Class - 12th

DPP − 07

Electric Charges and Fields

Topics:

- **Dipole Moment.**
- **Electric Field at an axial point of a Dipole.**
- **Electric Field at an equatorial point of a Dipole.**
- **Torque on a Dipole in a uniform electric field.**

Part - 1

1. An electric dipole is formed by $+4\ \mu C$ and $-4\ \mu C$ charges at $5\ mm$ distance. Calculate the dipole moment and give its direction.

2. Two point charges of $+0.2\ \mu C$ and $-0.2\ \mu C$ are separated by $10^{-8}\ m$. Determine the electric field at an axial point at a distance of $0.1\ m$ from their midpoint. Use the standard value of ε_0.

3. Two point charges, each of $5\ \mu C$ but opposite in sign, are placed $4\ cm$ apart. Calculate the electric field intensity at a point distant $4\ cm$ from the midpoint on the axial line of the dipole.

4. Calculate the field due to an electric dipole of length $10\ cm$ and consisting of charges of $\pm\ 100\ \mu C$ at a point $20\ cm$ from each charge.

5. A system has two charges $q_A = 2.5 \times 10^{-7}$ C and $q_B = -2.5 \times 10^{-7}$ C, located at points $A(0, 0, -15\ cm)$ and $B(0, 0, +15\ cm)$ respectively. What is the total charge and electric dipole moment of the system?

Part - 2

6. An electric dipole free to move is placed in a uniform electric field. Explain alongwith diagram its motion when it is placed,

    (a) Parallel to the field,

    (b) Perpendicular to the field.   **[CBSE Sample Paper 1990]**

7. An electric dipole is a pair of equal and opposite charges, separated by a small fixed distance between them. The dipole is free to move. What is the action on it, when it is placed in

   (a) A uniform electric field, and

   (b) A non-uniform electric field?

8. An electric dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Write the expression for the torque $\vec{\tau}$ experienced by the dipole. Identify two pairs of perpendicular vectors in the expression. Show diagrammatically the orientation of the dipole in the field for which the torque is (i) maximum (ii) half the maximum value (iii) zero.

   [CBSE Sample Paper 08]

9. Two small identical electric dipole AB and CD, each of dipole moment $\vec{p}$ are kept at an angle

   of 120° to each other in an external electric field $\vec{E}$ pointing along the x-axis as shown in fig.
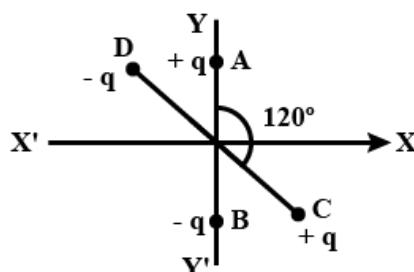
   Find the

   (a) Dipole moment of the arrangement, and

   (b) Magnitude and direction of the net torque acting on it.   **[CBSE D 11; OD 20]**

10. Three charges $+q$, $+q$ and $-2q$ are placed at the vertices of an equilateral triangle. What is the dipole moment of the system?

11. Plot a graph showing the variation of coulomb force (F) verus $\left(\frac{1}{r^2}\right)$, where r is the distance between the two charges of each pair of charges $(1\mu C, 2\mu C)$ and $(2\mu C, -3\mu C)$. Interpret the graphs obtained.   **[CBSE OD 11]**