



PLOT 5C, 2ND FLOOR, GANAPATI COMPLEX, SEC-13, OPP. JAIPURIA
SCHOOL, VASUNDHARA, GHAZIABAD (U.P)

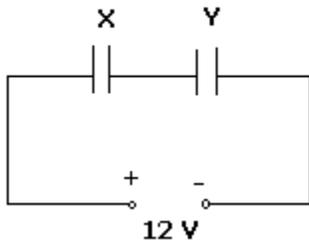
ELECTROSTATICS

1. Define the term 'dielectric constant' of a medium in terms of capacitance of a capacitor.
2. Define the term electric dipole moment. Is it a scalar or a vector quantity?
3. An electric dipole of a dipole moment $20 \times 10^{-6} \text{ Cm}$ is enclosed by a closed surface. What is the net flux coming out of the surface?
4. Why does the electric field inside a dielectric decrease when it is placed in an external electric field?
5. An electrostatic field line cannot be discontinuous. Why?
6. How does the Coulomb force between two point charges depend upon the dielectric constant of the intervening medium?
7. Two electric field lines never cross each other. Why?
8. The distance of the field point, on the equatorial plane of a small electric dipole, is halved. By what factor will the electric field, due to the dipole, change?
9. Two plane sheets of charge densities $+\sigma$ and $-\sigma$ are kept in air as shown in figure. What are the electric field intensities at points A and B?

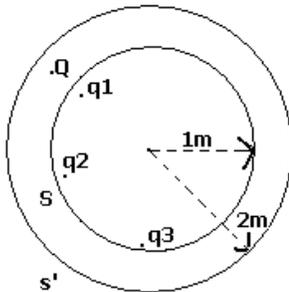


10. Write the S.I unit of (i) electric field intensity and (ii) electric dipole moment.
11. Two point charges q_1 and q_2 are placed close to each other. What is the nature of between the charges when $q_1 q_2 < 0$?
12. Which physical quantity has unit NC^{-1} ? It is a vector or scalar quantity?
13. How much work is done in moving a $500\mu\text{C}$ charge between two points on an equi potential surface?
14. A uniform electric field E exits between two charged plates as shown in the figure. What would be the work done in moving a charge 'q' along the closed rectangular path ABCDA?
15. What is the orientation of an electric dipole in a uniform electric field corresponds to its stable equilibrium?
16. A and B are two conducting spheres of the same radius, A being solid and B hollow. Both are charged to the same potential. What will be the relation between the charges on the two spheres?
17. In an electric field an electron is kept freely. If the electron is replaced by a proton, what will be the relationship between the forces experienced by them?
18. What is the amount of work done in moving a 100nC charge between two points 5cm apart on an equipotential surface?
19. Force between two point electric charges kept at a distance d apart in air is F . If these charges are kept at the same distance in water, how does the force between them change?
20. An electric dipole of length 10 cm having charges $\pm 6 \times 10^{-3} \text{ C}$, placed at 30° with respect to a uniform electric field, experiences a torque of magnitude $6\sqrt{3} \text{ Nm}$. Calculate :
 - i. The magnitude of the electric field.
 - ii. The potential energy of the dipole.

21. a) Why does the electric field inside a dielectric decrease when it is placed in an external electric field?
 b) A parallel plate capacitor with air between the plates has a capacitance of 8 pF. What will be the capacitance if the distance between the plates be reduced by half and the space between them is filled with a substance of dielectric constant $K=6$?
22. Three point charges of $+2\ \mu\text{C}$, $-3\ \mu\text{C}$ and $-3\ \mu\text{C}$ are kept at vertices A, B and C respectively of an equilateral triangle of side 20cm as shown in the figure. What should be the sign and magnitude of the charge to be placed at the mid-point (M) of side BC so that the charge at A remains in equilibrium?
23. Two point charges $+10\ \mu\text{C}$ and $-10\ \mu\text{C}$ are separated by a distance of 40 cm in air. (i) Calculate the electrostatic potential energy to be infinity. (ii) Draw an equipotential surface of the system.
24. X and Y are two parallel plate capacitors having the same area of plates and same separation between the plates. X has air between the plates and Y contains a dielectric medium of $\epsilon_r = 5$.



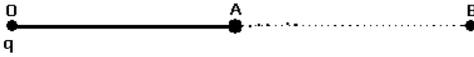
25. The flux of the electric field, through the closed spherical surface S' , is found to be four times that through the closed spherical surface S . find the magnitude of the charge Q .



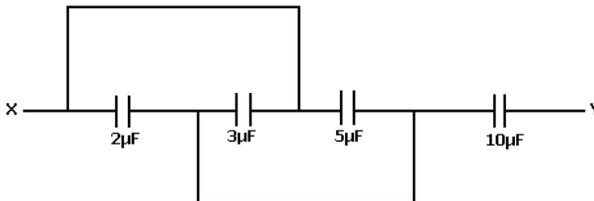
26. Find the ratio of the potential differences that must be applied across the (i) parallel, (ii) series combination of two identical capacitors so that the energy stored, in the two cases, becomes the same.
27. Mention any two properties of electric lines of force. Sketch them for an isolated positive point charge.
28. What is an electric line of force? Sketch lines force due to two equal positive charges placed at a small distance apart in air .
29. State Gauss' theorem in electrostatics. Using this theorem, prove that no electric field intensity exists inside a hollow charged conducting sphere.
30. Show mathematically that potential at a point on the equatorial line of an electric dipole is zero.
31. Two similarly and equally charged identical metal spheres A and B repel each other with a force of $2 \times 10^{-5}\ \text{N}$. A third identical uncharged sphere C is touched with A and then placed At the mid-point between A and B. Calculate the net electric force on C.
32. Two point charges of $+3 \times 10^{-8}\ \text{C}$ and $-2 \times 10^{-8}\ \text{C}$ are located 15 cm apart in air. Find at what point on the line joining these charges the electric potential is zero. Take potential at infinity to be zero.
33. An electric dipole is free to move in a uniform electric field. Explain its motion when it is placed
 (i) Parallel to the field,

(ii) Perpendicular to the field.

34. Find the ratio of linear momenta acquired by an α -particle and a proton accelerated through the same potential.
35. Force of attraction between two point charges placed at a distance 'd' apart in a medium is 'F'. What should be the distance apart in the same medium so that the force of attraction between them becomes $F/3$?
36. A point charge 'q' is placed at O as shown. Is $V_A - V_B$ positive, negative or zero, if 'q' is a (i) a positive charge (ii) a negative charge?



37. What is an equipotential surface? Show that the electric field is always directed perpendicular to an equipotential surface?
38. Derive an expression for the potential at a point along the axial line of a short electric dipole.
39. Four capacitors are connected as shown in the figure given below:
Calculate the equivalent capacitance between the points X and Y.



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40. An electric dipole of length 2 cm is placed with its axis making an angle of 60° to a uniform electric field of 10^5 N/C. If it experiences a torque of $8\sqrt{3}$ Nm, calculate the:
- Magnitude of the charge on the dipole
 - Potential energy of the dipole.
41. Calculate the potential at the centre of a square of side $\sqrt{4.5}$ m which carries at its four corners charges of $+5 \times 10^{-9}$ C, 2×10^{-9} C, -5×10^{-9} C, and -7×10^{-9} C respectively.
42. When two capacitors of C_1 and C_2 are connected in series the net capacitance is $3 \mu F$; when connected in parallel its value is $16 \mu F$. Calculate values of C_1 and C_2 .
43. Two point charges of values q and $2q$ are kept at a distance d apart from each other in air. A third charge Q is to be kept along the same line in such a way that the net force acting on q and $2q$ is zero. Calculate the position of charge Q in terms of q and d .
44. Two point electric charges of an unknown magnitude and sign are placed at a distance 'd' apart. The electric field intensity is zero at a point, not between them. Write two essential conditions for this to happen.
45. Explain the effect of introducing a dielectric slab between the plates of a parallel plate capacitor on its capacitance. Derive an expression for its capacitance with dielectric as the medium between the plates.