

Class XII- Physics

Chapter – 1 Electrostatics

1. Show how does the force between two point charges change if the dielectric constant of the medium in which they are kept increase?
2. Which physical quantity has its S.I unit : 1) Cm 2) N/C
3. Define one coulomb?
4. A free proton and a free electron are placed in a uniform field. Which of the two experience greater force and greater acceleration?
5. No two electric lines of force can intersect each other? Why?
6. An electric dipole when held at 30° with respect to a uniform electric field of 10^4 N/C experienced a Torque of $9 \times 10^{-26} \text{ Nm}$. Calculate dipole moment of the dipole?
7. (a) Explain the meaning of the statement 'electric charge of a body is quantized'.

(b) Why can one ignore quantization of electric charge when dealing with macroscopic i.e., large scale charges?
8. When a glass rod is rubbed with a silk cloth, charges appear on both. A similar phenomenon is observed with many other pairs of bodies. Explain how this observation is consistent with the law of conservation of charge.
9. An electric dipole with dipole moment $4 \times 10^{-9} \text{ Cm}$ is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4 \text{ N C}^{-1}$. Calculate the magnitude of the torque acting on the dipole.
10. Two point charges $+q$ and $+9q$ are separated by a distance of $10a$. Find the point on the line joining the two charges where electric field is zero?
11. Define the term dipole moment \vec{P} of an electric dipole indicating its direction. Write its S.I unit. An electric dipole is placed in a uniform electric field \vec{E} . Deduce the expression for the Torque acting on it.

12. Electric charge is uniformly distributed on the surface of a spherical balloon. Show how electric intensity and electric potential vary (a) on the surface (b) inside and (c) outside
13. What is the force between two small charged spheres having charges of $2 \times 10^{-7} \text{ C}$ and $3 \times 10^{-7} \text{ C}$ placed 30 cm apart in air?
14. A point charge $+10 \mu\text{C}$ is a distance 5 cm directly above the centre of a square of side 10 cm, as shown in Fig. 1.34. What is the magnitude of the electric flux through the square? (*Hint*: Think of the square as one face of a cube with edge 10 cm.)
15. (a) Sketch electric lines of force due to (i) isolated positive charge (ie $q > 0$) and (ii) isolated negative charge (ie $q < 0$)
- (b) Two point charges q and $-q$ are placed at a distance $2a$ apart. Calculate the electric field at a point P situated at a distance r along the perpendicular bisector of the line joining the charges. What is the field when $r \gg a$?
16. (a) What is an equi-potential surface? Show that the electric field is always directed perpendicular to an equi-potential surface.
- (b) Derive an expression for the potential at a point along the axial line of a short electric dipole?
17. (a) Two insulated charged copper spheres A and B have their centers separated by a distance of 50 cm. What is the mutual force of electrostatic repulsion if the charge on each is $6.5 \times 10^{-7} \text{ C}$? The radii of A and B are negligible compared to the distance of separation.

(b) What is the force of repulsion if each sphere is charged double the above amount, and the distance between them is halved?

18. Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs and of magnitude $17.0 \times 10^{-22} \text{ C/m}^2$. What is E: (a) in the outer region of the first plate, (b) in the outer region of the second plate, and (c) between the plates?

19. Four point charges $q_A = 2 \mu\text{C}$, $q_B = -5 \mu\text{C}$, $q_C = 2 \mu\text{C}$, and $q_D = -5 \mu\text{C}$ are located at the corners of a square ABCD of side 10 cms. What is the force on a charge of $1 \mu\text{C}$ placed at the centre of the square?

20. Two point charges $q_A = 3 \mu\text{C}$ and $q_B = -3 \mu\text{C}$ are located 20 cm apart in vacuum.

(a) What is the electric field at the midpoint O of the line AB joining the two charges?

(b) If a negative test charge of magnitude $1.5 \times 10^{-9} \text{ C}$ is placed at this point, what is the force experienced by the test charge?