\varepsilon_0}$

C. $\frac{2\sigma}{\varepsilon_0}$

D. zero

Answer:

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41. The electric potential at a point along the axis of an electric dipole depends on distance r from the dipole as

A. $\propto \frac{1}{r^2}$

B. $\propto \frac{1}{r}$

C. $\propto r$

D. $\propto \frac{1}{r^3}$

Answer:

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42. An electric dipole is kept in non-uniform electric field. It experiences

A. A torque but not a force

B. A force but not a torque

C. Neither force nor troque.

D. A force and a torque.

Answer:

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43. An electric dipole has length 2l. The ratio of electric field and potential (E/V) at midpoint of the dipole is

A. $\frac{1}{2}l$

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

C. zero

D. infinity

Answer:

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44. The only non polar molecule given below is_

A. H^2O

B. HCl

C. CO_2

D. NH_3

Answer:

Watch Video Solution

45. The electric dipole moment of an electron and a proton 4.2 nm apart is

A. 6.72×10^{-28}

B. 3.2×10^{-28}

C. 2.50×10^{-29}

D. 6.72×10^{-29}

Answer:

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46. According to Gauss' theorem, electric field of an infinitely long straight wire is proportional to

A. r^2

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

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

D. $\frac{1}{r^3}$

Answer:

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47. A charged parallel plate capacitor has a potential energy U. if a slab of dielectric

constant k is inserted between the plates, then the new potential energy will be_

A. UK

B. $\frac{U}{K}$

C. UK^2

D. $\frac{U}{K^2}$

Answer:

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48. If q is a charge on the capacitor and C is a capacitance, then energy stored in capacitor is

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

B. $2qC$

C. $\frac{q^2}{2}C$

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

Answer:

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49. In a charged capacitor, the energy resides in

A. positive and negative charges

B. Positive charges only

C. Negative charges only

D. The field between the plate

Answer:

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50. The electric field required for the breakdown of dielectric is called

A. Dielectric resistance

B. Dielectric strength

C. Dielectric number

D. Dielectric constant

Answer:

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51. Two parallel plates of area A are separated by two different dielectrics as shown in figure. The net capacitance is

A. $\frac{4\varepsilon_0 A}{3d}$

B. $\frac{3\varepsilon_0 A}{4d}$

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

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

Answer:

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52. A capacitor of capacity C has a charge Q and stored energy is W. If the charge is increased to 3Q, the stored energy will be

A. 3W

B. $W/3$

C. 9W

D. 6W

Answer:

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53. An air filled capacitor has a capacitance $2p^f$. Now the plate separation is doubled and the space is filled with dielectric medium, then the capacitance increase to 4_pF. The dielectric constant of dielectric medium is,

A. 6

B. 4

C. 2

D. 8

Answer:

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54. Capacity of an air capacitoris$20\mu F$ .Theseparation between the parallel plates is8mm.Acopper plate of 4mm thickness is introduced symmetrically between the plates. The capacitance now becomes_

A. $40\mu F$

B. $42\mu F$

C. $30\mu F$

D. $32\mu F$

Answer:

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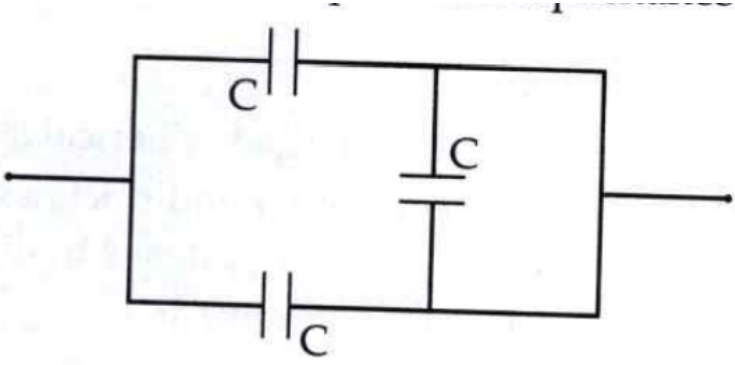
55. For the combination of capacitors given in the figure below, the equivalent capacitance is



A. C

B. 2C

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

D. 3C

Answer:

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56. In the series combination of three capacitors of capacitances $C_1, C_2, C_3,$ the equivalent capacitance will be

A. $C_1 + C_2 + C_3$

B. $\frac{1}{C_1 + C_2 + C_3}$

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

D. $\left(C_1^{-1} + C_2^{-1} + C_3^{-1}\right)^{-1}$

Answer:

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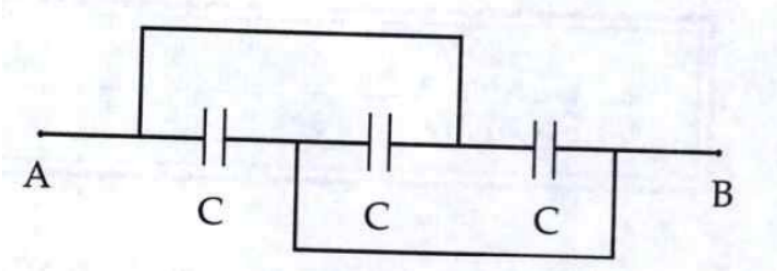
57. Three equal capacitors are connected as shown in figure. Then the equivalent

capacitance between A and B is



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

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

C. 3C

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

Answer:

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58. Displacement current is due to

A. Free electrons in motion.

B. Change in magnetic field

C. Time varying electric field

D. Alternating current

Answer:

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59. Displacement current is given by

A. $Ak\varepsilon_0 \frac{dE}{dt}$

B. $\frac{\varepsilon_0 k}{A} \frac{dE}{dt}$

C. $\frac{1}{A\varepsilon_0 k} \frac{dE}{dt}$

D. $A^2\varepsilon_0 k \frac{dE}{dt}$

Answer:

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60. Select and write correct alternative from the following alternatives: The displacement current is due to

A. Free electrons in motions

B. Change in magnetic field

C. Time varying electric field

D. Alternating current

Answer:

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61. Select and write correct alternative from the following alternatives::- The dimensional formula for the unit of capacitance is_

A. $\left[M^{-1}L^{-2}T^{4}A^{1}\right]$

B. $\left[M^{-1}L^{-1}T^{3}A^{1}\right]$

C. $\left[M^{-1}L^{-2}T^{4}A^{2}\right]$

D. $\left[M^{-1}L^{-1}T^{3}A^{2}\right]$

Answer:

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62. Select and write correct alternative from the following alternatives::- Capacitors are combined in parallel when we require a

A. Large capacitance and Small potential

B. Large capacitance and Large potential

C. Small capacitance and Large potential

D. Small capacitance and small potential

Answer:

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63. Select and write correct alternative from the following alternatives:- The work done to move a charge of $5\mu C$ through a distance of 2cm on an equipotential surface is

A. $10 \times 10^{-8} J$

B. $2.5 \times 10^{-4} J$

C. $1 \times 10^{-8} J$

D. zero

Answer:

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64. The safest way protect yourself from lightning is to be inside a car. Justify.

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65. Define electric potential

Watch Video Solution

66. Define potential gradient.

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67. State any four properties of a conductor under electrostatic condition.

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68. Distinguish between polar molecules and non polar molecules (Any 2 points)

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69. Draw a neat labelled diagram of equipotential surface for a uniform electric field and for a electric dipole.

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70. Derive an expression for potential energy of a dipole in an external electric field.

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71. A parallel plate air capacitor has a capacitance of $4\mu F$. A slab of dielectric constant 4 and thickness 4 cm completely fills the space between the plates. The potential difference between the plates is maintained constant at 200 volt. What is the change in the energy of a capacitor if the slab is removed?

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72. Van de Graff generator is used to

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73. Derive an expression for electric potential due to an electric dipole. Hence, state the expressions for electric potential for a point on its axis and equator.

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