PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

ELECTROSTATIC POTENTIAL AND CAPACITANCE

Section A Questions Answers

1. Why gravitational forces or spring forces are conservative forces ?

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2. Prove that electrostatic forces are conservative in nature and define electrostatic potential energy.

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3. Write similarities and difference between gravitational force and electrostatic force.

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4. Explain electrostatic potential energy in electric field due to an artangement of electric charge.

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5. Explain electrostatic potential energy difference and give the noteworthy comments on it

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6. Write SI unit of electrostatic potential and obtain its dimensional formula.

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7. Define electric potential and explain it. Write its SI unit and give its other units.

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8. Derive an expression for the electric potential in a electric field of positive point charge at distance r.

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9. Draw a graph for variation of potential V with distance r for a point charge Q.

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10. Derive scalar relation between electric field and electrostatic field .

Electric field of a charge Q at a distance

$$E = \frac{KQ}{r^{\circ}}$$

and electrostatic potential,

$$V = \frac{kQ}{r}$$

$\therefore$ Taking ratio , $\frac{E}{V} = \frac{1}{r}$

$\therefore V = Er$

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11. Distinguish between electric potential and electric potential energy.

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12. Derive the formula for the electric potential due to an electric dipole at a point from it.

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13. Write an equation of potential due to an electric dipole and give its important features. Discuss its special cases.

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14. Derive an expression for electric potential at a point due to a system of N charges.

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15. Write an expressions for electric potential due to a continuous distribution of charges.

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16. Write an expression for potential at the point outside a uniformly charged spherical shell outside on the surface and inside the shell.

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17. Draw a graph showing variation of potential with r distance for a uniformly charged spherical shell.

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18. Write the characteristics of equipotential surface.

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19. Show that the direction of electric field at a given is normal to the equipotential surface passing through that point.

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20. Write the characteristics of equipotential surface.

Watch Video Solution

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

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22. Derive the formula for the electric potential energy of system of two charges.

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23. Derive the formula for the electric potential energy of system of three charges.

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24. Obtain equation of electric energy of a single charge .

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25. Define electronVolt and convert it into Joule unit.

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26. Obtain the equation of electric potential energy of a system of two electric charges in external electric field.

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27. Derive equation of potential energy of an electric dipole in a uniform electric field .

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28. Explain the position (orientations) of a dipole in stable equilibrium, unstable equilibrium.

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29. Obtain the equation of electric potential energy of a dipole from equation of potential energy of a system of two electric charges.

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30. Explain electrostatics of conductors. Explain the effects produced inside a metallic conductor placed in an external electric field.

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31. Write important results regarding electrostatic of conductors.

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32. Inside a conductor electrostatic field is zero'. Explain.

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33. At the surface of a charged conductor electrostatic field must be normal to the surface at every point'. Explain.

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34. The interior of a conductor can have no excess charge in the static situation'. Explain

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35. Show that electrostatic potential ls constant throughout the volume of the conductor and has the same value (as inside) on its surface.

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36. Obtain an expression for electric field at the surface of a charged conductor.

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37. Explain electrostatic shielding with necessary diagram.

OR

Electric field inside hollow region of conductor in uniform electric field is same Explain.

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38. Explain the difference in the behaviour of a conductor and dielectric in the presence of external electric field.

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39. Write the types of dielectric and explain them. Give some examples of dielectric substance.

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40. Explain polarization of nonpolar molecule in uniform electric field and define the linear isotropic dielectrics.

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41. Explain polarisation of polar molecule in uniform electric field.

Watch Video Solution

42. How does the polarised cliclectric morufy the original external field inside it ?

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43. What is capacitor ? And explain capacitance. Give its SI unit.

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44. What happens if the magnitude of capacitance of capacitor are large ?

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45. Derive expression for the capacitance of the parallel plate capacitor,

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46. Why is a F unit so big in practice ?

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47. Calculate the capacitantce of two plates of equal area of 1 m^2 separated by distance 1 mm

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48. Explain the effect of dielectric capacitance of parallel plate capacitor and obtain the formula of dielectric constant.

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49. Write the necessity of combination of capacitor and ways of its connections .

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50. What is series connection of capacitors ?

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51. Obtain the formula for the effective capacitance of the series combination of different n capacitors.

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52. What is a parallel connection of capacitors ? Obtain the formula for the effective capacitance in the parallel combination of two different capacitors.

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53. Obtain the formula for the effective capacitance of the parallel combination of different n capacitors.

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54. Write the difference between capacitors in series and parallel connections.

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55. How does a capacitor store energy ? And obtain the formula for the energy stored in the capacitor ?

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56. Obtain the expression for the energy stored per unit volume in a charged capacitor.

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57. Derive the equations of stored energy for series or parallel connection of many capacitors.

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Section A Try Yourself

1. What are conservative force , non - conservative force , conservative field and non - conservative field ?

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2. Give the definitions of conservative force .

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3. Prove that electrostatic forces are conservative in nature and define electrostatic potential energy.

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4. Prove that electrostatic forces are conservative in nature and define electrostatic potential energy.

Watch Video Solution

5. Define electrostatic potential.

Watch Video Solution

6. Is electrostatic potential vector or scalar?

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7. Write SI unit of electrostatic unit. Give its other units.

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8. Derive an expression for electric potential at a point due to a system of N charges.

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9. Write the relation between the electric field of an electric charge and electrostatic potential at any point

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10. Shows that how the electrostatic potential varies with r for a point charge.

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11. Write an equation of potential due to an electric dipole and give its important features. Discuss its special cases.

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12. What is the electric potential at a point in the equatorial plane ?

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13. Obtain the equation of electric field by dipole at a point on axis of dipole.

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14. Write an equation for potential due to a system of charges.

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15. Write an equation for potential due to linear charge distribution.

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16. Write an equation for potential due to volume charge distribution.

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17. Write an equation for potential at a point in a uniformly charged spherical shell.

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18. Draw a graph of $V \rightarrow r$ for spherical shell.

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19. Define an equipotential surface.

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20. Electric field is always ______ to the equipotential surface at every point. (Fill in the gap)

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21. Draw an equipotential surface for dipole.

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22. Draw an equipotential surface of two identical positive charges for small distance.

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23. Draw an equipotential surface for an uniform electric field.

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24. Draw an equipotential surface for a point charge.

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25. Write the relation between electric field and electrostatic potential.

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26. What is potential gradient ?

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27. Define an electron Volt and show it in Joule unit.

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28. 1 eV = ____ J. (Fill in the gap)

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29. Write an equation of torque on dipole placed in uniform electric field.

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30. When the torque acting on electric dipole ii uniform electric field becomes maximum ?

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31. What is dielectric?

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32. What is pollination? Describe its types

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33. What are polar and non-polar molecules ? Give their examples.

Watch Video Solution

34. What are polar and non-polar molecules ? Give their examples.

Watch Video Solution

35. What is linear isotropic dielectric?

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36. On which the extent of polarization depend ?

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37. Write the relation between $\overrightarrow{P}$ and $\overrightarrow{E}$ for a linear isotropic dielectric.

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38. Due to which the surface charge density arises on the surface of a dielectric slab, when it is placed in a uniform electric field ?

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39. Write definition of capacitance.

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40. Write definition of capacitance of capacitor.

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41. Does capacitance of parallel plate capacitor depend on p.d. of its plate ?

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42. Write dimensional formula of capacitance.

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43. Define dielectric constant.

Watch Video Solution

44. Write the capacitance of parallel plate capacitor with medium of dielectric of dielectric constant K.

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45. Write the formula of capacitance of capacitor having dielectric constant K = 2.

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46. What is series connection of capacitors ?

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47. What is parallel connection of capacitors ?

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48. The magnitude of effective capacitance in series connection of capacitors increases. Is this statement true or false ?

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49. Which quantity is same in each capacitor of series connection ?

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50. Two capacitors each having capacitance of $2\mu F$ is connected in series what will the effective capacitance of these capacitors ?

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Section B Numericals

1. Calculate the potential at a point P due to a charge of 4×10^{-7} C located 9 cm away.

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2. Hence ohtaln the work done in bringing charge of 2×10^{-9} C . From infinity to the point P. Does the answer depend on the path along which the charge is brought ?

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3. Two charges 3×10^{-8} C and -2×10^{-8} C are located 15 cm apart. At what point on the line joining the two charges is the electric potential zero ? Take the potential at infinity to be zero.

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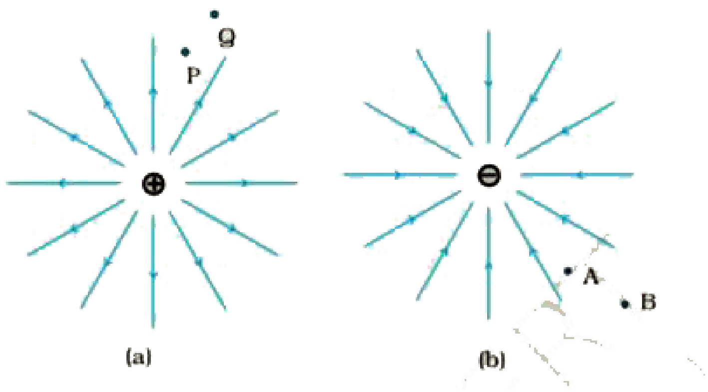
4. Figures 2.8 (a) and (b) show the field lines of a positive and negative point charge respectively.



(a) Give the signs of the potential difference

$V_P - V_Q : V_B - V_A$.

(b) Give the sign of the potential energy difference of a small negative charge between the points Q and P, A and B.

(c) Give the sign of the work done by the field in moving a small positive charge from Q to P.

(d) Give the sign of the work done by the external agency in moving a small negative charge from B to A.

(e) Does the kinetic energy of a small negative charge increase or decrease in going from B to A?

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5. Four charges are arranged at the corners of a square ABCD of side d as show in figure.

(a) Find the work required to put together this arrangement.

(b) A charge q_0 is brought to the centre E of the square the four charges being held fixed at its corners. How much extra work is needed to do this ?

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6. Determine the electrostatic potential energy of a system consisting of two charges 7 μC and - 2 μC (and with no external field) placed at (-9 cm, 0, 0) and (9 cm, 0, 0) respectively.

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7. How much work is required separate the two charges infinitely away from each other ?

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8. Suppose that the same system of charge is now placed in an external electric field E = A(l/ r^2), $A = 9 \times 10^5 cm^{-2}$. What would the electrostatic energy of the configuration be ?

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9. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29} C m. A mole of this substance is polarised (at low temperature) by applying a strong electrostatic field of magnitude $10^6 Vm^{-1}$. The direction of the field is suddenly changed by an angle of 60°. Estimate the heat released by the substance in aligning its dipoles along the new direction of the field. For simplicity, assume 100% polarisation of the sample.

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10. (a) A comb run through one's dry hair attracts small bits of paper. Why? What happens if the hair is wet or if it is a rainy day? (Remember, a paper does not conduct electricity.)

(b) Ordinary rubber is an insulator. But special rubber tyres of aircraft are made slightly conducting. Why is this necessary?

(c) Vehicles carrying inflammable materials usually have metallic ropes touching the ground during motion. Why?

(d) A bird perches on a bare high power line, and nothing happens to the bird. A man standing on the ground touches the same line and gets a fatal shock. Why?

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14. A slab of material of dielectric constant K has the same area as the plates of a parallel-plate capacitor but has a thickness $\left(\frac{3}{4}\right)$ d where d is the separation of the plates. How Is the capacitance changed when the slab Is inserted between the plates ?

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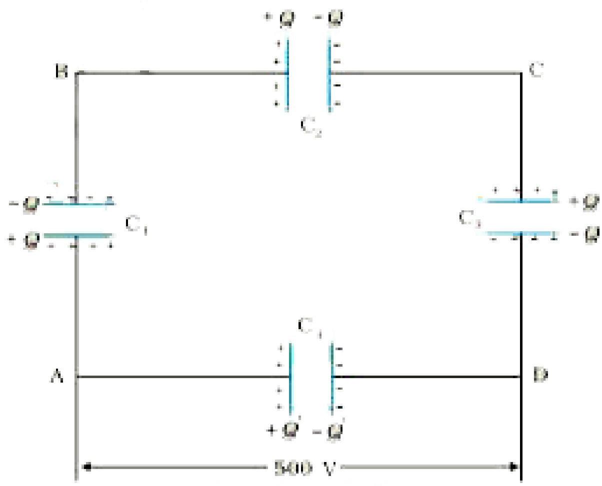
15. A network of four 10 μF capacitors is connected to a 500 V supply, as shown in Fig.

2.29. Determine (a) the equivalent capacitance of the network and (b) the charge on each capacitor. (Note, the charge on a capacitor is the charge on the plate with higher potential, equal and opposite to the charge on the plate with lower potential.)



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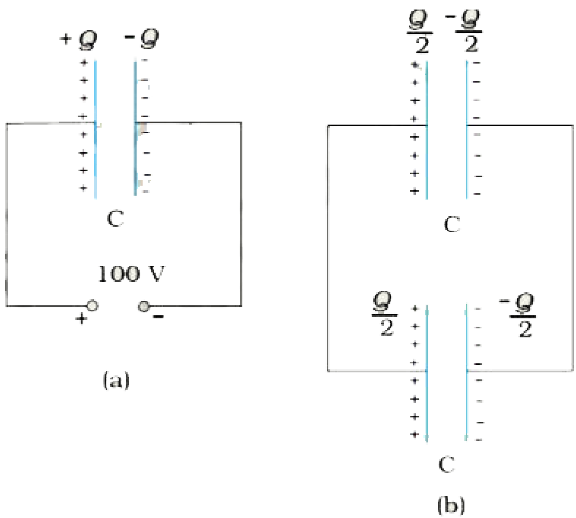
16. (a) A 900 pF capacitor is charged by 100 V battery [Fig. 2.31(a)]. How much electrostatic energy is stored by the capacitor?

(b) The capacitor is disconnected from the battery and connected to another 900 pF capacitor [Fig. 2.31(b)]. What is the electrostatic energy stored by the system?



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Section B Numerical From Textual Exercise

1. Two charge $5 \times 10^{-8} C$ and -3×10^{-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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2. A regular hexagon of side 10 cm has a charge $5\mu C$ at each of its vertices. Calculate the potential at the centre of the hexagon.

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3. Two charges 2 μC and –2 μC are placed at points A and B 6 cm apart.

(a) Identify an equipotential surface of the system.

(b) What is the direction of the electric field at every point on this surface?

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4. A spherical conductor of radius 12 cm has a charge of 1.6×10^{-7} C distributed uniformly on its surface . What is the electric field

(a) inside the sphere

(b) just outside the sphere.

(c) at a point 18 cm from the centre of the sphere ?

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5. A parallel plate capacitor with air between the plates has a capacitance of 8 pF (1pF = 10^{-12} F). What will be the capacitance if the distance between the plates is reduced by half, and the space between them is filled with a substance of dielectric constant 6?

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6. Three capacitors each of capacitance 9 pF are connected in series.

(a) What is the total capacitance of the combination?

(b) What is the potential difference across each capacitor if the combination is connected to a 120 V supply?

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7. Three capacitors of capacitances 2 pF, 3 pF and 4 pF are connected in parallel

(a) What is the total capacitance of the combination?

(b) Determine the charge on each capacitor if the combination is connected to a 100 V supply

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

Calculate the capacitance of the capacitor. If this capacitor is connected to a 100 V supply, what is the charge on each plate of the capacitor?

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9. Explain what would happen if in the capacitor given in Exercise, a 3 mm thick mica sheet (of dielectric constant = 6) were inserted between the plates,

(a) while the voltage supply remained connected.

(b) after the supply was disconnected.

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

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11. A 600pF capacitor is charged by a 200V supply. It is then disconnected from the supply and is connected to another unchanged

600pF capacitor. How much electrostatic energy is lost in the process.

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12. A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of -2×10^{-9} C from a point P (0, 0, 3 cm) to a point Q (0, 4 cm, 0), via a point R (0, 6 cm, 9 cm)

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13. A cube of side b has a charge q at each of its vertices. Determine the potential and electric field due to this charge array at the centre of the cube.

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14. Two tiny spheres carrying charges 1.5 μC and 2.5 μC are located 30 cm apart. Find the potential and electric field:

(a) at the mid-point of the line joining the two charges, and

(b) at a point 10 cm from this midpoint in a plane normal to the line and passing through the mid-point.

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15. A spherical conducting shell of inner radius r_1 and outer radius r_2 has a charge Q.

Is the electric field inside a cavity (with no charge) zero, even if the shell is not spherical, but has any irregular shape ? Explain.

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16. (a) Show that the normal component of electrostatic field has a discontinuity from one side of a charged surface to another given by

$$(E_2 - E_1).\, n = \frac{\sigma}{\varepsilon_0}$$

where $\widehat{n}$ is a unit vector normal to the surface at a point and σ is the surface charge density at that point. (The direction of $\widehat{n}$ is from side 1 to side 2.) Hence, show that just outside a conductor, the electric field is $\sigma\widehat{n} / \varepsilon_0$.

(b) Show that the tangential component of electrostatic field is continuous from one side of a charged surface to another. [Hint: For (a), use Gauss's law. For, (b) use the fact that work done by electrostatic field on a closed loop is zero.]

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17. (a) Show that the normal component of electrostatic field has a discontinuity from one side of a charged surface to another given by

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18. A long charged cylinder of linear charged density λ is surrounded by a hollow co-axial conducting cylinder. What is the electric field in the space between the two cylinders?

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19. In a hydrogen atom, the electron and proton are bound at a distance of about 0.53 Å

(a) Estimate the potential energy of the system in eV, taking the zero of the potential energy at infinite separation of the electron from proton.

(b) What is the minimum work required to free the electron, given that its kinetic energy in the orbit is half the magnitude of potential energy obtained in (a)?

(c) What are the answers to (a) and (b) above if the zero of potential energy is taken at 1.06 Å separation?

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20. If one of the two electrons of a H_2 molecule is removed, we get a hydrogen molecular ion H_2^+.In the ground state of an H_2^+ , the two protons are separated by roughly 1.5 Å, and the electron is roughly 1 Å from each proton. Determine the potential energy of the system. Specify your choice of the zero of potential energy

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21. Two charged conducting spheres of radii a and b are connected to each other by a wire. What is the ratio of electric fields at the surfaces of the two spheres? Use the result obtained to explain why charge density on the sharp and pointed ends of a conductor is higher than on its flatter portions.

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22. Two charges –q and +q are located at points (0, 0, –a) and (0, 0, a), respectively.

(a) What is the electrostatic potential at the points (0, 0, z) and (x, y, 0) ?

(b) Obtain the dependence of potential on the distance r of a point from the origin when $r/a >> 1$.

(c) How much work is done in moving a small test charge from the point (5,0,0) to (–7,0,0) along the x-axis? Does the answer change if the path of the test charge between the same points is not along the x-axis?

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23. Figure 2.32 shows a charge array known as an electric quadrupole. For a point on the axis of the quadrupole, obtain the dependence of potential on r for $r / a > \; > 1$, and contrast your results with that due to an electric dipole, and an electric monopole (i.e., a single charge).

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24. An electrical technician requires a capacitance,of 2 μF in a circuit across a potential difference of 1 kV. A large number of $1\mu F$ capacitors are available to him each of which can withstand a potential difference of more than 400 V. Suggest a possible arrangement that requires the minimum number of capacitors .

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

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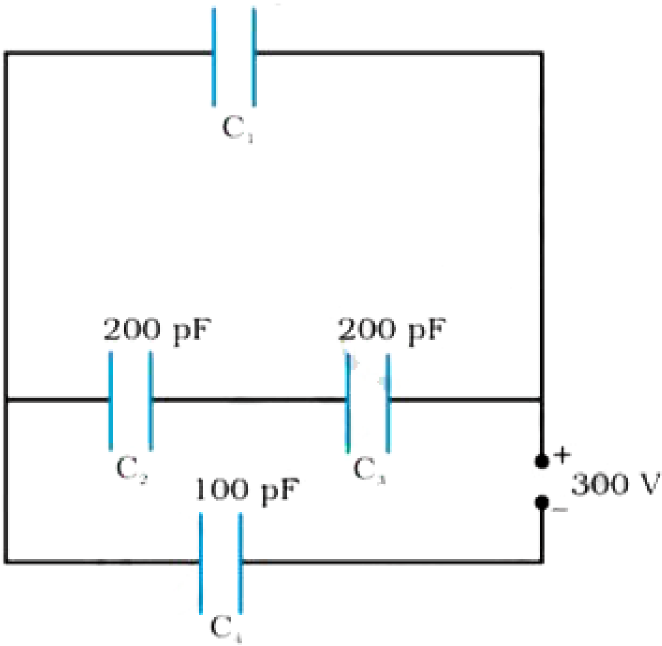
26. Obtain the equivalent capacitance of the network in Fig. 2.33. For a 300 V supply, determine the charge and voltage across each

capacitor.



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

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

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

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28. A 4 μF capacitor is charged by a 200 V supply. It is then disconnected from the supply, and is connecled to another uncharged 2 μf capacitor. How much electrostatic energy of the first capacilor is lost in the form of heat and electromagnetic radiation ?

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29. Show that the force on each plate of a parallel plate capacitor has a magnitude equal to (½) QE, where Q is the charge on the capacitor, and E is the magnitude of electric Held between the plates. Explain the origin of the factor $1/2$

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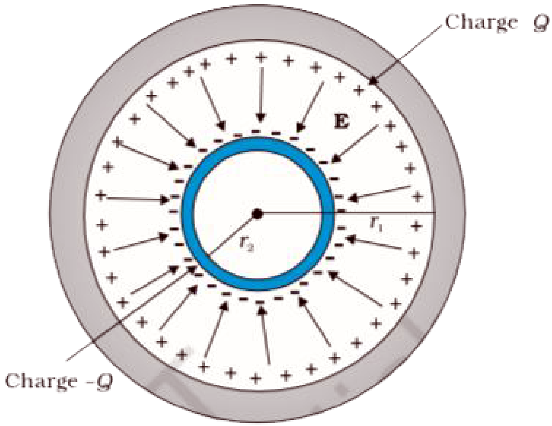
30. A spherical capacitor consists of two concentric spherical conductors, held in position by suitable insulating supports (Fig. 2.34). Show that the capacitance of a spherical capacitor is given by

$$C = \frac{4\pi\varepsilon_0 r_1 r_0}{r_1 - r_2}$$



where r_1 and r_2 are the radii of outer and inner spheres, respectively.

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31. 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 μC. The space between the concentric spheres is filled with a liquid of dielectric constant 32.

(a) Determine the capacitance of the capacitor.

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

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

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32. Answer carefully:

(a) Two large conducting spheres carrying charges Q_1 and Q_2 are brought close to each other. Is the magnitude of electrostatic force between them exactly given by $Q_1, Q_2 / 4\pi\varepsilon_0 r^2$, where r is the distance between their centres?

(b) If Coulomb's law involved $1/r^3$ dependence (instead of would Gauss's law be still true ?

(c) A small test charge is released at rest at a point in an electrostatic field configuration. Will it travel along the field line passing through that point?

(d) What is the work done by the field of a nucleus in a complete circular orbit of the electron? What if the orbit is elliptical?

(e) We know that electric field is discontinuous across the surface of a charged conductor. Is electric potential also discontinuous there?

(f) What meaning would you give to the capacitance of a single conductor?

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

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$Q_1, Q_2 / 4\pi\varepsilon_0 r^2$, where r is the distance between their centres?

(b) If Coulomb’s law involved $1/r^3$ dependence (instead of would Gauss’s law be still true ?

(c) A small test charge is released at rest at a point in an electrostatic field configuration. Will it travel along the field line passing through that point?

(d) What is the work done by the field of a nucleus in a complete circular orbit of the electron? What if the orbit is elliptical?

(e) We know that electric field is discontinuous across the surface of a charged conductor. Is electric potential also discontinuous there?

(f) What meaning would you give to the capacitance of a single conductor?

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

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39. A cylindrical capacitor has two co-axial cylinders of length 15 cm, and radii 1.5 cm and 1.4 cm. The outer cylinder is earthed and the inner cylinder is given a charge of 3.5 μC. Determine the capacitance of the system and - the potential of the inner cylinder. Neglect end effects (i.e., bending of field lines at the ends).

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

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41. Describe schematically the equipotential surfaces corresponding to

(a) a constant electric field in the z-direction,

(b) a field that uniformly increases in magnitude but remains in a constant (say, z) direction,

(c) a single positive charge at the origin, and

(d) a uniform grid consisting of long equally spaced parallel charged wires in a plane.

42. A small sphere of radius r_1 and charge q_1 is enclosed by a spherical shell of radius r and charge q_2 Show that if q_1 is positive, charge will necessarily flow from the sphere to the shell (when the two are connected by a wire) no matter what the charge q_2 on the shell is.

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43. The top of the atmosphere is at about 400 kV ,with respect to the surface or the earth, corresponding to an electric field that decreases with altitude. Near the surracc of the earth, chc field is about 100 Vm^{-1}. Why then do we not get an electric shock as we step out of our house into the open ? (Assume lhe house to be a steel cage so there is no field inside) .

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

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45. The discharging current in the atmosphere due to the small conductivity of air is known to be 1800 A on an average over the globe. Why then does the atmosphere not discharge itself completely in due course and become electrically neutral ? In other words, what keeps the atmosphere charged?

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46. What are the forms, of energy into which the electrical energy of the atmosphere is dissipated during a lightning ?

(Hint : The earth has an electric field of about 100 Vm^{-1} at its surface In the downward direction, corresponding to a surface charge density = $-10^{-9}cm^{-2}$. Due to the slight conductivity of the atmosphere up to about 50 km (beyond which it is good conductor), about + 1800 C is pumped every second into the earth as a whole. The earth, however, does not get discharged since thunderstorms and lightning occurring continually all over the globe pump an equal amount of negative charge on the earth).

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Section B Numerical From Darpan Based On Textbook

1. An electric field is represented by $\overrightarrow{E} = \mathrm{Ax}\hat{i}$ where A = $10\frac{V}{m^2}$. Find the potential of the origin with respect to the point (10,20) m.

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2. Charge Q is distributed uniformly over a non conducting sphere of radius R. Find the electric p-0tential at distance r from the centre of the sphere r $(r < R)$. The electric field at a distance r from the centre of the sphere is given as $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{R^3}\hat{r}$. Also find the potential at the centre of the sphere .

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3. Prove that the force acting on one plate due to the other in a parallel plate capacitor is $F = \frac{1}{2}\frac{CV^2}{d}$.

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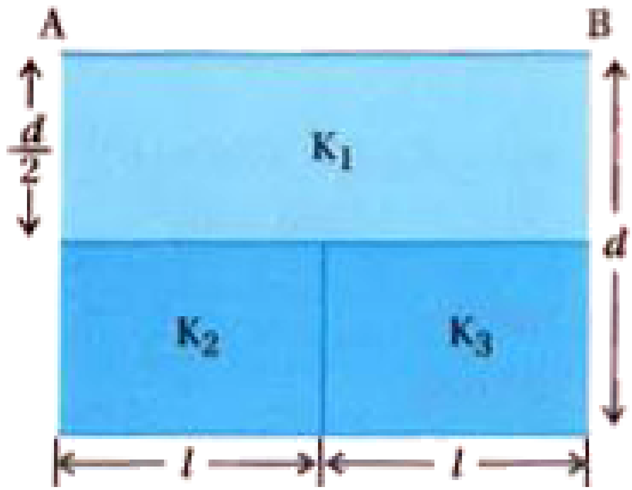
4. Find the capacitance of the capacitor shown in the figure. Area of AB is A. K_1, K_2, K_3 are dielectric constants of respective materials



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5. A substance has a dielectric constant 2.0 and its dielectric strength is 20×10^6 V/m . It is taken as a dielectric material in a parallel plate capacitor. The minimum area of its each plate such that its capacitance becomes $8.85 \times 10^{-2} \mu F$ and it can withstand a potential difference of 2000 V is ......

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6. In a certain region, the electric potential is given by the formula V (x, y, z) = $2x^2y + 3y^3z - 4z^4x$. Find the components of electric field and the vector electric field at point (1, 1, 1) in this field.

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7. A spherical drop of water bas 3×10^{10} C amount of charge residing on it. 500 V electric potential exists on its surface. Calculate the

radius of this drop. If eight such drops (having identical charge and radii) combine to form a single drop, calculate the electric potential on the surface of the new drop. $(k = 9 \times 10^9$ SI)

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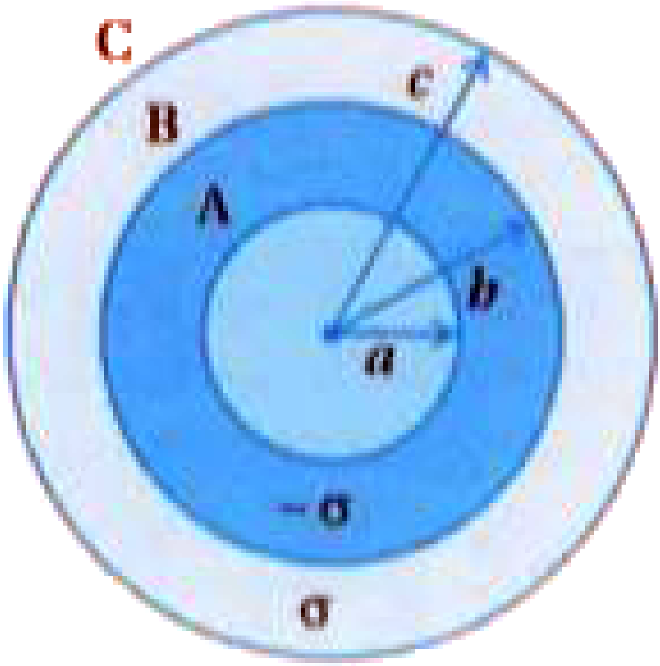
8. Consider A, D and C to be the co-centric shells of metal . Their radii are a ,b and c respectively (a < b < c). Their surface charge densities are $\sigma, -\sigma$ and σ respectively. Calculate the electric potential on the surface of shell A.



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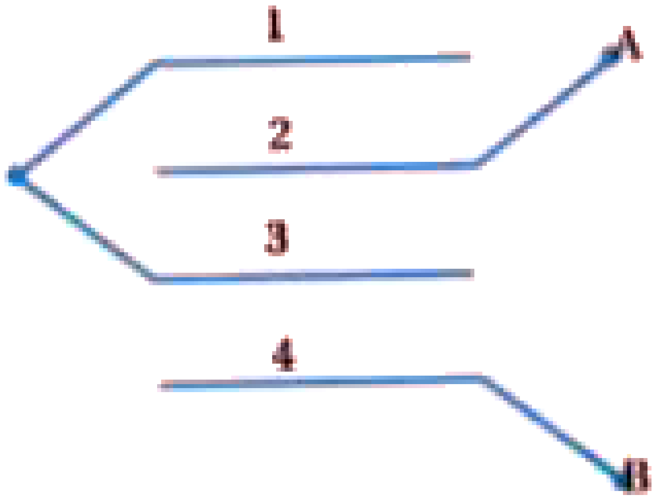
9. The area of each plate shown In the figure is A and the distance between consecutive plates is d. What is the equivalent capacitance between points A and B ?



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10. A point P, is 40 m away from charge 2 μ C and 20 m away from charge 4 μC. Find the electric potential at point P. How much work to be done for a charge ot - 0.4 C brought from infinity to point P ?

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11. Two charges 2 C and 3 C are located 100 m apart. At what point on the line joining the two charges is the electric potential zero ? Take the potential at infinity to be zero. .

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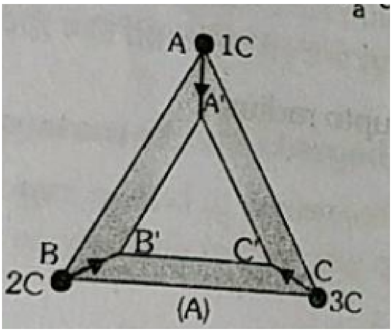
12. Three point charges 1 C, 2 C and 3 C are placed at the corners of a equilateral triangle. The length of triangle is 1 m. What would be the work required to put these charge on the corner of an equilateral triangle of length 0.5 m ?



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13. Determine the electrostatic potential energy of a system consisting of two charges 6 μC and - 3 μC (and with no external field) placed at (-9 cm, 0, 0) and (9 cm, 0, 0) respectively.

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14. How much work is required separate the two charges infinitely away from each other ?

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15. Suppose that the same system of charge is now placed in an external electric field E = A(l/ r^2), $A = 9 \times 10^5 cm^{-2}$. What would the electrostatic energy of the configuration be ?

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16. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-30} Cm. A mole of this substance is polarised (at low temperature) by applying a strong electrostatic field of magnitude $10^7 vm^{-1}$. The direction of the field is suddenly changed by an angle of 60°. Estimate the heat released by the substance in aligning its dipole along the new direction of the field. For simplicity assume 100 % polarisation of the sample. 1 mole $= 6 \times 10^{23}$ molecule.

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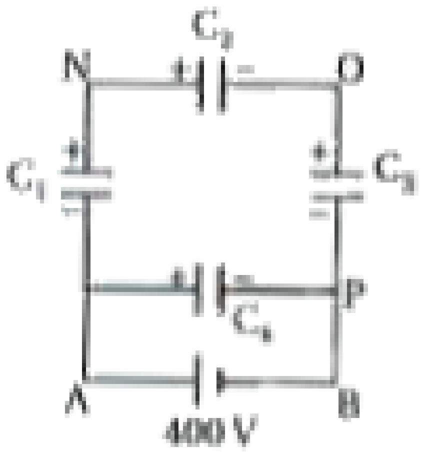
17. Determine the equivalent capacitance of the network and the charge on each capacitor.

Each capacitor having capacitance of 12 μF.



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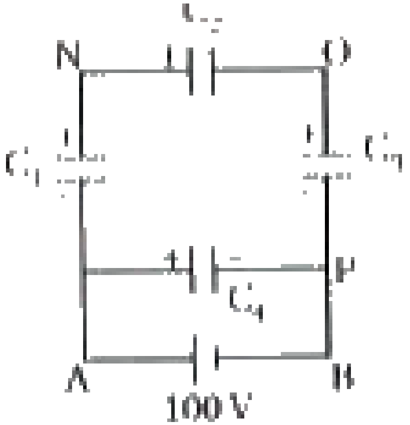
18. Determine the equivalent capacitance of the network and the charge on each capacitor.

Each capacitor having capacitance of 6 μF.



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19. A 900 pF capacitor is charged by 50 V battery. Find the electrostatic potential energy of this capacitor. (2) Now this capacitor is disconnected from the battery and connect to another equivalent capacitor, then what is the total electrostatic energy stored by the system respectively ?

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Section B Questions

1. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickless $\left(\frac{1}{2}\right)d.$ Where d is the separation of the plates . How is the capacitance changed when the slab is inserted between the plates

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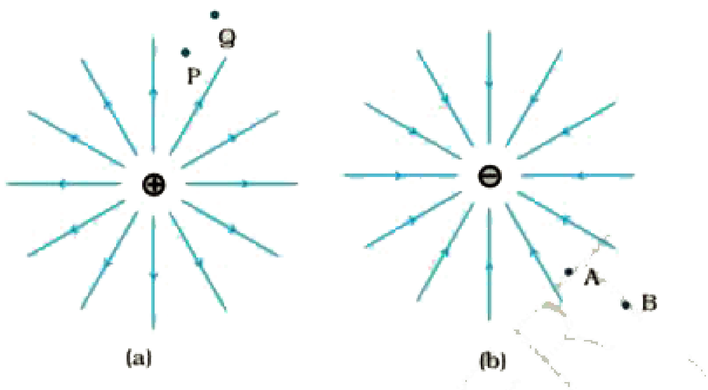
2. Figures 2.8 (a) and (b) show the field lines of a positive and negative point charge respectively.



(a) (b)

(a) Give the signs of the potential difference

$V_P - V_Q : V_B - V_A$.

(b) Give the sign of the potential energy difference of a small negative charge between the points Q and P, A and B.

(c) Give the sign of the work done by the field in moving a small positive charge from Q to P.

(d) Give the sign of the work done by the external agency in moving a small negative charge from B to A.

(e) Does the kinetic energy of a small negative charge increase or decrease in going from B to A?

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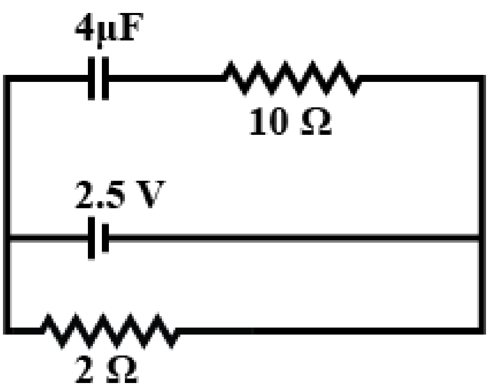
Section C Ncert Exemplar Solution Multiple Choice Questions Mcqs

1. A capacitor of 4 μF is connected as shown in the circuit as per figure. The internal resistance of the batlery is 0.5 Ω. The amount of charge on the capacitor plates will be:



(a) $0\mu C$

(b) $4\mu C$

(c) $16\mu C$

(d) $8\mu C$

A. $0\mu C$

B. $4\mu C$

C. $16\mu C$

D. $8\mu C$

Answer: C

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2. A positively charged particle is released from rest in an unform electric field. The electric potential energy of the charge

A. remains a constant because the electric field is uniform.

B. increases because the charge moves along the electric field.

C. decreasases because the charge moves along the electric field

D. decreases because the charge moves opposite to the electric field.

Answer: A::B::C::D

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3. Figure shows some equipotential line distributed in space. A charged object is move from point A point B.

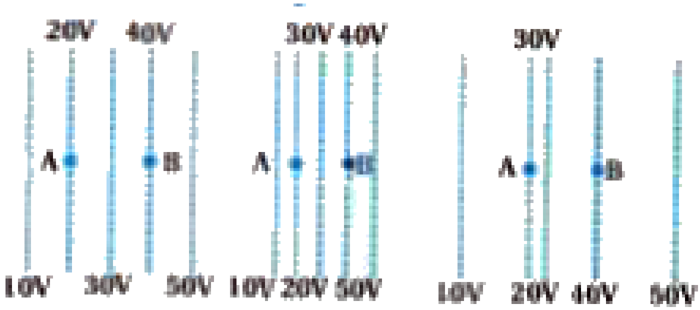

Figure (I) Figure (II) Figure (III)

A. The work done in figure (I) is the greatest

B. The work done in figure (ii) is least.

C. The work done is the same in figures (i), (ii), (iii).

D. The work done in figure (iii) is greater than figure (ii) but equal to that in figure (i).

Answer: A::D

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4. The electrostatic potential on the surface of a charged conducting sphere is 100V. Two statements arc made in this regard :

S_1 : At any point inside the sphere, electric intensity is zero.

S_2 : At any point inside the sphere, the '

electrostatic potential is 100V .

Which of the following is a correct statement ?

A. S_1 is true but s_2 is false

B. Both S_1 and S_2 are false.

C. S_1 is true S_2 is also true and S_1 is the cause of S_2

D. S_1 is true S_2 is also true but the statements are independent.

Answer: A::B::C::D

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5. Equipotential at a great distance from a collection of charges whose total sum is not zero are approximately

A. spheres

B. planes

C. paraboloids

D. ellipsoids

Answer:

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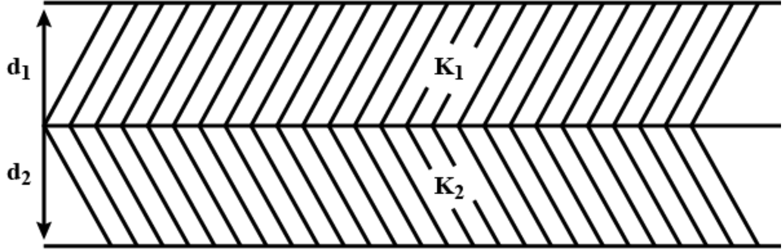
6. A parallel plate capacitor is made of two dielectric blocks in series. One of the blocks has thickness d_1 and dielectric constant k_1 and the other has thickness d_2 and dielectric constant k_2 as shown in figure. This arrangement can be thought as a dielectric slab of thickness d = $(d_1 + d_2)$ and effective dielectric constant k. The k is ......



(a) $\dfrac{K_1 d_1 + K_2 d_2}{d_1 + d_2}$

(b) $\dfrac{K_1 d_1 + K_2 d_2}{K_1 + K_2}$

(c) $\dfrac{K_1 K_2 (d_1 + d_2)}{(K_1 d_2 + K_2 d_1)}$

(d) $\dfrac{2K_1 K_2}{K_1 + K_2}$

A. $\dfrac{K_1 d_1 + K_2 d_2}{d_1 + d_2}$

B. $\dfrac{K_1 d_1 + K_2 d_2}{K_1 + K_2}$

C. $\dfrac{K_1 K_2 (d_1 + d_2)}{(K_1 d_2 + K_2 d_1)}$

D. $\dfrac{2K_1 K_2}{K_1 + K_2}$

Answer: C

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7. Consider a uniform electric field in the $\hat{z}$ direction. The potential is a constant

A. in all space

B. for any x for a given z.

C. for any y for a given z.

D. on the x-y plane for a given z.

Answer: B::C::D

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8. Equipotential surfaces,

A. Are closer in regions of large elelctric fields compared to regions of lower electric fields

B. will be more crowded near sharp edges of a conductor.

C. will be more crowded near regions of large charge densities.

D. will always be equally spaced.

Answer: A::B::C

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9. The work done to move a charge along equipotential from A to B

A. cannot be defined as $-\int_A^B Edl$

B. must be defined as $-\int_A^B$ E dl

C. is zero

D. can have a non zero value

Answer: C

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10. In a region of constant potential

A. the electric field is uniform

B. the electric field is zero

C. there can be no charge inside the region.

D. the electric field shall necessarily change if a charge is placed outside the region.

Answer: B::C

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11. In the circuit shown in figure initially key K_1 is closed and key K_2 is open. Then K_1 is opened and K_2 is closed (order is important).

Take Q_1 and Q_2 as charges on C_1 and C_2 and V_1 and V_2 as voltage respectively. Then,

(a) Charge on C_1 gets redistributed such that

$V_1 - V_2$

(b) Charge on C_1 gets redistributed such that

$Q_1 = Q_2$

(c) Charge on C_1 gets redistributed such that

$C_1V_1 + C_2V_2 = C_1E$

(d) Charge on C_1 gets redistributed such that

$Q_1 + Q_2 = Q$

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

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

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

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

Answer: A::D

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12. If a conductor has a potential V $\neq$ 0 and there are no charges anywhere else outside, then

A. there must be charges on the surface of inside itself

B. there cannot be any charge in the body of the conductor.

C. there must be charges only on the surface.

D. there must be charges inside the surface.

Answer: B::C

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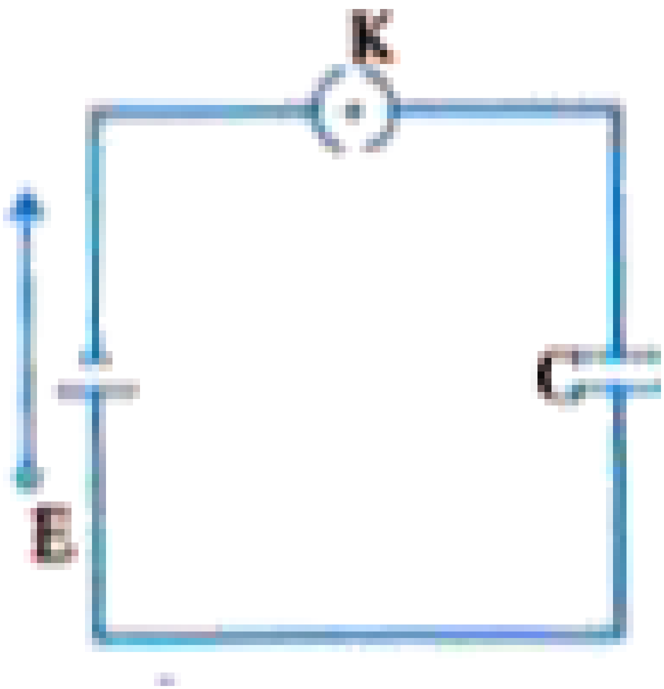
13. A parallel plate capacitor is connected to a battery as shown in figure .Consider two situations ,

(A) Key K is kept closed and plates of capacitors are moved apart using insulating handle.

(B) Key K is opened and plates of capacitors arc moved apart using insulating handle. Choose the correct optlons.



,

A. In A : Q remains same but C changes.

B. In B : E remains same but C changes.

C. In A : E remains same and hence Q changes.

D. In B : Q remains same and hence E changes.

Answer: C::D

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Section C Ncert Exemplar Solution Very Short Aswer Type Questions

1. Consider two conducting spheres of radii R_1 and R_2 with $R_1 > R_2$. If the two are at the same potential, the larger sphere bas more charge than the smaller sphere. State whether the charge density of the smaller sphere is more or less than that of the larger one.

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2. Do free electrons travel to region of higher potential or lower potential ?

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3. Can there be a potential difference between two adjacent conductors carrying the same charge ?

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4. Can the potential function have an maximum or minimum in free space ?

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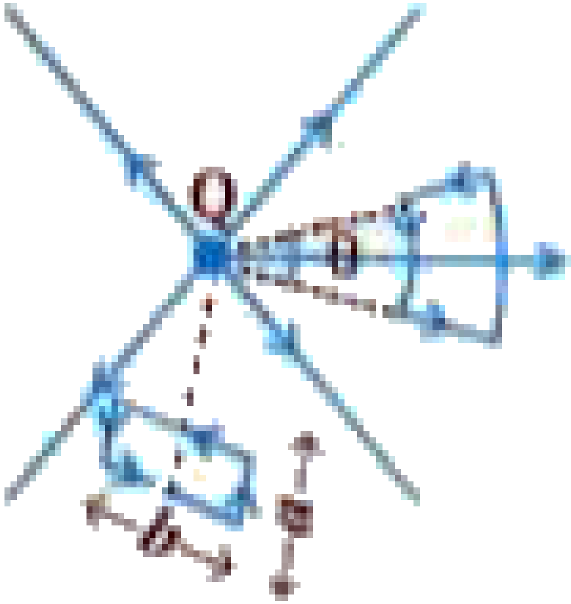
5. A test charge q is made to move in the electr field of a point charge Q along two different closed paths as per figure. First path has sections along and perpedicular to lines electric field. Second path is a rectangular loo of the same area as the first loop. How do(the work done compare in the two cases ?



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Section C Ncert Exemplar Solution Short Aswer Type Questions

1. Prove that a closed equipotential surface with no charge within ilself must enclose an equipotential volume.

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

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3. Prove that, if an insulated, uncharged conductor is placed near a charged conductor and no other conductors are present, the uncharged body must be intermediate in potential between that of the charged body and that of infinity.

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4. Calculate potential energy of a point charge - q placed along the axis due to a charge + Q uniformly distributed along a ring of radius-, R. Sketch P .F. as a function or axial distance z from the centre of the ring. Looking at graph, can you see what would happen if - q is displaced slightly from the centre of the ring (along the axis) ?

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5. Calculate potential on the axis of a ring due to charge Q uniformly distributed along the ring of radius R.

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Section C Ncert Exemplar Solution Long Answer Type Questions

1. Find the equation of the equipotential for an infinite cylinder of radius r_0 carrying charge of linear density λ.

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2. Two point charges of magnitude + q and - q are placed at $\left(-\frac{d}{2}, 0, 0\right)$ and $\left(\frac{d}{2}, 0, 0\right)$. respectively. Find the equation of the equipotential surface where the potential is zero.

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

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4. A capacitor is made of two circular plates of radius R each, separated by a dJstance $d << R$. The capacitor is connected to a constant voltage. A th.in conducting disc of radius $r << R$ and thickness $t << R$ is placed at a centre of the bottom plate. Find the minimum voltage required to lift the disc if the mass of the disc is m.

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5. In a quark model of elementary particles a neutron is made of one up quarks is made of one up quarks

[charge $\frac{2}{3}$e] and two down quarks [charges $-\frac{1}{3}e$]. Assume that they have a triangle configuration with slde length of the order of 10^{-15} m. Calculate electrosatic potential energy of neutron and compare it with it, mass 939 MeV.

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6. Repeal above exercise for a proton which is made of two up and one down quark.

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7. Two metal spheres, one of radius R and the other of radius 2R, both have same surfac charge density σ. They are brought in contac and separated. What will be new surface charge densites on them ?

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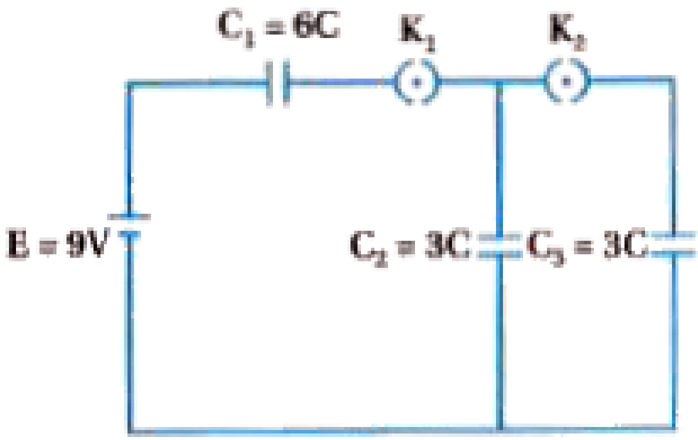
8. In the circuit shown in figure, initially K_1 is closed and K_2 is open. What are the charges on each capacitors ? Then K_1 was opened and K_2 was closed (order is in important), what will be the charge on each capacitor now? (C = 1 μF]



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9. Calculate potential on the axis of a disc of radius R due to a charge Q uniformly distributed on its surface.

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10. Two charges q_1 and q_2 are placed at (0, 0, d) and (0, 0, - d) respectively. Find locus or points where the potential is zero.

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11. Two charges - q each are separated by distanc · 2d. A third charge + q is kept at mid point C Find potential energy of + q as a function small distance x from O due to - q charges Sketch P.E. v/s x and convince yourself that the, charge at O is in an unstable equilibrium.

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

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Section D Multiple Choice Questions Mcqs

1. When a unit positive charge moves from one point to another point in an electric field, work done on it ......

A. is zero.

B. depends on positions of those two points.

C. depends on the path, joining those two points.

D. does not depend on the positions of those two points.

Answer: D

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2. Electric force on an electron, in an electric field is ....

A. in the direction of electric field

B. zero

C. in the direction, opposite to electric field

D. perpendicular to electric field

Answer: C::D

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3. When a proton moves opposite to electric field, work done on it by electric field is ..... . and electrostatic potential energy of proton ......,

A. negative, increases

B. negative, decreases

C. positive, increases

D. positive, decreases

Answer: A::C

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4. When a negative charge is moved from surface of Earth to a certain height, its gravitational potential energy ....

A. remains constant

B. increases

C. decreases

D. would become infinite

Answer: A::C

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5. A moving electron approaches another electron. What would be the change in the potential energy of this system ?

A. Remains constant

B. Increases

C. Decreases

D. May increase or decrease

Answer: A::C

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6. When a charged conductor is placed In an external electric field, inside the conductor we have ....

A. $E \neq 0, V \neq 0$

B. $E = 0, V \neq 0$

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

D. $E = 0, V = 0$

Answer:

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7. Electrostatic potential can be defined at any - point in the electric field because electric field is

A. conseivative

B. non-conservative

C. scalar

D. always uniform

Answer: A::C

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8. Electrostatic potential at some point in the clecLric field means ...... of unit ...... charge at that point.

A. negative, electrostatic potential energy

B. positive, electrostatic potential energy

C. negative, total energy

D. positive, total energy

Answer: A::C

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9. At points P and Q, two identical charges each q are placed. When we move from P to Q (oa - the line joining them), electrostatic potential

A. goes on decreasing

B. goes on increasing.

C. first goes on decreasing, then after becoming 1ninimum, it goes on increasing.

D. first increases, becomes maximum and then decreases.

Answer: A::B::C::D

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10. Inside a uniformly charged spherical shell, electric field is ...... and electrostatic potential is .....

A. equal, zero

B. equal, equal

C. zero, equal

D. zero, zero

Answer: A

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11. Electrostatic potential at one point is V. Then electric field along X-axis can be written as $\vec{E}_x$ =..........

A. $\int_0^{\infty} V dx \hat{i}$

B. $\frac{dV}{dx} \hat{i}$

C. $-\frac{dV}{dx} \hat{i}$

D. $-\int_0^{\infty} V dx \hat{i}$

Answer: A::D

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12. Surface of Earth is considered at ...... gravitational potential (in practice).

A. infinite

B. negative

C. positive

D. zero

Answer:

Watch Video Solution

13. Electric field is directed along the direction in which rate of electric potential is ....

A. decrease fastest

B. decrease slowest

C. increase fastest

D. increase, slowest

Answer: A::C::D

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14. A proton is moving away from an electron, then find the change in potential energy of the system.

A. decreases

B. increases

C. remains constant

D. may decrease or increase

Answer: A::C

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15. Unit of line integration of electric field is ......

A. Vm^{-1}

B. JC^{-1}

C. NC^{-1}

D. Vm

Answer: A::C

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16. The line integral or an electric field along the circumference of a circle of radius r, drawn with a point charge Q at the centre will be.........

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

B. $\frac{Q}{2\varepsilon_0 r}$

C. Zero

D. $2\pi Qr$

Answer:

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17. 2C electric charge Is displaced from a point of electric potential -20 V to some other point.

The work done is 200 J, then electric potential of second point V_2 = ... volt.

A. 60

B. 80

C. 180

D. 220

Answer:

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18. The work done by carrying, unit positive charge in an electric field under repulsive force from infinity to a given point, its ......

A. kinetic energy increases

B. kinetic energy decreases

C. potential energy decreases

D. mechanical energy increases

Answer: A::C::D

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19. Which one of the following is not a unit of electric potential ?

A. JC^{-1}

B. V

C. W

D. NmC^{-1}

Answer:

Watch Video Solution

20. Give dimensional formula of electric potential.

A. $M^1L^{-2}T^{-3}A^{-1}$

B. $M^1L^2T^3A^{-1}$

C. $M^1L^2T^{-3}A^1$

D. $M^1L^2T^{-3}A^{-1}$

Answer: A::B::C

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21. A particle having mass m and charge q is , rest. On applying a uniform electric field E it, it starts moving. What is its kinetic energ when it travels a distance y in the direction force ?

A. qE^2y

B. qEy^2

C. qEy

D. q^2Ey

Answer:

Watch Video Solution

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22. For a uniform electric field $\overrightarrow{E} = E_0(\hat{i})$, if the electric potential at x = 0 is zero, then the vaJut of electric potential at x = +x will be ..... .

A. xE_0

B. $-xE_0$

C. x^2E_0

D. $-x^2E_0$

Answer:

Watch Video Solution

23. The work done by the charge Q through displacement $\Delta \overrightarrow{r} = a\hat{i} + b\hat{j}$ in electric field $\overrightarrow{E} = E_1\hat{i} + E_2\hat{j}$ is ....

A. $Q[E_1a + E_2b]$

B. $Q\left[\sqrt{(E_1a)^2 + (E_2b)^2}\right]$

C. $\dfrac{Q(E_1 + E_2)}{\sqrt{a^2 + b^2}}$

D. $Q\left(\sqrt{E_1^2 + E_2^2}\right)\sqrt{a^2 + b^2}$

Answer: A::B

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24. What is the diameter of sphere of 4V potential kept near the points situated at same distance from an electron ?

A. $14.4A^{\circ}$

B. $7.2A^{\circ}$

C. $1.4A^{\circ}$

D. $0.7A^{\circ}$

Answer: A::B

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25. Two spheres or different radii are given equal amount of charge. The electric potential will be ....

A. Equal on surface of both spheres

B. More on the surface of larger sphere

C. More on the surface of smaller sphere

D. Dependent on the mass of spheres

Answer: A::B::C::D

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26. Charges on two spherical shells of radius r_1 and r_2 are same, then ratio of their electric potential ,will be ......

A. $\dfrac{r_1^2}{r_2^2}$

B. $\dfrac{r_1^2}{r_1^2}$

C. $\dfrac{r_1}{r_2}$

D. $\dfrac{r_2}{r_1}$

Answer: A::B

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27. Two metallic sphenrs of radil R_1 and R_2 are charged. Now they are brought into contact with each other with conducting wire and then separated. If the electric fields on their surfaces are E_1 and E_2 respectively $\frac{E_1}{E_2}$ = ...

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

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

C. $\frac{R_2^2}{R_1^2}$

D. $\frac{R_1^2}{R_2^2}$

Answer: A::B

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28. Electric field on surfaces of two spheres of radius r_1 and r_2 are same, then ratio of their electric potential will be ....

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

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

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

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

Answer: A::B

Watch Video Solution

29. Surface churgc densities on the spheres of radius r_1 and r_2 are same, then ratio of their electric potential will be ....

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

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

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

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

Answer: A::B

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30. Potenlials of points P and Q are 10V and -4 V respectively. Work done in taking 100 electrons from P to Q ....

A. $22.4 \times 10^{-16} J$

B. $2.24 \times 10^{-16} J$

C. $-9.6 \times 10^{-17} J$

D. 9.6×10^{-17} J

Answer: A::B::D

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31. A point P al a certain distance from charge Q has electric potential 600 V and elecuic field intensity 150 N/C, lhen distance of point from charge Q is ...... M.

A. 4

B. 2

C. 3.2

D. 6.5

Answer: D

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32. The spheres of radius r and R having charge q and Q respectively on them . When they are joined with conducting ,wire, the energy of this system does not dissipated then ....

A. qr= QR

B. qR=Qr

C. $qr^2 = QR^2$

D. $qR^2 = Qr^2$

Answer:

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33. The spherical shell has radius r. The potential difference V is between centre to distnnce 3r. The electric field at a distance 3r will be ....

A. $\frac{V}{6r}$

B. $\frac{V}{4r}$

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

D. $\frac{V}{2r}$

Answer:

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34. The radius of a charged hollow sphere is 10 cm. If V is the potential of a point away from 5 cm from the centre of sphere, then what will be potential of a point away from 15 cm from the centre of sphere ?

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

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

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

D. 3V

Answer: B::C

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35. Electrostatic potential is ...... physical quantity.

A. scalar and dimensionless

B. vector and dimensionless

C. scalar with dimensions

D. vector with dimensions

Answer: A::C::D

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36. Kinetic energy of a charged particle decreases by 100 J when it is brought from a point of 100 V potential to a point of 200 V potential, then charge of particle is ...... C.

A. 0.1

B. 1.0

C. 10

D. 100

Answer: A

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37. Electric potential at 5 can distance from centre of shell of 14 cm radius is 10 V, then potentiaJ at IO cm djstance from centre will be

....

A. zero

B. 5V

C. 10 V

D. 20 V

Answer: A

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38. A particle having mass 1 g and electric charge $10^{-8}C$ travels from a point A having electric potential 600 V to the point B having zero potential. What would be the change in its kinetic energy ?

A. -6×10^{-6} erg

B. -6×10^{-6}J

C. 6×10^{-6} J

D. 6×10^{-6} erg

Answer: A

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39. The electric potential due to any point electric dipole varies as ....

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

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

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

D. r^2

Answer: A::B

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

A. zero

B. -3J

C. 4J

D. 10J

Answer:

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41. The dipole moment of a dipole is 4×10^{-9} Cm. The po1ential of a point away from 0.2 rn, the direction maJting an angle 60° with axis of dipole is ....

A. 4.5V

B. 45 V

C. 450 V

D. 4500 V

Answer: D

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42. 10 μC charge Is placed on each vertex of equilateral triangle of 10 cm side. Electric potential energy of system is ......

A. 100 J

B. 27 J

C. zero

D. infinte

Answer: B

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43. For a point on the axis of the electric dipole $\theta = 0$ and $\theta = \pi$ = ... , ...

A. $-\frac{kP}{r^2}, +\frac{kP}{r^2}$

B. $+\frac{kP}{r^2}, -\frac{kP}{r^2}$

C. 0,0

D. $+\frac{kP}{r}, \ -\frac{kP}{r}$

Answer: B

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44. Potential energy of an electric dipole is minimum (Negatively maximum) when ....

A. The dipole is perpendicular to the field

B. The dipole is parallel to the field

C. The dipole is antiparallel to the field.

D. The dipole moment makes 60° with the field.

Answer: A::B::C::D

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45. When a n electric dipole is in st able equilibrium, in uniform electric field, its electrostatic potential energy is ......

A. $-pE$

B. pE

C. 0

D. $\propto$

Answer:

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46. A surface, value of electric potential on whichis same at all the points, is called ...... surface.

A. Gaussian

B. Amperian

C. Equipotential

D. Equifield

Answer: A::B::D

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47. Angle between equipotential surface and electric field is ......

A. π

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

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

D. 0

Answer: B

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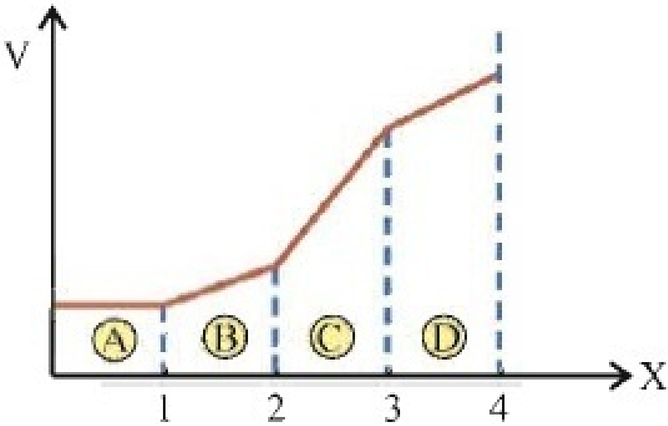
48. A V - X graph for an electric field in X-direction is shown in the figure. In which region is the magnitude of electric field maximum ?



(a) A

(b) B

(c) C

(d) D

A. A

B. B

C. C

D. D

Answer: C

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49. Uniformly polarised dielectric has ...... of induced charge.

A. linear charge density

B. surface charge density

C. volume charge density

D. none of above

Answer: A::C::D

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50. $C^2 mN^{-1}$ is unit of ....

A. electric susceptibility

B. Polarizability

C. dipole moment

D. permittivity of medium

Answer: A::B

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51. Value of dielectric constant of metal is.......

A. zero

B. 1

C. any value greater than 1

D. infinite

Answer:

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52. Which of the following atoms has permanent electric dipole moment zero ?

A. HCl

B. H_2O

C. NO_2

D. H_2

Answer: B

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53. Which of the following atoms behave as polar dielectric ?

A. H_2 and H_2O

B. O_2 and H_2O

C. CO_2 and H_2O

D. HCl and H_2O

Answer: A::B::C::D

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54. The charge 3.0×10^{-5} C are placed on a metal sphere of radius 3.0 m, then the energy stored in it will be ....

A. $\frac{3}{8\pi} \in_0 \times 10^{10} J$

B. $\frac{3}{8\pi \in_0} \times 10^{-10} J$

C. $\frac{3}{8 \in_0} \times 10^{-5} J$

D. $\frac{8 \in_0}{3} \times 10^{5} J$

Answer: A::C

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55. A parallel plate capacitor is charged and then isolated. Now a dielectric slab is Introduced in it. Which of the following quantities will remain constant ?

A. Electric charge Q

B. Potential difference V

C. Capacitance C

D. Energy U

Answer: A::C

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56. A parallel plate capacitor is charged with a battery and then separated from it. Now if the distance between its two plates is increased, what will be the changes in electric charge, potential difference and capacitance respectively ?

A. remains constant, decreases, decreases

B. increases, decreases, decreases

C. remains constant, decreases, increases

D. remains constant, increases, decreases

Answer: A::C::D

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57. Which of the following one, the capacitance of parallel plate capacitor does not depend ?

A. On the area of the plate

B. On the distance between two plates

C. On the charge of the plate

D. On the shape of the plate

Answer: A::C

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58. Which of the following equation doesn't represent energy of charged capacitor ?

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

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

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

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

Answer: A::B

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59. Energy stored in capacitor is in the form of

......

A. electrical potential energy

B. magnetic energy

C. mechanical energy

D. heat energy

Answer: A::C

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60. Two plates of parallel plate capacitor are joined inside with metal rod. The capacitance of a capacitor is ....

A. zero

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

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

D. infinite

Answer:

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61. There are 10 capacitors. each of capacitance 10μF. The ratio of maximum to minimum capacitance obtained by their combination is

......

A. $5:1$

B. $10:1$

C. $50:1$

D. $100:1$

Answer: A

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62. The capacitance of a parallel capacitor is 5 μF. When glass slab inserting between two plates, its potential difference becomes $\frac{1}{8}$ the times hence the dielectric constant of a slab ......

A. 1.6

B. 5

C. 8

D. 40

Answer:

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63. 

If equivalent capacitance of given circuit is $15\mu F$ then C = ...

(a) $5\mu F$

(b) $35\mu F$

(c) $50\mu F$

(d) $60\mu F$

A. $5\mu F$

B. $35\mu F$

C. $50\mu F$

D. $60\mu F$

Answer:

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64. Capacitance of spherical capacitor is 1 μF, so its diameter = ... m. $\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 SI\right]$

A. 1.8

B. 18

C. 1.8×10^3

D. 1.8×10^4

Answer: A::D

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65. By increasing the charge on the plate of capacitor ....

A. its capacitance increases

B. p.d. between two plates increases

C. p.d. between two plates decreases

D. both option (A) and (B) increases

Answer: A::B::C::D

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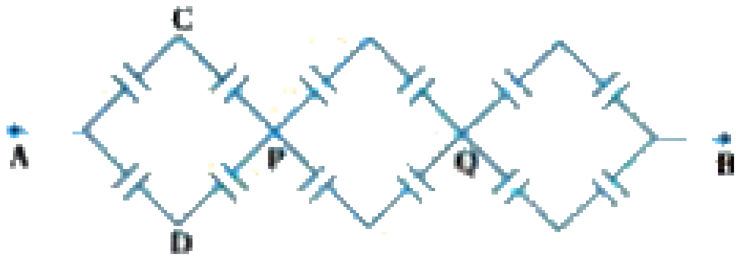
66. In the figure below the capacitance of ever capacitor is 3 μF. Find the equivalent capacitance between A and 8.



A. $1\mu F$

B. $9\mu F$

C. $\frac{1}{3}$ F

D. $12\mu F$

Answer: A

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67. 27 small drops of water having same chargt and same radius are combined to form one big drop. The ratio of capacitance of one big drop to small drop is ....

A. $2:1$

B. $3:1$

C. $1:3$

D. $1:2$

Answer: A::C

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68. If the charge on capacitor is increased by 5C, the energy stored in the capacitor is increased by 21%, what will be initial charge on the capacitor ?

A. 10 C

B. 20 C

C. 50 C

D. 40 C

Answer: C

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69. The capacitance of a variable capacitor joined with a battery of 100 V is changed from 2μF to $10\mu F$. What is the change in the energy stored in it ?

A. $2 \times 10^2 J$

B. 2.5×10^2 J

C. $6.5 \times 10^{-2} J$ J

D. 4×10^{-2} J

Answer: A::B::D

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70. 4 μF and 6 μF capacitors are joined in series and 500 V are applied between the outer plates of the system. What is the charge on each plate '?

A. $1.2 \times 10^{-3} C$

B. 6.0×10^{-3} C

C. 5.0×10^{-3}

D. 1.0×10^{-3} C

Answer: A::B::C

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71. Two spherical shells of radius 20 cm and 10 cm, having same charge of 150 μC each are connected by means of a conducting wire. What will be their common potential ?

A. 9×10^{6}

B. 4.5×10^{6}

C. 1.8×10^{6}

D. 13.5×10^{6}

Answer: A

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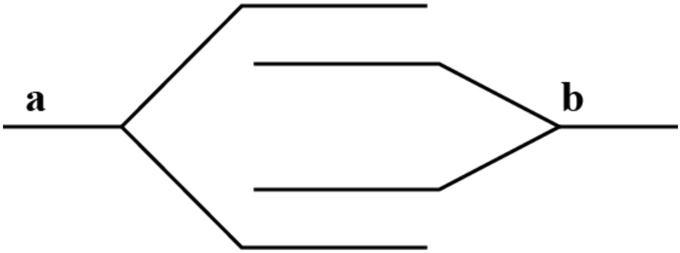
72. The area of every plate shown in the figure is A and the separation between the successive plates is d. What is the capacitance between points a and b ?



(a) $\dfrac{\varepsilon_0 A}{d}$

(b) $\dfrac{2\varepsilon_0 A}{d}$

(c) $\dfrac{3\varepsilon_0 A}{d}$

(d) $\dfrac{4\varepsilon_0 A}{d}$

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

B. $\dfrac{2\varepsilon_0 A}{d}$

C. $\dfrac{3\varepsilon_0 A}{d}$

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

Answer: A::B::D

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73. The capacitance of a parallel plate capacitor formed by the circular plates of diameter 4.0 cm is equal to the capacitance or a sphere of diameter 200 cm. Find the distance between two plates.

A. 2×10^{-4} m

B. 1×10^{-4} m

C. 3×10^{-4} m

D. 4×10^{-4} m

Answer: A::D

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74. If a capacitor having capacitance of 600 μF is charged at a uniform rate of $50\frac{\mu C}{s}$. What is the time required to increase its potential by 10 volt ?

A. 500 s

B. 6000 s

C. 12 s

D. 120 s

Answer: A::B

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75. The capacitance of a capildtor is 10 μF. The potential difference on it is 50 V. If the distance between its platsis halved, what will he the potential difference now ?

A. 100 V

B. 50 V

C. 25 V

D. 75 V

Answer: B

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76. 3 identical capacitors are joined in parallel and are charged with a battery of 10 V. Now the battery is removed and they are joined in series with each other in this condition what would be the potential difference between the freed plates in the combination?

A. 30 V

B. 10 V

C. 60 V

D. $\frac{10}{3} V$

Answer: C

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77. To get 2F capacitance, the area of each plate kept at separation of 2 mm is .... ' ($\varepsilon_0 = 8.85 \times 10^{-12}$ MKS)

A. $4 \times 10^5 m^2$

B. $4.51 \times 10^5 m^2$

C. $4.51 \times 10^8 cm^2$

D. $4.51 \times 10^8 m^2$

Answer: A::B::D

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78. Considering the earth as a metallic sphere its capacitance would be nearly ...... μF .

(R = 6400 k.m $\varepsilon_0 = 8.85 \times 10^{-12}$ SI unit)

A. $70 \mu F$

B. $7.0 \times 10^4 \mu F$

C. $7.0 \times 10^3 \mu F$

D. $700 \mu F$

Answer:

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79. If volume of Earth is V and area of Earth is A, then its capacitance will be ......

A. $4\pi\varepsilon\frac{A}{V}$

B. $4\pi\varepsilon_0\frac{V}{A}$

C. $12\pi\varepsilon_0\frac{A}{V}$

D. $12\pi \in_0 \frac{V}{A}$

Answer: A::B

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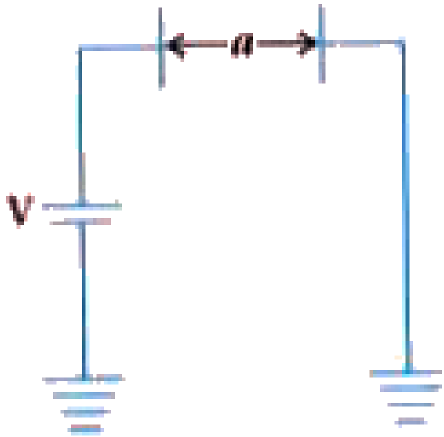
80. The distance between two plates of capacitor is d and area of each plate is A of a parallel plate capacitor. Its one plate is connected to positive terminal of battery and negative of battery is connecting to earthing. If second plate is connecting to earthing, then charge on plates will be ......



A. $\frac{\in_0 AV}{a}$

B. $\frac{3}{2}\frac{\in_0 AV}{a}$

C. $\frac{2 \in_0 AV}{a}$

D. $\frac{\in_0 AV}{2a}$

Answer: A

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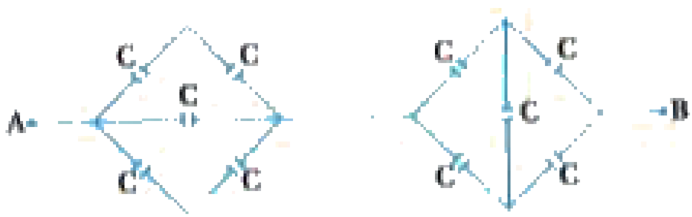
81. Find the effective capacitance between A and B or a given circuit.



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

B. C

C. 2C

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

Answer: B::C

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82. 

For a given circuit, the effective capacitance between P and U is ...... , capacitance of each capacitor is C.

A. 6 C

B. 4 C

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

D. $\frac{6}{11}C$

Answer: A::C

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83. A network of capacitors are prepared as shown in figure. Find the equivalent capacitance hetwcen A and B .

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

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

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

D. 3C

Answer: C::D

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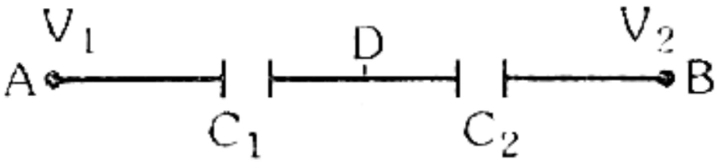
84. The potential at point D is = ... as shown

In below figure.



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

(b) $\frac{C_1V_2 + C_2V_1}{C_1 + C_2}$

(c) $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

(d) $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

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

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

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

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

Answer: A::B::C

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85. Energy of a charged capacitor is U. Now it is removed from a battery and then is connectec to another identical uncharged capacitor it parallel. What will be the energy of eacl capacitor now ?

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

B. U

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

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

Answer: D

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86. For a capacitor the distane between two plates is 4x and the electric field between them is E_0. Now a dielectric slab having dielectric constant 3 and thickkness x is placed between them in contact with one plate. In this condition what is the p.d. between its two plates ?

A. $\frac{10E_0x}{3}$

B. $\frac{11E_0x}{3}$

C. $\frac{13E_0x}{3}$

D. $\frac{9E_0x}{3}$

Answer: A::C

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87. In the beginning the space between the plates of a parallel plate capacitor contains air and thereafter it is filled up with a medium of dielectric constant K. Then ......

A. The electric field and the capacitance become K times.

B. The electric field becomes $\frac{1}{K}$ times and the capacitance becomes K times.

C. The electric field becomes K times and the capacitance becomes $\frac{1}{K}$ times.

D. The electric field and the capacitance become $\frac{1}{K}$ times

Answer: A::B::C::D

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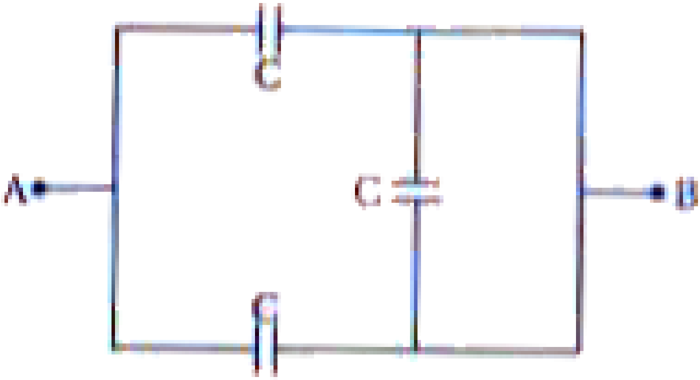
88. In the figure below, what is the equivalent capacitance between points A and B ?



A. 3 C

B. 2 C

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

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

Answer: B::C

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89. By which type of supply capacitor works ?

A. A .C. supply

B. D.C supply

C. Both

D. A.C. or D.C.

Answer: B

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90. Whichof the following represents unit Faraday ?

A. VC^{-1}

B. CV^{-1}

C. JC^{-1}

D. CJ^{-1}

Answer: A::C

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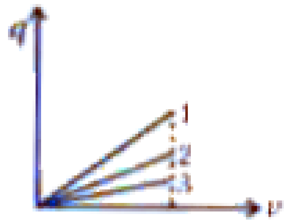
91. The the following table, the area of plates and separation benvcen the places are given. In the nearby figure, q $\rightarrow$ V graph for the,n are shown. Determine which graph is for which capacitor.

Capacitor	area	separation
C_1	A	d
C_2	$2A$	d
C_3	A	$2d$



A. $1 \rightarrow C_2 \quad 2 \rightarrow C_3 \quad 3 \rightarrow C_1$

B. $1 \rightarrow C_1 \quad 2 \rightarrow C_2 \quad 3 \rightarrow C_3$

C. $1 \rightarrow C_2 \quad 2 \rightarrow C_1 \quad 3 \rightarrow C_3$

D. $1 \rightarrow C_3 \quad 2 \rightarrow C_1 \quad 3 \rightarrow C_2$

Answer: A::B::C

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92. A : When an electric charge is distributed between two bodies , no charge is destroyed but the electrostatic energy decreases.

R : Certain energy is dissipated in the form of heat.

A. a Assertation is correct and Reason is correct and Reason explain Assertation

B. b Assertation is correct and Reason is correct and Reason is not explain Assertation

C. c Assertation is correct, Reason is incorrect

D. d Assertation and Reason are incorrect

Answer: A

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93. A : Three capacitors having $C_1 < C_2 < C_3$ are connected in parallel its effective capacitance will be $C_p > C_3$.

$$R: \frac{1}{C_P} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

A. If both assertion and reason are true and reson is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If the assertion is true but the reason are false.

D. If both the assertion and reason are false.

Answer: C

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Section D Mcqs Asked In Cometitive Exams

1. Capacitance of a capacitor 100 μ F. The work is done for depositing chargc 8×10^{-18} C on it will be ....

A. $16.10^{23} J$

B. 3.1×10^{-26} J

C. 4×10^{-10} J

D. 32×10^{-32} J

Answer: A::B::C

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2. A fully charged capacitor has a capacitance· C. It is discharged through a small ,coil of -resistance wire embedded in a thermally insulated block of specific heat capacity s and mass. If the temperature of the block is raised by ΔT, the potential difference V across the capacitance is ....

A. $\frac{ms\Delta T}{C}$

B. $\sqrt{\frac{2ms\Delta T}{C}}$

C. $\sqrt{\frac{2mC\Delta T}{s}}$

D. $\frac{mC\Delta T}{s}$

Answer: A::B::C::D

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3. Two insulating plates arc both uniformly charged in such a way that the potential difference between them is $V_2 - V_1$ = 20V (i.e. plate 2 is at a higher potential). The plate are separated by d = 0.1m and can be treated as infinitely large. An electron is released from rest on the inner surface of plate 1. What is its speed when it hits plate 2 ?

$(e = 1.6 \times 10^{-19} C m_e = 9.11 \times 10^{-31}$ kg)

A. 1.87×10^{6}m /s

B. 3.2×10^{-18}m/s

C. 2.65×10^{6} m/s

D. 7.02×10^{12} m/s

Answer: A::B

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4. An electric charge $10^{-3}\mu C$ is placed at the origin (0, 0) of X-Y co-ordinate system. Two points is A and B are situated at $(\sqrt{2}, \sqrt{2})$ and (2, 0) respectively. The potential difference between the points A and B ,will be ......

A. 9 V

B. 0 V

C. 2 V

D. 4.5 V

Answer:

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5. A battery is used to charge a parallel plate capacitor till the potential difference between the plates become equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and the work clone by the battery will be ....

A. 1

B. 2

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

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

Answer: A::B

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6. Potentials of points P and Q are 10 V and - 4 V respectively. Work done in taking 100 electrons from P to Q ....

A. $22.4 \times 10^{-16} J$

B. $2.24 \times 10^{-16} J$

C. $-9.6 \times 10^{-17} J$

D. $9.6 \times 10^{-17} J$

Answer: A::B::D

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7. Two capacitors C_1 and C_2 are charged to 120 V and 200 V respectively. It is found that by connecting them together the potential on each one can be made zero. Then

A. $5C_1 = 3C_2$

B. $3C_1 = 5C_2$

C. $3C_1 + 5C_2 = 0$

D. $9C_1 = 4C_2$

Answer: A::B::C

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8. A parallel plate capacitor is made of two circular plates separated by a distanc of 5mm and with a dielectric of dielectric constant 2.2

between them . When the electric field in the dielectric is 3×10^4V/m the charge density of the positive plate will be close to :

A. $3 \times 10^4 C / m^2$

B. $6 \times 10^4 C / m^2$

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

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

Answer: A::B::C

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9. Assum that an electric field $\overrightarrow{E} = 30x^2\hat{i}$ exists in space. Then the potential difference $V_A - V_0$, where V_0 the potential at the origin and V_A the potential at x = 2 m is :

A. -80 J

B. 80 J

C. 120 J

D. -120 J

Answer:

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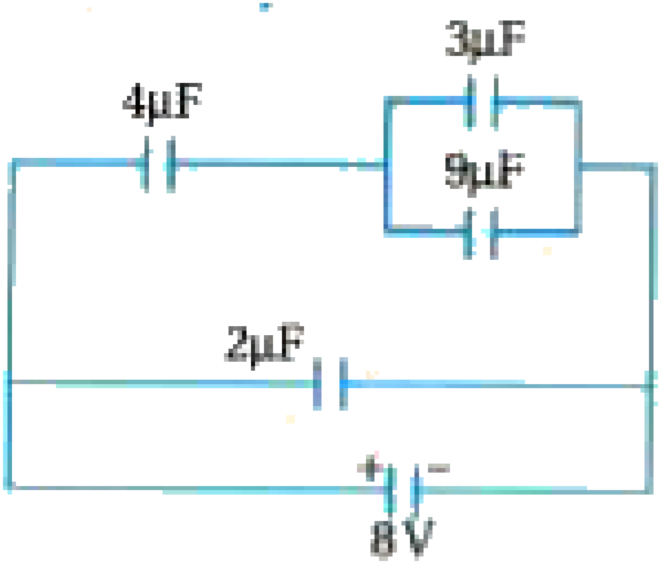
10. A combination of capacitors is set up as shown in the figure. The magnitude of the electric field, due of a point charge Q (having a charge equal to the sum of the charges on the 4 μF and 9 μF capacitors), at a point distant 30 m from it, would equal :



A. $240\frac{N}{C}$

B. $360\frac{N}{C}$

C. $420\frac{N}{C}$

D. $480\frac{N}{C}$

Answer: B::C::D

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11. An electrical technician requires a capacitance,of 2 μF in a circuit across a potential difference of 1 kV. A large number of

$1\mu F$ capacitors are available to him each of which can withstand a potential difference of more than 400 V. Suggest a possible arrangement that requires the minimum number of capacitors .

A. 24

B. 32

C. 2

D. 16

Answer: B::C

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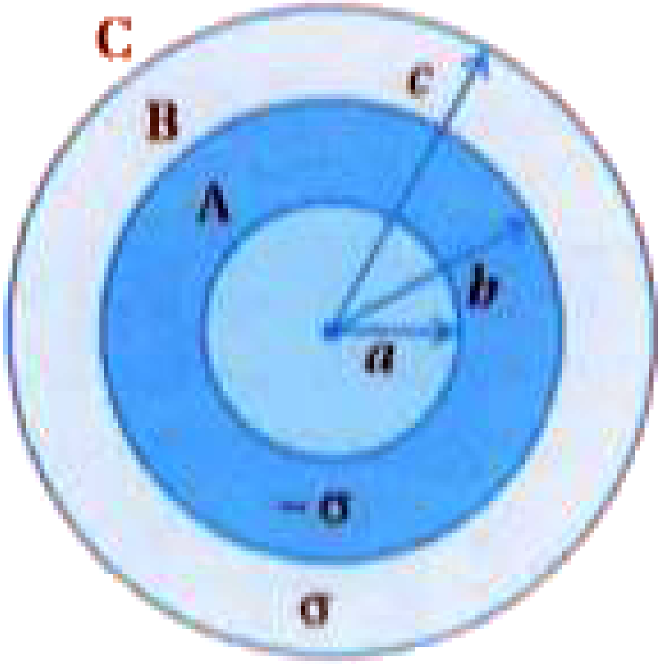
12. Consider A, D and C to be the co-centric shells of metal . Their radii are a ,b and c respectively (a < b < c). Their surface charge densities are $\sigma, -\sigma$ and σ respectively. Calculate the electric potential on the surface of shell A.



A. $\dfrac{\sigma}{\varepsilon_0}\left[\dfrac{a^2-b^2}{a}+c\right]$

B. $\dfrac{\sigma}{\varepsilon_0}\left[\dfrac{a^2-b^2}{b}+c\right]$

C. $\dfrac{\sigma}{\varepsilon_0}\left[\dfrac{a^2-b^2}{b}+a\right]$

D. $\dfrac{\sigma}{\varepsilon_0}\left[\dfrac{a^2-b^2}{c}+a\right]$

Answer: A::B::C

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13. A parallel plate capacitor of capacitance 90 pF is connected to a battery of emf 20 V. If a dielectric material of dielectric constant $K = \frac{5}{3}$ is inserted between the plates the magnitude of the charge will be :

A. 1.2 nC

B. 0.3 n C

C. 2.4 n C

D. 0.9 n C

Answer: A::B::C

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14. A 60 pF capacitor is fully charged by a 20 V supply. It is then disconnected from the supply and is connected to another uncharged 60 pF capacitor in parallel. The electrostatic energy that is lost in this process by the time the charge is redistributed between them is (in nJ)

A. 30

B. 15

C. 12

D. 6

Answer:

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15. If two capacitors C_1 and C_2 are connected in a parallel combination then the equivalent capacitance is $10\mu F$. If both the capacitors are connected across a I V battery, then energy stored in C_2 is 4 times of that in C_1. The equivalent capacitance if they are connected in series is

A. $16\mu F$

B. $1.6\mu F$

C. $4\mu F$

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

Answer: A

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16. If the electric field around a surface is given by

$\left|\vec{E}\right| = \frac{Q}{E_0\left|\vec{A}\right|}$ where $\vec{A}$ is the normal area of surface and Q_{in} is the charge enclosed by the surface. This relation of Gauss's law is valid when

A. the surface is equipotential.

B. the magnitude of the electric field is constant.

C. the magnitude of the electric field is constant and the surface is equipotential.

D. for all the Gaussian surfaces.

Answer: A::C::D

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

A. (A) The energy stored in the capacitor decreases K times.

B. (B) The change in energy stored is

$$\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$$

C. (C) The charge on the capacitor is not conserved.

D. (D) The potential difference between the plates decreases K times.

Answer: A::C::D

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18. A parallel plate air capacitor has capacity 'C' distance of separation between plates is 'd' and potential difference 'V' is applied between the plates force of attraction between the plates of the parallel plate air capacitor is :

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

B. $\frac{C^2V^2}{2d}$

C. $\frac{CV^2}{2d}$

D. $\frac{CV^2}{d}$

Answer: B::C::D

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19. In a certain region, the electric potential is given by the formula V(x ,y, z) = 6xy - y + 2yz Find the components of electric field and the vector electric field at point (1, 1, 0) in this field. Find the vector of electric at (1, 1, 0).

A. $-\left(6\hat{\imath}+9\hat{\jmath}+\hat{k}\right)$

B. $-\left(3\hat{\imath}+5\hat{\jmath}+3\hat{k}\right)$

C. $-\left(6\hat{\imath}+5\hat{\jmath}+2\hat{k}\right)$

D. $-\left(2\hat{\imath}+3\hat{\jmath}+\hat{k}\right)$

Answer: A::B

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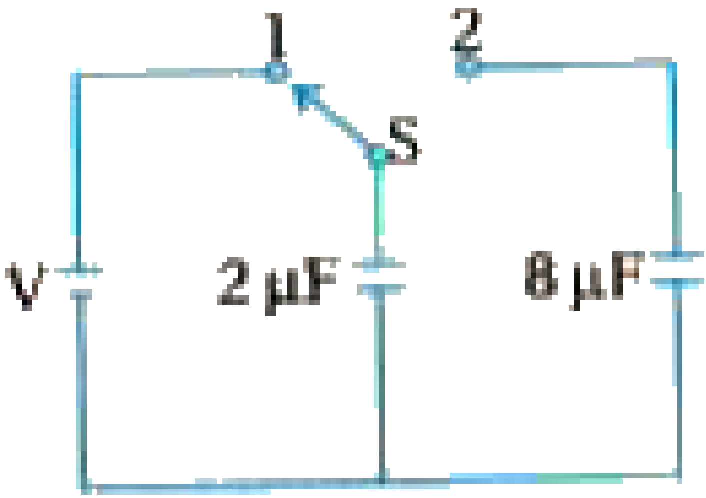
20. A capacitor of 2 μF is charged as shown in the diagram . When the switch S is turned to position 2, the percentage of its stored energy dissipated is



A. $20\ \%$

B. $75\ \%$

C. $80\ \%$

D. $0\ \%$

Answer:

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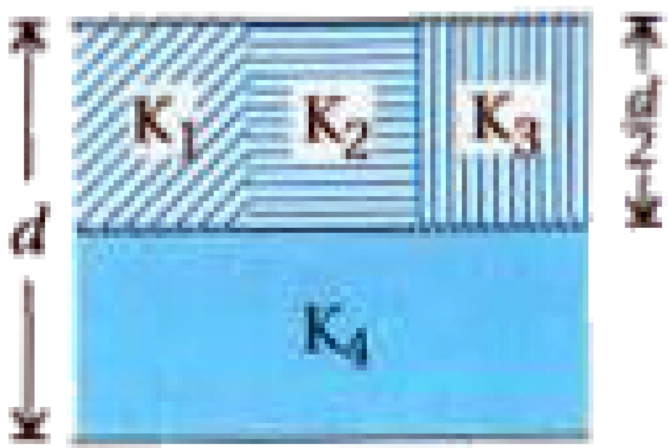
21. A parallel-plate capacitor of area A, plate separation d and capacitance C is filled with four dielectric ,materials having dielectric constants K_1, K_2, K_3 and K_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then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



A. $\dfrac{2}{K} = \dfrac{3}{K_1 + K_2 + K_3} + \dfrac{1}{K_4}$

B. $\dfrac{1}{K} = \dfrac{1}{K_1} + \dfrac{1}{K_2} + \dfrac{1}{K_3} + \dfrac{3}{2K_4}$

C. $K = K_1 + K_2 K_3 + 3K_4$

D. $K = \frac{2}{3}[K_1 + K_2 + K_3] + 2K_4$

Answer: A::B::C::D

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22. A molecule of a substance has permanent dipole moment p. A mole of this substance is polarised by applying a strong electrostatic field E. The direction of the field is suddenly changed by an angle of 60°. If N is the

Avogadro's nwnber the amount of work done by the field is ......

A. 2 NpE

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

C. NpE

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

Answer: A::B

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

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

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

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

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

Answer: A::B

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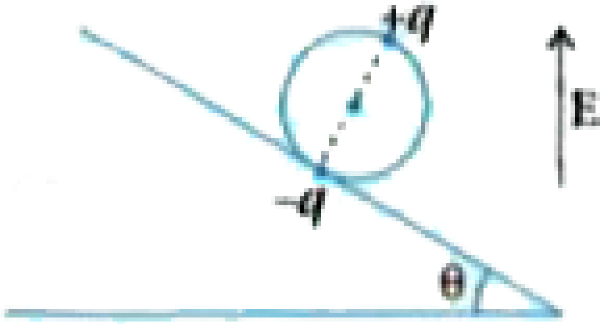
24. A wheel having mass m has charges + q and - q on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of a vertical electric field

E. Then value of E is ......



A. $\dfrac{mg\tan\theta}{q}$

B. $\dfrac{mg}{q}$

C. $\dfrac{mg}{2q}$

D. $\dfrac{mg\tan\theta}{2q}$

Answer: B

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25. Q amount of electric charge is present on the surface of a sphere having radius R. Calculate the total energy of the system.

A. $\frac{kQ^2}{R}$

B. $\frac{1}{2}\frac{kQ^2}{R}$

C. $\frac{kQ^2}{R^2}$

D. $\frac{1}{2}\frac{kQ^2}{R^2}$

Answer: A::B

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26. Charges 1μc are placed at each of the four corners of a square of side $2\sqrt{2}$ m. The potential at the point of Intersection of the diagonals is ...... (K = 9×10^9 SI unit)

A. 18×10^3 V

B. 1800 V

C. $18\sqrt{2} \times 10^3 V$

D. None of these

Answer: A::C

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27. Energy of a charged capacitor is U. Now it is. removed from the battery and then it is connected to another uncharged capacitor having the capacitance twice the first one In parallel. The energy of first and second capacitors respectively is ......

A. $\frac{1}{9}U, \frac{1}{9}$ U

B. $\frac{2}{9}U, \frac{1}{9}U$

C. $\frac{1}{9}U, \frac{2}{9}U$

D. $\frac{2}{9}U, \frac{2}{9}$ U

Answer: A::B

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28. The dimensional formula of capacitance Is ...... Take Q as the dimension formula of charge.

A. $M^{1}L^{-2}Q^{-2}$

B. $M^{-1}L^{-2}T^{2}Q^{2}$

C. $M^{-1}L^{-2}T^{2}Q^{2}$

D. $M^{1}L^{-2}T^{-2}Q^{-2}$

Answer: A::B

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29. A uniform electric field is prevailing in X-direction in certain region. The Co-ordinates of points P, Q and R are (0, 0), (2, 0), (0, 2) respectively which of the following alternatives is true for the potentials at these points ?

A. $V_P > V_Q, V_P = V_R$

B. $V_P = V_Q, V_P > V_R$

C. $V_P < V_R, V_Q = V_R$

D. $V_P = V_Q, V_P < V_Q$

Answer:

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30. An electric dipole of dipole moment $\overrightarrow{P}$ is placed parallel to the uniform electric field of intensity $\overrightarrow{E}$. On rotating it through 180° the amount of work done is ..... .

A. zero

B. $-2pE$

C. pE

D. 2 pE

Answer: B

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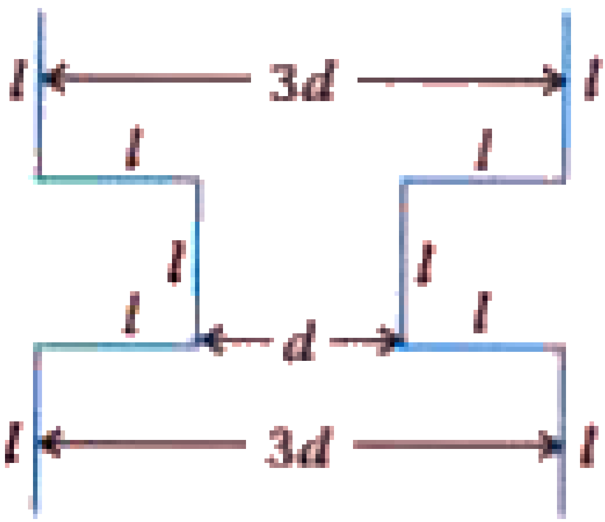
31. Ten identical square metallic plates are arranged as shown in figure. Length of each plate is l. The equivalent capacitance of this arrangement would be ....



A. $\frac{3 \in_0 l^2}{2d}$

B. $\frac{5 \in_0 l^2}{3d}$

C. $\frac{3 \in_0 l^2}{d}$

D. $\frac{4 \in_0 l^2}{d}$

Answer: B::C::D

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32. On the axis and on the equator of an electric dipole for all points ....

A. (A) On both of them $V \neq 0$

B. (B) On both of them $V = 0$

C. (C) On the axis $V = 0$ and on equator $V \neq 0$

D. (D) On the axis $V \neq 0$ and on equator $V = 0$

Answer: A::D

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33. The unit of polarizabity of the molecule is

....

A. $C^2 m^1 N^{-1}$

B. $C^2 m^{-1} N^1$

C. $C^{-2} m^1 N^{-1}$

D. $C^2 m^{-1} N^{-1}$

Answer: A::B::C

View Text Solution

34. The unit of Intensity of polarization is ....

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

B. $\frac{C^2}{m^2}$

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

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

Answer: B::C

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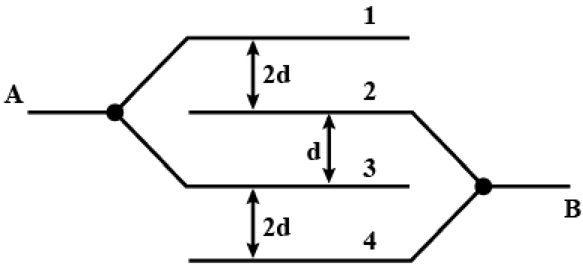
35. In the figure area of each plate is A and the distance between consecutive plates is as shown in the figure. What is the effective capacitance between points A & B.



(a) $\frac{A\varepsilon_0}{d}$

(b) $\frac{3A\varepsilon_0}{d}$

(c) $\frac{2A\varepsilon_0}{d}$

(d) $\frac{4A\varepsilon_0}{d}$

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

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

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

D. $\dfrac{4A\varepsilon_0}{d}$

Answer: A::B::D

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36. A moving positive charge approaches a negative charge. What will happen to the potential energy of the system?

A. will remain constant

B. will decrease

C. will increase

D. may increase or decrease

Answer: A::C::D

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37. Value of dielectric strength for air is ...... Vm^{-1}

A. 3×10^4

B. 3×10^6

C. 6×10^3

D. 4×10^3

Answer: A::C

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38. Three capacitors of 2 pF, 3 pF and 4 pF are connected in parallel. What is the total capacitance of a network ?

A. 9 pF

B. $\frac{12}{13}$ pF

C. $\frac{13}{12}pF$

D. $\frac{1}{9}$ pF

Answer:

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39. Equipotential surface through a point is ...... to the electric field at that point.

A. parallel

B. normal

C. at an angle of 45°

D. at an angle of 30°

Answer: A

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