SAMUTHRA INSTITUTE
(Ocean of Knowledge)
No.38, 3rd Floor, College Road, Nungambakkam, Chennai-6, Phone : 9789977960

REVISON TEST -02 **Total Marks -30**

12th Physics -Electric Charges and Fields

X

Multiple Choice Questions 5x1 =5

1. Gauss's law states that

   a. the total electric field flux coming out of an open surface equals the net charge enclosed within the volume divided by ε_0
   b. the total electric field flux coming out of any surface equals the charge enclosed within the volume divided by ε_0
   c. the total electric field flux coming out of a closed surface in vacuum equals the net charge enclosed within the volume divided by ε_0
   d. the total electric field flux coming out of a closed surface equals the net charge enclosed within the volume

2. An electric dipole with dipole moment 4×10^{-9}Cm is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4 \mathrm{N/C}$Calculate the magnitude of the torque acting on the dipole.

   a. 1.0×10^{-4}Cm
   b. 1.5×10^{-8}Nm
   c. 2.5×10^{-4}Cm
   d. 3.5×10^{-4}Cm

3. There is a uniform field of strength $10^3 \mathrm{Vm}^{-1}$ along the y-axis. A body of mass 1g and charge 10^{-6} C is projected into the field from the origin along the positive x-axis with a velocity of $10 \mathrm{ms}^{-1}$. Its speed (in ms^{-1} after 10 second will be (neglect gravitation)

   a. $10\sqrt{2}$
   b. 20.0
   c. $5\sqrt{2}$
   d. 10.0

4. Careful measurement of the electric field at the surface of a black box indicates that the net outward flux through the surface of the box is $8.0 \times 10^3 \mathrm{Nm}^2/\mathrm{C}$.

(i) What is the net charge inside the box?

(ii) If the net outward flux through the surface of the box were zero, could you conclude that there were no charges inside the box?

a. 0.04 μC, Yes
b. 0.06 μC, Yes
c. 0.05 μC, No
d. 0.07 μC, No

5. A pendulum bob of mass m carrying a charge q is at rest with its string making an angle θ with the vertical in a uniform horizontal electric field E. The tension in the string is

a. $\frac{qE}{cos\theta}$
b. mg
c. $\frac{qE}{sin\theta}$
d. $\frac{mg}{sin\theta}$

Short Type 1 Questions 4 x2 =8

6. What is the relevance of large value of K (= 81) for water?

7. Does motion of a body affect its charge?

8. Why does an ebonite rod get negatively charged on rubbing with fur?

9. A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80.0 μCm^{-2}.

i. Find the charge on the sphere.
ii. What is the total electric flux leaving the surface of the sphere?

Short Type 2 Questions 3 x3 =9

10. Dielectric constant of a medium is unity. What will be its permittivity?

11. A polythene piece rubbed with wool is found to have a negative charge of $3.2 \times 10^{-7} C$

a. Estimate the number of electrons transferred (from which to which)?

b. Is there a transfer of mass from wool to polythene?

12. A positive point charge (+q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate. Derive the expression for the electric field at the surface of a charged conductor.

Long Type Questions 2 x4 =8

13. A conducting sphere of radius 10 cm has an unknown charge. If the electric field 20 cm from the centre of the sphere is $1.5 \times 10^3 N/C$ and points radially inward, what is the net charge on the sphere?

14. i. An electric dipole of dipole moment p consists of point charges +qand -q separated by a distance 2a apart. Deduce the expression for the electric field E due to the dipole at a distance x from the centre of the dipole on its axial line in terms of the dipole moment p .Hence, show that in the limit $x >> a, \mathbf{E} \longrightarrow 2p/\left(4\pi\varepsilon_0 x^3\right)$.

ii. Given the electric field in the region $E = 2x\hat{\mathbf{i}}$, find the net electric flux through the cube and the charge enclosed by it.