Answer on Question #54452-Physics-Other

Two charges of +25*10^-9 coulomb and -25*10^10-9 coulomb are placed 6 cm at apart. Find the electric field intensity rasoi ratio at points 4 m from the centre of the electric dipole (1) on the axial line (2) on equatorial line

(1)1000/49

(2)49/1000

(3)500/49

(4)49/500

Solution

Here, $q = 25 \cdot 10^{-9} C, 2a = 6m, r = 4m.$

$$p = q(2a) = 25 \cdot 10^{-9} \cdot 6 = 1.5 \cdot 10^{-7} Cm$$

Now,

$$E_{axial} = \frac{1}{4\pi\varepsilon_0} \frac{2pr}{(r^2 - a^2)^2} = \frac{9 \cdot 10^9 \cdot 2 \cdot 1.5 \cdot 10^{-7} \cdot 4}{(4^2 - 3^2)^2} = \frac{10800}{49} \frac{N}{C}$$

$$E_{equi} = \frac{1}{4\pi\varepsilon_0} \frac{p}{(r^2 + a^2)^{\frac{3}{2}}} = \frac{9 \cdot 10^9 \cdot 1.5 \cdot 10^{-7}}{(4^2 + 3^2)^{\frac{3}{2}}} = \frac{1350}{125} \frac{N}{C}$$

The ratio is

$$\frac{E_{axial}}{E_{equi}} = \frac{\frac{10800}{49}}{\frac{1350}{125}} = \frac{1000}{49}.$$

Answer: (1)1000/49.

Problem 2.03. Two charges of $+ 25 \times 10^{-9}$ coulomb and $- 25 \times 10^{-9}$ coulomb are placed 6 m apart. Find the electric field at a point 4 m from the centre of the electric dipole (*i*) on axial line (*ii*) on equitorial line.

Sol. Here, $q = 25 \times 10^{-9}$ C, $2a = 6$ m, $r = 4$ m

$\therefore \quad p = q(2a) = 25 \times 10^{-9} \times 6 = 1{\cdot}5 \times 10^{-7}$ C m

Now, $$E_{axial} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{2pr}{(r^2 - a^2)^2} = \frac{9 \times 10^9 \times 2 \times 1{\cdot}5 \times 10^{-7}}{(4^2 - 3^2)}$$

$$= \frac{2700}{49} = \mathbf{55{\cdot}1\ N\ C^{-1}}$$

and $$E_{equi} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p}{(r^2 + a^2)^{3/2}} = \frac{9 \times 10^9 \times 1{\cdot}5 \times 10^{-7}}{(4^2 + 3^2)^{3/2}}$$

$$= \frac{1350}{125} = \mathbf{10{\cdot}8\ N\ C^{-1}}$$