

2 – MARKS QUESTION

Q.52: Differentiate between electric field intensity due to a single point charge and electric field due to a dipole.

Q.53: The electric field due to a small dipole at a distance 'r' from its centre on axial line is E. At what distance, an equal electric field will be obtained in its equatorial position ? [Ans: $\frac{r_1}{\sqrt[3]{2}}$] **HOTS**

Q.54: Calculate the field due to an electric dipole of length 10 cm and consisting of charges $\pm 100 \mu\text{C}$ at a point 12 cm from each charge. [Ans: $4.09 \times 10^8 \text{ N/C}$]

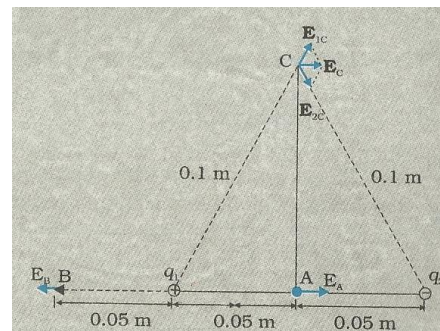
3 – MARKS QUESTION

Q.55: Calculate the electrostatic field intensity at a point on the equatorial line of a dipole. **CBSE**

Q.56: Show mathematically that the electric field intensity due to a short dipole at a distance 'd' along its axis is twice the intensity at the same distance along the equatorial line.

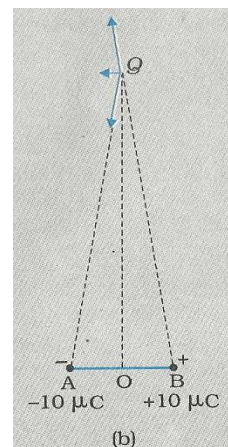
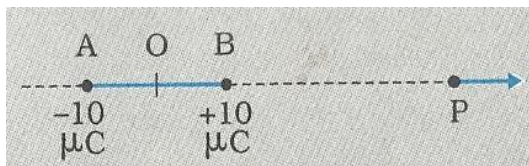
Q.57: Three point charges, 1pC each, are kept at the vertices of an equilateral triangle of side 10cm. Find the net electric field at the centroid of triangle. **CBSE – 2024**

☑(S)Q.58: Two point charges q_1 and q_2 of magnitudes $+10^8 \text{ C}$ and -10^8 C respectively are placed 0.1 m apart. Calculate the electric field at point B, C and A.



☑(S)Q.59: Two charges $\pm 10 \mu\text{C}$ are placed 5.0 mm apart. Determine the electric field at (a) a point P on the axis of the dipole 15 cm away from its centre O on the side of the positive charge, as shown in figure (a), and (b) a point Q, 15 cm away from O on a line passing through O and normal to the axis of the dipole, as shown in figure (b).

[Ans: (a) $2.6 \times 10^5 \text{ N/C}$ (b) $1.33 \times 10^5 \text{ N/C}$]



➤ **DIPOLE IN A UNIFORM ELECTRIC FIELD :**

Q.60: Is torque a vector quantity?

Q.61: What is the net force on an electric dipole placed in a uniform electric field?

Q.62: What orientation of an electric dipole in a uniform electric field corresponds to its stable

equilibrium?

Q.63: When is an electric dipole in unstable equilibrium in an electric field?

Q.64: Does a dipole experienced a force when placed in the non – uniform electric field ?

Q.65: An electric dipole is placed in a uniform electric field. At what position , will it experience a maximum torque?

Q.66: Write the expression for the torque $\vec{\tau}$ experienced by the dipole in uniform electric field \vec{E} , and identify two pairs of perpendicular vectors in the expression.

Q.67: Show diagrammatically the orientation of the dipole in the field for which the torque is :

- (i) maximum (ii) Half the maximum value (iii) Zero.

Q.68: An electric dipole is placed at an angle θ from the direction of a uniform electric field \vec{E} . What force and torque is acting on the dipole?

Q.69: An electric dipole with dipole moment 4×10^{-9} Cm is aligned at 30° with the direction of a uniform electric field of magnitude 5×10^4 N / C. calculate the magnitude of the torque acting on the dipole. [Ans: 10^{-4} N m]

Q.70: An electric dipole moment 3×10^{-8} Cm placed with its axis making an angle of 30° with a uniform electric field, experience a torque of 1.2×10^3 Nm. Calculate the magnitude of electric field. [Ans: 8×10^{10} N / m]

Q.71: An electric dipole is held at an angle ‘ θ ’ in a uniform external electric field ‘E’. Will there be any

(i) net translating force

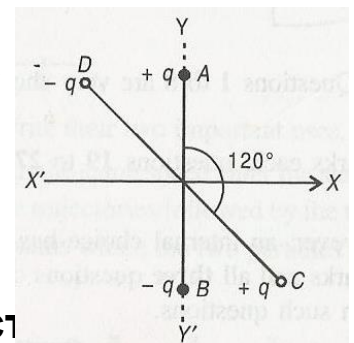
(ii) torque acting on it ? specify its direction. Hence define dipole moment.

(iii) Explain what happens to the dipole on being released.

CBSE

Q.72: Two small identical electrical dipoles AB and CD , each of dipole moment ‘p’ are kept at an angle of 120° as shown in the figure. What is the resultant dipole moment of this combination ? If this system is subjected to electric field (\vec{E}) directed along + X direction , what will be the magnitude and direction of the torque acting on this ? **CBSE**

[Ans: $p_R = p$ & $\phi = 30^\circ$ $\tau = \frac{1}{2} pE$]



➤ **POTENTIAL ENERGY OF DIPOLE IN A UNIFORM ELECTRIC FIELD**

Q.73: An electric dipole is aligned parallel to the field. Calculate the work done in rotating it through 180° . [Ans: $2 pE$] **CBSE**

Q.74: Derive an expression for total work done in rotating an electric dipole through an angle θ in a uniform electric field.

Q.75: An electric dipole of length 10 cm having charges 6×10^{-3} C , placed at 60° with respect to a uniform electric field, experience a torque of $6\sqrt{3}$ Nm. Calculate

(i) magnitude of electric field and

(ii) potential energy of electric dipole. [Ans: (i) $2\sqrt{3} \times 10^{-4}$ N/C (ii) -18 J] **CBSE - C**

Q.76: Calculate the amount of work done in rotating a dipole, of dipole moment 3×10^{-8} cm, from its position of stable equilibrium to the position of unstable equilibrium, in a uniform electric field of intensity 10^4 N / C. [Ans: 6×10^{-4} J] **CBSE - F**