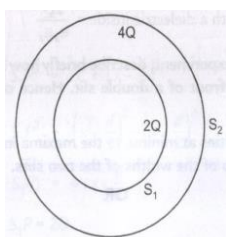


HOLIDAY HOMEWORK (SUMMER VACATION-2025)

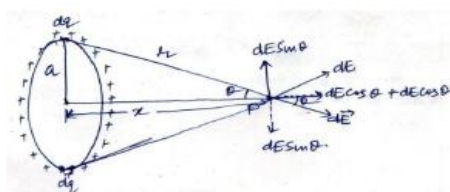
CLASS-XIIA SUBJECT-PHYSICS

CHAPTER-1 (ELECTRIC CHARGES AND FIELDS)

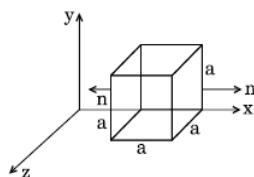
1. Write Coulomb's law in vector form. What is the importance of expressing it in vector form ?
2. Two insulated charged copper spheres A and B of identical size have charges q_A and $-3q_A$ respectively. When they are brought in contact with each other and then separated, what are the new charges on them ?
3. Write any two limitations of Coulomb's law.
4. How does the Coulomb force between two point charges depend upon the dielectric constant of the intervening medium ?
5. Two point charges having equal charges separated by $1m$ distance experience a force of $8N$. What will be the force experienced by them, if they are held in water, at the same distance ? (Given : $K_{water} = 80$)
6. Does the charge given to a metallic sphere depend on whether it is hollow or solid ? Give reason for your answer.
7. State any two properties of electric field lines.
8. Why do the electrostatic field lines are always normal to the surface of a conductor ?
9. (i) Depict electric field lines due to two positive charges kept at a certain distance apart.
(ii) Depict electric field lines due to an electric dipole or due to two opposite charges kept at certain distance apart.
10. (i) A point charge $+Q$ is placed in the vicinity of a conducting surface. Trace the field lines between the charge and the conducting surface. (ii) Draw the electric field lines due to uniformly charged thin spherical shell when charge on the shell is (a) positive, (b) negative
11. Define dipole moment. Write its S.I. unit. Is it a scalar or vector quantity ?
12. An electric dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Write the value of the angle between $\vec{p}$ and $\vec{E}$ for which the torque experienced by the dipole is minimum.
13. State Gauss's law in electrostatics.
14. A charge q is placed at the centre of a cube, what is the electric flux passing through one of its faces ?
15. Consider two hollow concentric spheres, S_1 & S_2 , enclosing charges $2Q$ & $4Q$ respectively as shown. (i) Find out the ratio of the electric flux through them. (ii) how will the electric flux through the sphere S_1 change, if a medium of dielectric constant ϵ_r is introduced in the space inside S_1 in place of air ? Deduce the necessary expression.



16. A charge is distributed uniformly over a ring of radius ' a '. Obtain an expression for the electric field intensity E at a point on the axis of the ring. Hence show that for points at large distances from the ring, it behaves like a point charge.



17. An electric dipole is held in a uniform electric field. Using suitable diagram show that it does not undergo any translatory motion. Derive the expression for the torque acting on it.
18. (i) What would happen if the dipole is held in the non-uniform field ?
(ii) What would happen if the external electric field E is increasing (a) parallel to $\vec{p}$ and (b) anti-parallel to $\vec{p}$.
19. Write down six significances of Gauss Law.
20. Two point charges of $+16 \mu\text{C}$ and $-9 \mu\text{C}$ are placed 8 cm apart in air. Determine the position of the point at which the resultant electric field is zero.
21. Find expression for electric field due to an electric dipole on its axial line at a point very far from the dipole.
22.
 - (i) State Gauss theorem and apply it to find electric field due to a spherical shell at a point (a) Outside of the shell and (b) Inside of the shell. Draw the graph between electric field and distance of point from the shell in both cases.
 - (ii) A copper ball of density 8.6 g cm^{-3} , 1 cm in diameter is immersed in oil of density 0.8 g cm^{-3} . If the ball remains suspended in oil in a uniform electric field of intensity $3.6 \times 10^4 \text{ NC}^{-1}$ acting in upward direction, what is the charge on the ball?
23. Given the components of an electric field as $E_x = \alpha x$, $E_y = 0$ and $E_z = 0$, where α is dimensional constant. Calculate the flux through the cube of side 'a' as shown in the figure and the effective charge inside the cube.



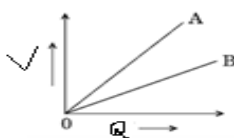
24. Given a uniform electric field $\vec{E} = 6 \times 10^3 \hat{i} \text{ N/C}$, Find the flux of this field through a square of 10 cm on a side whose plane is parallel to Y-Z plane. What would be the flux through the same square if the plane makes a 30° angle with the x- axis ?
25. Two point charges $4 \mu\text{C}$ and $+1 \mu\text{C}$ are separated by a distance of 2 m in air. Find the point on the line-joining charges at which the net electric field of the system is zero.

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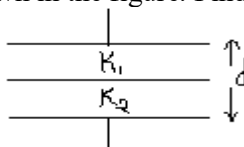
CHAPTER 2. ELECTRIC POTENTIAL AND CAPACITANCE

26. Define electric potential at a point. Write its S.I. unit. Is potential a scalar or vector ?
27. Why is the potential inside a hollow spherical charged conductor constant and has the same value as on its surface ?
28. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 5 V. What is the potential at the centre of the sphere ?
29. A point charge $+Q$ is placed at a point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero ?
30. "For any charge configuration, equipotential surface through a point is normal to the electric field." Justify this statement.
31. No work done in moving a charge from one point to another on an equipotential surface. Why?
32. Can electric field exist tangential to an equipotential surface ? Give reason.
33. Draw two equipotential surface in a uniform electric field.
34. A charge ' q ' is being moved from a point A above a dipole of dipole moment ' p ' to a point B below the dipole in equatorial plane without acceleration. Find the work done in the process.

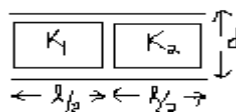
35. What is the amount of work done in moving a point charge Q around a circular arc of radius ' r ' at the centre of which another point charge ' q ' is located ?
36. Define the capacitance of a capacitor. On what factors does it depends ?
37. Define dielectric constant of a medium in terms of capacitance.
38. A metal plate is introduced between the plates of a charged parallel plate capacitor. What is the effect on the capacitance of the capacitor ?
39. How is the electric field due to a charged parallel plate capacitor affected when a dielectric slab is inserted between the plates fully occupying the intervening region ?
40. The graph shows the variation of voltage V across the plates of two capacitors A and B versus increase of charge Q stored on them. Which of the capacitors has higher capacitance ? Give reason for your answer.



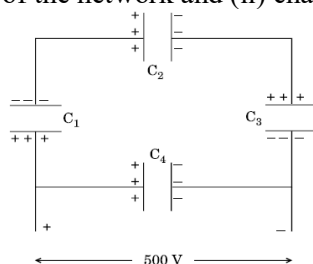
41. A parallel plate capacitor of plate area A and separation d is filled with dielectrics of dielectric constants K_1 and K_2 as shown in the figure. Find the net capacitance of the capacitor.



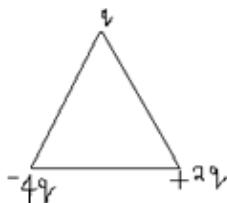
42. Two dielectric slabs of dielectric constants K_1 and K_2 are filled in between the two plates, each of area A , of the parallel plate capacitor as shown. Find net capacitance of the capacitor.



43. How will the (i) energy stored and (ii) the electric field inside the air capacitor be affected when it is completely filled with a dielectric material of dielectric constant K ?
44. (i) Draw 3 equipotential surfaces corresponding to a field that uniformly increases in magnitude but remains constant along z -direction.
(ii) How are these surfaces different from that of a constant electric field along z - direction ?
45. (i) What is a dielectric ? Give one example (ii) Distinguish with the help of a suitable diagram, the difference in the behaviour of a conductor and a dielectric placed in an external electric field. How does polarized dielectric modify the original external field ?
46. Why does the capacitance of a parallel plate capacitor increase on introduction of a dielectric in between its plates ?
47. Three capacitors of capacitances C_1 , C_2 & C_3 are connected (a) in series (b) in parallel. Show that the energy stored in the series combination is the same as that in the parallel combination.
48. A network of four capacitors each of $10 \mu F$ capacitance is connected to a $500 V$ supply as shown in the figure. Determine the –
(i) equivalent capacitance of the network and (ii) charge on each capacitor



49. Two point charges $20 \times 10^{-6} \text{ C}$ and $-4 \times 10^{-6} \text{ C}$ are separated by a distance of 50 cm in air. Find-(i) the point on the line joining the charges, where the electrostatic potential is zero.
(ii) calculate the electrostatic potential energy of the system.
50. Calculate the work done to dissociate the system of three charges placed on the vertices of an equilateral triangle of side 10 cm as shown in figure. Here $q = 1.6 \times 10^{-10} \text{ C}$.



51. Defined the term of “Potential energy” of charge ‘q’ at a distance ‘r’ in an external electric field.
52. What is the geometrical shape of equipotential surfaces due to a single isolated charge?
53. A parallel plate capacitor is charged by a battery. After some time the battery is disconnected and a dielectric slab of dielectric constant K is inserted between the plates. How would (i) the capacitance (ii) the electric field between the plates and (iii) the energy stored in the capacitor be affected? Justify your answer. 3
54. In which orientation, a dipole placed in a uniform electric field is in (i) stable, (ii) unstable equilibrium?
55. A parallel plate capacitor is charged by a battery. After sometime the battery is disconnected and a dielectric slabs its thickness equal to the plate separation is inserted between the plates. How will (i) the capacitance of the capacitor. (ii) Potential difference between the plates and (iii) the energy stored in the capacitor be affected? Justify your answer in each case. 3
56. (a) Depict the equipotential surfaces for a system of two identical positive point charges placed a distance ‘d’ apart.
(b) Deduce the expression for the potential energy of a system of two point charges q_1 and q_2 brought from infinity to the points r_1 and r_2 respectively in the presence of external electric field E . 3

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CHAPTER-3 CURRENT ELECTRICITY
PREPARE THE NOTES OF THIS CHAPTER IN YOUR CW NOTEBOOK AS PER
LATEST SYLLABUS.