JES - PHYSICS ASSIGNMENT -2

Concept Achievement Test (CAT - 5)

1. The dimensional formula of electric intensity is
   (a) $[MLT^{-2}A^{-1}]$ (b) $[MLT^{-3}A^{-1}]$ (c) $[ML^2T^{-3}A^{-1}]$ (d) $[ML^2T^{-3}A^{-2}]$

2. Which of the following is deflected by electric field?
   (a) X-rays (b) γ-rays (c) Neutrons (d) α-particles

3. An electron is moving towards x-axis. An electric field is along y-direction then path of electron is
   (a) circular (b) elliptical (c) parabola (d) linear

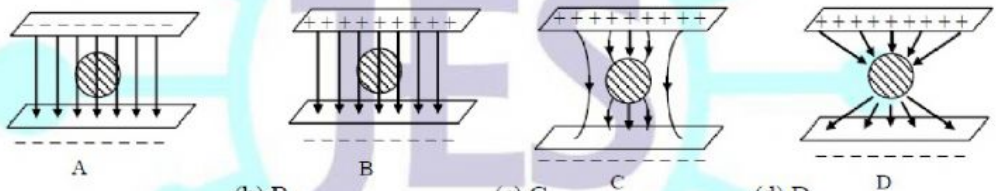
4. An electron enters in an electric field with its velocity in the direction of the electric lines of force. Then
   (a) the path of the electron will be a circle. (b) the path of the electron will be a parabola.
   (c) the velocity of the electron will decrease. (d) the velocity of the electron will increase.

5. A hollow sphere of charge does not produce an electric field at any
   (a) point beyond 2 metres (b) point beyond 10 metres
   (c) interior point (d) outer point

6. The electric field strength at a distance x from a charge Q is E. What will be electric field strength if the distance of the observation point is increased by 2x?
   (a) $\frac{E}{2}$ (b) $\frac{E}{3}$ (c) $\frac{E}{4}$ (d) $\frac{E}{9}$

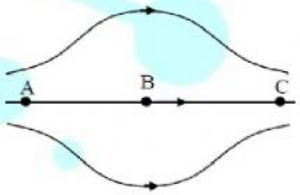
7. Deuteron and α-particle are put 1 Å apart in air. Magnitude of intensity of electric field due to deuteron at α-particle is
   (a) Zero (b) 2.88×10^{11} newton/coulomb
   (c) 1.44×10^{11} newton / coulomb (d) 5.76×10^{11} newton / coulomb

8. An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force look like



   (a) A (b) B (c) C (d) D

9. The figure shows some of the electric field lines corresponding to an electric field. The figure suggests



   (a) $E_A > E_B > E_C$
   (b) $E_A = E_B = E_C$
   (c) $E_A = E_C > E_B$
   (d) $E_A = E_B < E_C$

Concept Achievement Test (CAT - 6)

1. The distance between the two charges +q and – q of a dipole is r. On the axial line at a distance d from the centre of dipole, the intensity is proportional to

   (a) $\frac{q}{d^2}$ (b) $\frac{qr}{d^2}$ (c) $\frac{q}{d^3}$ (d) $\frac{qr}{d^3}$

2. If the magnitude of intensity of electric field at a distance x on axial line and at a distance y on equatorial line on a given dipole are equal, then x : y is

   (a) 1 : 1 (b) $1:\sqrt{2}$ (c) 1 : 2 (d) $\sqrt[3]{2}:1$

3. The electric field at a point on equatorial line of a dipole and direction of the dipole moment

   (a) will be parallel (b) will be in opposite direction

   (c) will be perpendicular (d) are not related

4. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then electric field at Q is proportional to

   (a) p^{-1} and r^{-2} (b) p and r^{-2} (c) p^2 and r^{-3} (d) p and r^{-3}

5. Two charges $+ 3.2 \times 10^{-19}$ and $- 3.2 \times 10^{-19}$ placed at 2.4 A apart to form an electric dipole. It is placed in a uniform electric field of intensity 4×10^5 volt/m. The electric dipole moment is

   (a) 15.36×10^{-29} coulomb × m (b) 15.36×10^{-19} coulomb × m

   (c) 7.68×10^{-29} coulomb × m (d) 7.68×10^{-19} coulomb × m

Concept Achievement Test (CAT - 7)

1. If an electric dipole is placed in a uniform electric field, it experiences

   (a) torque only. (b) net force only.

   (c) both torque and net force. (d) neither torque nor net force.

2. An electric dipole placed in a non-uniform electric field experiences

   (a) both, a torque and a net force. (b) only a force but no torque.

   (c) only a torque but no net force. (d) no torque and no net force.

3. What is the angle between electric dipole moment $\vec{p}$ and the electric field strength $\vec{E}$ when the dipole is in stable equilibrium?

   (a) 0 (b) $\frac{\pi}{4}$ (c) $-\frac{\pi}{4}$ (d) π

4. How does a torque affect the dipole in an electric field?

   (a) Torque sets dipole into continuous rotational motion.

   (b) Torque sets dipole into continuous linear motion.

   (c) Torque tries to align the dipole along the field.

   (d) All of the above.

6. The electric intensity due to a dipole of length 10 cm and having a charge of 500 μC, at a point on the axis at a distance 20 cm from one of the charges in air, is
   (a) 6.25×10^7 N/C (b) 9.28×10^7 N/C (c) 13.1×11^7 N/C (d) 20.5×10^7 N/C
7. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90° about its perpendicular axis, the electric field at the same point will be
   (a) E (b) $\frac{E}{4}$ (c) $\frac{E}{2}$ (d) 2E

Concept Achievement Test (CAT - 8)

1. The S.I. unit of electric flux is
   (a) weber (b) newton per coulomb
   (c) volt × metre (d) joule per coulomb
2. A cube of side l is placed in a uniform field E, where $\vec{E} = E\hat{i}$. The net electric flux through the cube is
   (a) Zero (b) l^2E (c) $4l^2E$ (d) $6l^2E$
3. A point charge + q is placed at the centre of a cube of side L. The electric flux emerging from the cube is
   (a) $\frac{q}{\varepsilon_0}$ (b) zero (c) $\frac{6qL^2}{\varepsilon_0}$ (d) $\frac{q}{6L^2\varepsilon_0}$
4. Flux coming out from a unit positive charge placed in air is
   (a) ε_0 (b) ε_0^{-1} (c) $(4\pi\varepsilon_0)^{-1}$ (d) $4\pi\varepsilon_0$

Concept Achievement Test (CAT - 9)

1. Gaussian surface cannot pass through discrete charge because
   (a) its an imaginary surface.
   (b) electric field is not defined at the location of charge.
   (c) electric field is normal at that point.
   (d) electric field is tangential at that point.
2. Gauss' law helps in
   (a) determination of electric force between point charges.
   (b) situations where Coulomb's law fails.
   (c) determination of electric field due to symmetric charge distribution.
   (d) determining electric potential due to symmetric charge distributions.
3. It is not convenient to use a spherical Gaussian surface to find the electric field due to an electric dipole using Gauss' theorem because
   (a) Gauss' law fails in this case.
   (b) this problem does not have spherical symmetry.
   (c) Coulomb's law is more fundamental than Gauss' law.
   (d) spherical Gaussian surface will alter the dipole moment.
4. Gauss' law should be invalid if
   (a) there were magnetic monopoles.
   (b) the inverse square law was not exactly true
   (c) the velocity of light was not a universal constant.
   (d) None of these

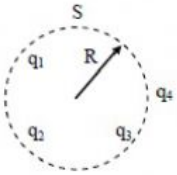
5. At the point inside a charged spherical shell, electric field is
(a) infinite (b) maximum (c) minimum. (d) zero

6. The inward and outward electric flux for a closed surface in units of N-m^2/C are respectively 8×10^3 and 4×10^3. Then the total charge inside the surface is [where ε_0 = permittivity constant]
(a) 4×10^3 C (b) -4×10^3 C (c) $\frac{(-4\times10^3)}{\varepsilon_0}$C (d) $-4 \times 10^3\ \varepsilon_0$C

7. A conducting sphere of radius 0.10 4m has an unknown charge. If the electric field at 0.20 m from the centre of the sphere is 1.5×10^3 NC^{-1} and points radially inward, what is the electric flux?
(a) 753.7 Nm^{2}C^{-1} (b) $-$ 753.7 Nm^{2}C^{-1} (c) 669.8 Nm^{2}C^{-1} (d) 667.8 Nm^{2}C^{-1}

8. A plastic rod of length 2.2 m and radius 3.6 mm carries a negative charge of 3.8×10^{-7} C spread uniformly over its surface. What is the electric field near the mid-point of the rod, at a point on its surface?
(a) -8.6×10^5 N/C (b) 8.6×10^5 N/C (c) -8.6×10^{-5} N/C (d) 8.6×10^{-5} N/C

9. q_1, q_2, q_3 and q_4 are point charges located at points as shown in the figure and S is a spherical gaussian surface of radius R. Which of the following is true according to the Gauss' law?



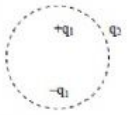
(a) $\oint_S (\vec{E}_1+\vec{E}_2+\vec{E}_3).d\vec{A} = \frac{q_1+q_2+q_3}{2\varepsilon_0}$

(b) $\oint_S (\vec{E}_1+\vec{E}_2+\vec{E}_3).d\vec{A} = \frac{q_1+q_2+q_3}{\varepsilon_0}$

(c) $\oint_S (\vec{E}_1+\vec{E}_2+\vec{E}_3).d\vec{A} = \frac{q_1+q_2+q_3+q_4}{\varepsilon_0}$

(d) $\oint_S (\vec{E}_1+\vec{E}_2+\vec{E}_3).d\vec{A} = q_1+q_2+q_3+q_4$

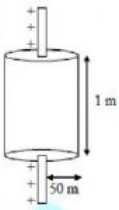
10. Consider the charge configuration and spherical gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface the electric field will be due to



(a) q_2 (b) only the positive charges
(c) all the charges (d) $+q_1$ and $-q_1$

11. According to Gauss' theorem, electric field of an infinitely long straight wire is proportional to
(a) r (b) $\frac{1}{r^2}$ (c) $\frac{1}{r^3}$ (d) $\frac{1}{r}$

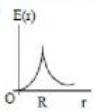
12. Electric charge is uniformly distributed along a long straight wire of radius 1mm. The charge per cm length of the wire is Q coulomb. Another cylindrical surface of radius 50 cm and length 1 m symmetrically encloses the wire as shown in the figure. The total electric flux passing through the cylindrical surface is

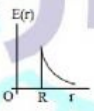


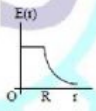
(a) $\frac{Q}{\varepsilon_0}$ (b) $\frac{100Q}{\varepsilon_0}$
(c) $\frac{10Q}{(\pi\varepsilon_0)}$ (d) $\frac{100Q}{(\pi\varepsilon_0)}$

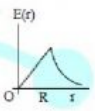
13. Electric field intensity at a point in between two parallel sheets with like charges of same surface charge densities (σ) is
(a) $\frac{\sigma}{2\varepsilon_0}$ (b) $\frac{\sigma}{\varepsilon_0}$ (c) zero (d) $\frac{2\sigma}{\varepsilon_0}$

14. A thin spherical shell of radius R has charge Q spread uniformly over its surface. Which of the following graphs most closely represents the electric field E(r) produced by the shell in the range $0 \le r < \infty$ where r is the distance from the centre of the shell?

(a) 

(b) 

(c) 

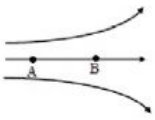
(d) 

15. A thin charged shell of surface charge density -1.77×10^{-6} Cm^{-2} is placed in air. The electric field at its surface is
(a) 2×10^6 NC^{-1} (b) -2×10^6 NC^{-1} (c) 2×10^{-5} NC^{-1} (d) -2×10^5 NC^{-1}

Exercise – 1

Graphical questions

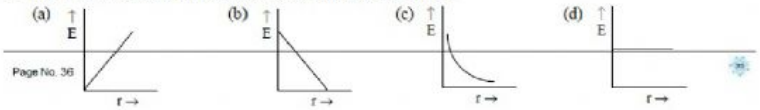
1. The adjoining diagram shows the electric lines of force emerging from a charged body. If the electric fields at A and B are E_A and E_B respectively and the distance between them is r, then;



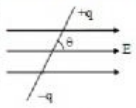
(a) $E_A > E_B$ (b) $E_A < E_B$

(c) $E_A = E_B$ (d) $E_A > \frac{E_B}{r^3}$

2. The E-r curve for an infinite linear charge distribution will be:



3. The electric dipole is situated is an electric field as shown in figure. The dipole and electric field are both in the plane of the paper. The dipole is rotated about an axis perpendicular to plane of paper passing through A in anticlockwise direction. If the angle of rotation (θ) is measured with respect to the direction of electric field, then the torque (τ) experienced by the dipole for different values of the angle of rotation O will be represented in figure, by curve

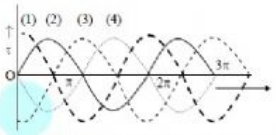


(a) curve (1)

(b) curve (2)

(c) curve (3)

(d) curve (4)



4. Which of the following plots represents the variation of the electric field with distance from the centre of a uniformly charged non-conducting sphere of radius R?

(a) (b) (c) (d)