

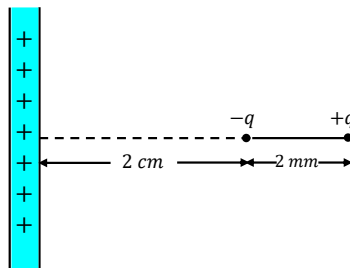
Class - 12th

Electric Charges and Fields

Topics:

- **Application of Gauss Theorem**

1. An infinite line produces a field of $9 \times 10^4 \text{ NC}^{-1}$ at a distance of 4 cm . Calculate the linear charge density. (Ans: $2 \times 10^{-7} \text{ Cm}^{-1}$)
2. A cylinder of large length carries a charge of $2 \times 10^{-8} \text{ Cm}^{-1}$. Find the electric field at a distance of 0.2 cm from it. (Ans: 1800 Vm^{-1})
3. Two large metal plates each of area 1 m^2 are placed facing each other at a distance of 10 cm and carry equal and opposite charges on their faces. If the electric field between the plates is 100 NC^{-1} , find the charge on each plate. (Ans: $8.85 \times 10^{-10} \text{ C}$)
4. A charge of $17.7 \times 10^{-4} \text{ C}$ is distributed uniformly over a large sheet of area 200 m^2 . Calculate the electric field intensity at a distance of 20 cm from it in air. (Ans: $5 \times 10^5 \text{ NC}^{-1}$)
5. A charged particle having a charge of $-2.0 \times 10^{-6} \text{ C}$ is placed close to a non-conducting plate having a surface charge density of $4.0 \times 10^{-6} \text{ Cm}^{-2}$. Find the force of attraction between the particle and the plate. (Ans: 0.45 N)
6. A particle of mass $9 \times 10^{-5} \text{ g}$ is kept over a large horizontal sheet of charge density $5 \times 10^{-5} \text{ Cm}^{-2}$. What charge should be given to the particle, so that if released, it does not fall? (Ans: $3.12 \times 10^{-13} \text{ C}$)
7. Two long parallel wires carry charges λ_1 and λ_2 per unit length. The separation between their axes is d . Find the magnitude of the force exerted on unit length of one due to the charge on the other. (Ans: $f = \frac{\lambda_1 \lambda_2}{2\pi\epsilon_0 d}$)
8. An electric dipole consists of charges $\pm 2 \times 10^{-8} \text{ C}$, separated by a distance of 2 mm . It is placed near a long line charge of density $4.0 \times 10^{-4} \text{ Cm}^{-1}$, as shown in figure, such that the negative charge is at a distance of 2 cm from the line charge. Calculate the force acting on the dipole.



(Ans: 6.5 N)

9. A large plane sheet of charge having surface charge density $5.0 \times 10^{-16} \text{ Cm}^{-2}$ lies in the X - Y plane. Find the electric flux through a circular area of radius 0.1 m , if the normal to the circular area makes an angle of 60° with the Z -axis. (Ans: $4.44 \times 10^{-7} \text{ Nm}^2 \text{ C}^{-1}$)
10. A spherical shell of metal has a radius of 0.25 m and carries a charge of $0.2 \mu\text{C}$. Calculate the electric field intensity at a point (i) inside the shell, (ii) just outside the shell and (iii) 3.0 m from the centre of the shell. (Ans: (i) 0 , (ii) $2.88 \times 10^4 \text{ NC}^{-1}$ (iii) 200 NC^{-1})