Brain International School

Vikas Puri, New Delhi

ASSIGNMENT NO. 1

SUBJECT: PHYSICS CLASS-XII APRIL,2025

CH: 1-(ELECTRIC CHARGE AND FIELD)

1. A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed

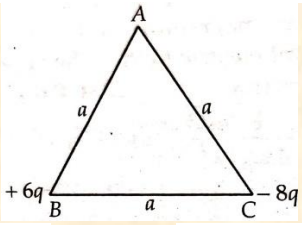
   (a) perpendicular to the diameter
   (b) parallel to the diameter
   (c) at an angle tilted towards the diameter
   (d) at an angle tilted away from the diameter.

2. The Electric field at a point is

   (a) always continuous.
   (b) continuous if there is no charge at that point.
   (c) discontinuous only if there is a negative charge at that point.
   (d) discontinuous if there is a charge at that point..

3. A metallic spherical shell has an inner radius R_1 and outer radius R_2. A charge Q is placed at the centre of the spherical cavity. What will be surface charge density on (i) the inner surface, and (ii) the outer surface?
4. Two charges q and $-3q$ are placed fixed on x-axis separated by distance'd'. Where a third charge 2q should be placed such that it will not experience any force?
5. Consider a sphere of radius R with charge density distributed as $\rho(r) = kr$ *for* $r \leq R = 0$ for $r > R$. Find the electric field at all points r.
6. Total charge –Q is uniformly spread along length of a ring of radius R. A small test charge $+q$ of mass m is kept at the centre of the ring and is given a gentle push along the axis of the ring. (a) Show that the particle executes a simple harmonic oscillation. (b) Obtain its time period.
7. A paisa coin is made up of Al-Mg alloy and weighs 0.75g. It has a square shape and its diagonal measures 17 mm. It is electrically neutral and contains equal amounts of positive and negative charges. Treating the paisa coins made up of only Al; find the magnitude of equal number of positive and negative charges. What conclusion do you draw from this magnitude?
8. An arbitrary surface encloses a dipole. What is the electric flux through this surface?
9. The sum of two-point charges is 7μC. They repel each other with a force of 1 N when kept 30 cm apart in free space. Calculate the value of each charge.

10. Two-point charges +6q and −8q are placed at the vertices 'B' and 'C' of an equilateral triangle ABC of side 'a' as shown in figure. (a) Obtain the expression for (i) the magnitude and (ii) the direction of the resultant electric field at the vertex A due to these two charges.



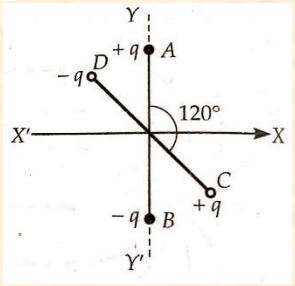
11. An electric dipole of dipole moment 4×10^{-5}C m is placed in a uniform electric field of 10^{-3} NC^{-1}making an angle of 30° with the direction of the field. Determine the torque exerted by the electric field on the dipole.

Ans: 2×10^{-8} Nm

12. An electric dipole is placed at an angle of 60° with an electric field of magnitude 4×10^{5} NC^{-1}. It experiences a torque of $8\sqrt{3}$ Nm. If the length of the dipole is 4 cm, determine the magnitude of either charge of the dipole.

Ans: 10^{-3}C

13. Two small identical electrical dipoles AB and CD, each of dipole moment 'p' are kept at an angle of 120° as shown in 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?

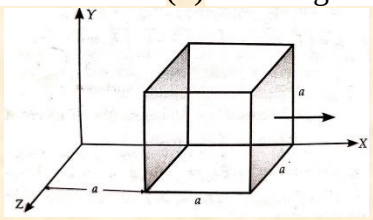


Ans: $\tau = \frac{1}{2}$ pE

14. If $\vec{E} = 6\,\hat{\imath} + 3\,\hat{\jmath} + 4\,\hat{k}$, calculate the electric flux through a surface of area 20 units in Y - Z plane.

Ans: ϕ_E = 120 units.

15. The electric field components in figure are $E_x = \alpha\, x^{1/2}$, $E_y = E_z = 0$, in which α=800 N/Cm^2. Calculate (i) the flux ϕ_E through the cube and (ii) the charge within the cube. Assume that a = 0.1m.



Ans: q = 9.27×10^{-12}C.