EXERCISE–I (Conceptual Question) Build Up your Understanding

ELECTRIC CHARGE & METHODS OF CHARGING

1. Which of the following charges can not be present on an oil drop in Millikan's experiment :-
(1) 4.0×10^{-19} C (2) 6.0×10^{-19},C (3) 10.0×10^{-19} C (4) All of them

2. In nature, the electric charge of any system is always equal to :
(1) half integral multiple of the least amount of charge
(2) zero
(3) square of the least amount of charge
(4) integral multiple of the least amount of charge

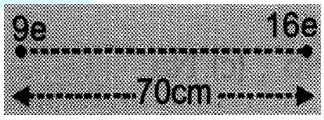
3. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then :
(1) negative and distributed uniformly over its surface.
(2) negative and appears only at the point on the sphere closest to the point charge
(3) negative and distributed non-uniformly over its entire surface of the sphere
(4) zero

COULOMB'S LAW AND EQUILIBRIUM OF CHARGE SYSTEM

4. force between two identical spheres charged with same charge is F. If 50% charge of one sphere is transferred to the other sphere then the new force will be :-
(1) $\frac{3}{4}$F (2) $\frac{3}{8}$F (3) $\frac{3}{2}$F (4) None of these

5. two point charges placed at a distance 'r' in air exert a force 'F'. The distance at which they exert same force when placed in a certain medium (dielectric constant K) is :-
(1) rK (2) r / K (3) $r/\sqrt{K}$ (4) $r\sqrt{K}$

6. Two charges are placed as shown in figure. Where should a third charge be placed so that it remains at rest ?



(1) 30 cm from 9e (2) 40 cm from 16e (3) 40 cm from 9e (4) (1) or (2)

7. Two point charges +9q and +q are kept 16 cm apart. Where should a third charge Q be placed between them so that the system remains in equilibrium ?
(1) 24 cm from + 9q (2) 12 cm from+ 9q (3) 24 cm from + q (4) 12 cm from + q

8. Two balls carrying charges +7 μC and –5 μC attract each other with a force F. If a charge –2 μC is added to both, the force between them will be :-
(1) F (2) $\frac{F}{2}$ (3) 2F (4) Zero

9. Two equal and like charges when placed 5 cm apart experience a repulsive force of 0.144 newtons. The magnitude of the charge in micro-coulomb will be
(1) 0.2 (2) 2 (3) 20 (4) 12

10. Two point charges of +2 μC reple each other with a force of 12 N. If each is given an additional charge of –4 μC, then force will become:-
(1) 4 N (attractive) (2) 60 N (attractive) (3) 4 N (repulsive) (4) 12 N (attractive)

11. What equal charges should to be placed on earth and moon to neutralize their gravitational attraction? (mass of earth = 10^{25} kg, mass of moon = 10^{23} kg)
(1) 8.6×10^{13} C (2) 6.8×10^{26} C (3) 8.6×10^{3} C (4) 9×10^{6} C

12. A point charge q_1 exerts a force F upon another point charge q_2. If a third charge q_3 be placed quite close to the charge q_2 then the force that charge q_1 exerts on the charge q_2 will be :-
(1) F (2) > F (3) < F (4) zero

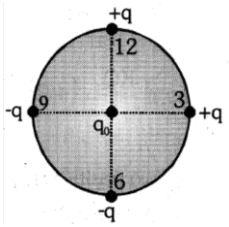
13. A charge Q is divided in two parts Q_1 and Q_2 and these charges are placed at a distance R. There will be maximum repulsion between them when:-
(1) $Q_1 = Q - q$, $Q_2 = q$ (2) $Q_1 = \frac{2Q}{3}$, $Q_2 = \frac{Q}{3}$
(3) $Q_1 = \frac{3Q}{4}$, $Q_2 = \frac{Q}{4}$ (4) $Q_1 = Q_2 = \frac{Q}{2}$

14. The force of repulsion between two point charges is F, when these are 1 m apart. Now the point charges are replaced by conducting spheres of radii 5 cm having the charge same as that of point charges. The distance between their centres is 1 m, then the force of replusion will :-
(1) increase (2) decrease (3) remain same (4) become $\frac{10F}{9}$

15. Two charges 4q and q are placed at a distance λ apart. A third charged particle Q is placed at the middle of them. If resultant force on q is zero then the value of Q is :-
(1) q (2) – q (3) 2q (4) – 2q

16. Two similar spheres having +q and –q charges are kept at a certain separation. F force acts between them. If another similar sphere having +q charge is kept in the middle of then, it experiences a force in magnitude and direction as :-
(1) zero having no direction (2) 8F towards +q charge
(3) 8F towards –q charge (4) 4F towards +q charge

17. Four charges are placed at the circumference of the dial of a clock as shown in figure. If the clock has only hour hand, then the resultant force on a positive charge q_0 placed at the centre, points in the direction which shows the time as :-



(1) 1 : 30 (2) 7 : 30 (3) 4 : 30 (4) 10 : 30

18. Two small spheres each having a charge +Q are suspended by insulating threads of length L from a hook. This arrangement is taken to a space where there is no gravitational effect, then the angle between the two threads and the tension in each will be :-

(1) 180°, $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{(2L)^2}$ (2) 90°, $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

(3) 180°, $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{2L^2}$ (4) 180°, $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

19. Identify the wrong statement in the following :-
Coulomb's law correctly describes the electric force that.
(1) binds the electrons of an atom to it's nucleus
(2) binds the protons and neutrons in the nucleus of an atom
(3) binds the atoms together to form molecules
(4) binds the atoms and molecules together to form solids

ELECTRIC FIELD INTENSITY

20. Two charges 9e and 3e are placed at a separation r. The distance of the point where the electric field intensity will be zero, is :-

(1) $\frac{r}{(1+\sqrt{3})}$ from 9e charge (2) $\frac{\sqrt{3}r}{\sqrt{3}+1}$ from 9e charge

(3) $\frac{r}{(1-\sqrt{3})}$ from 3e charge (4) $\frac{\sqrt{3}r}{1+\sqrt{3}}$ from 3e charge

21. A ring of radius R is charge uniformly with a charge +Q. The electric field at a point on its axis at a distance r from any point on the ring will be :-

(1) $\frac{KQ}{(r^2-R^2)}$ (2) $\frac{KQ}{r^2}$ (3) $\frac{KQ}{r^3}(r^2-R^{2^{1/2}})$ (4) $\frac{KQr}{R^3}$

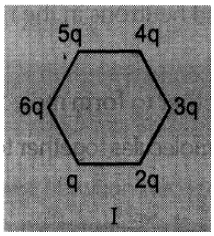
22. Two positive charges of 1 μC and 2 μC are placed 1 meter apart. The value of electric field in N/C at the mid. point of the two charges will be :-

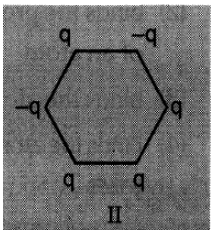
(1) 10.8×10^4 (2) 3.6×10^4 (3) 1.8×10^4 (4) 5.4×10^4

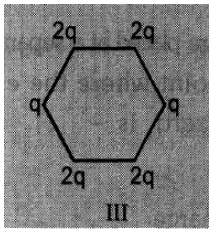
23. The electric field in a certain region is given by $\vec{E} = \left(\frac{K}{x^3}\right)\hat{i}$. The dimensions of K are :-

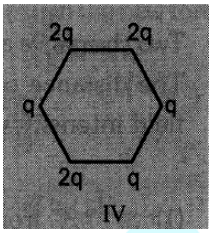
(1) $MLT^{-3}A^{-1}$ (2) $ML^{-2}T^{-3}A^{-1}$ (3) $ML^4T^{-3}A^{-1}$ (4) M°L°T°A°

24. Figure below shows regular hexagon, with different charges placed at the vertices. In which of the following cases is the electric field at the centre zero?



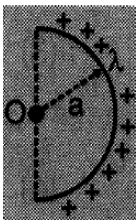






(1) IV (2) III (3) I (4) II

25. Electric field at the centre 'O' of a semicircle of radius 'a' having linear charge density λ is given as :-

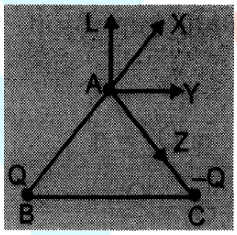


(1) $\frac{2\lambda}{\epsilon_0 a}$ (2) $\frac{\lambda\pi}{\epsilon_0 a}$ (3) $\frac{\lambda}{2\pi\epsilon_0 a}$ (4) $\frac{\lambda}{\pi\epsilon_0 a}$

26. A semicircular ring of radius 0.5 m is uniformly charged with a total charge of 1.4×10^{-9} C. The electric field intensity at the centre of this ring is :-

(1) zero (2) 320 V/m. (3) 64 V/m. (4) 32 V/m.

27. For the given figure the direction of electric field at A will be :



(1) towards AL (2) towards AY (3) towards AX (4) towards AZ

28. -1×10^{-6} C charge is on a drop of water having mass 10^{-6} kg. What electric field should be applied on the drop so that it is in the balanced condition with its weight ?

(1) 10 V/m upward (2) 10 V/m downward
(3) 0.1 V/m downward (4) 0.1 V/m upward

29. Two small identical spheres, each of mass 1g and carrying same charge 10^{-9} C are suspended by threads of equal lengths. If the distance between the centres of the spheres is 0.3 cm in equilibrium then the inclination of the thread with the vertical will be :-

(1) $\tan^{-1}(0.1)$ (2) $\tan^{-1}(2)$ (3) $\tan^{-1}(1.5)$ (4) $\tan^{-1}(0.6)$

ELECTRIC FIELD LINES, ELECTRIC FLUX & GAUS'S THEOREM

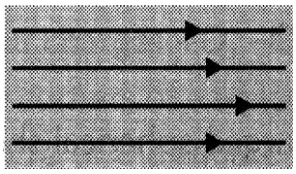
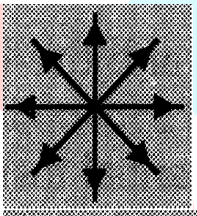
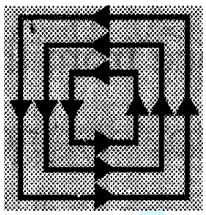
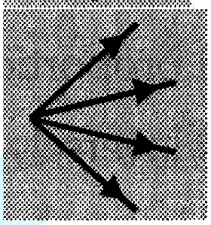
30. Two infinitely long parallel wires having linear charge densities λ_1 and λ_2 respectively are placed at a distance R. The force per unit length on either wire will be :-

(1) $\frac{k2\lambda_1\lambda_2}{R^2}$ (2) $\frac{k2\lambda_1\lambda_2}{R}$ (3) $\frac{k\lambda_1\lambda_2}{R^2}$ (4) $\frac{k\lambda_1\lambda_2}{R}$

31. Choose the correct statement regarding electric lines of force :-
(1) They emerge from negative charge and terminate at positive charge
(2) The electric field in that region is weak where the density of electric lines of force are more
(3) They are in radial directions for a point charge
(4) They have a physical existence

32. A solid sphere of radius R, is charged uniformly with total charge Q. Then the correct expression for electric field is (r = distance from centre) :-
(1) $\frac{KQr}{R^3}$, where $r < R$ (2) $\frac{KQ}{r^2}$, where $r \geq R$
(3) it is zero, at all points (4) (1) and (2) both

33. Which one of the following pattern of electrostatic lines of force is not possible ?

(1) 
(2) 
(3) 
(4) 

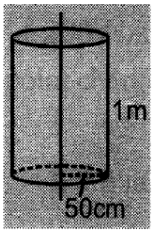
34. A sphere of radius Rand charge Q is placed inside a concentric imaginary sphere of radius 2R. The flux associated with the imaginary sphere is :-
(1) $\frac{Q}{\epsilon_0}$ (2) $\frac{Q}{2\epsilon_0}$ (3) $\frac{4Q}{\epsilon_0}$ (4) $\frac{2Q}{\epsilon_0}$

35. A non-conducting sphere of radius R is charged uniformly. The magnitude of the electric field due to the sphere at a distance r from its centre :-
(a) increases as r increases, for $r < R$ (b) decreases as r increases, for $0 < r < \infty$
(c) decreases as r increases, for $R < r < \infty$ (d) is discontinuous at r = R
(1) a, c (2) c, d (3) a, b (4) b, d

36. 20 μC charge is placed inside a closed surface; then flux linked with the surface is ϕ. If 80 μC charge is put inside the surface then change in flux is :-
(1) 4ϕ (2) 5ϕ (3) ϕ (4) 8ϕ

37. In a region of space the electric field is given by $\vec{E} = 8\hat{i} + 4\hat{j} + 3\hat{k}$. The electric flux through a surface of area of 100 units in the x-y plane is:-
(l) 800 units (2) 300 units (3) 400 units (4) 1500 units

38. Electric charge is uniformly distributed over a long straight wire of radius 1 mm. The charge per cm length of the wire is Q coulombs. A cylindrical surface of radius 50 cm and length 1m encloses the wire symmetrically as shown in fig·
The total flux passing through the cylindrical surface is:-



(1) $\frac{Q}{\epsilon_0}$ (2) $\frac{100\,Q}{\epsilon_0}$ (3) $\frac{10\,Q}{\pi\,\epsilon_0}$ (4) $\frac{100\,Q}{\pi\,\epsilon_0}$

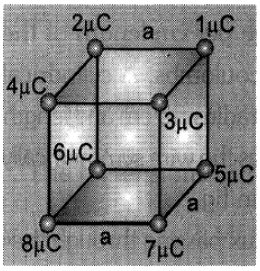
39. Gaus's law is given by $\epsilon_0 \oint_s \vec{E}.d\vec{s} = q$, H net charge enclosed by a Gaussian surface is zero then :-
(1) E must be zero on the surface
(2) Number of incoming and outgoing electric lines are equal
(3) There is a net incoming of electric lines
(4) None

40. The electric field is 100 V/m, at a distance of 20 cm from the centre of a dielectric sphere of radius 10 cm. Then E at 3 cm distance from the centre of sphere is :-
(1) 100 V/m (2) 125 V/m (3) 120 V/m (4) zero

41. If the electric flux entering and leaving a closed surface is ϕ_1 and ϕ_2 respectively then electric charge inside the surface will be :-
(1) $(\phi_1 + \phi_2)\varepsilon_0$ (2) $(\phi_2 - \phi_1)\varepsilon_0$ (3) $\frac{\phi_1+\phi_2}{\varepsilon_0}$ (4) $\frac{\phi_2-\phi_1}{\varepsilon_0}$

42. The electric field in a region of space is given by $E = (5\hat{i} + 2\hat{j})$ N/C. The electric flux through an area of 2 m^2 lying in the YZ plane, in S.I. units is :-
(1) 10 (2) 20 (3) $10\sqrt{2}$ (4) $2\sqrt{29}$

43. The total flux associated with the given cube will be where 'a' is side of the cube :-
($\frac{1}{\epsilon_0} = 4\pi \times 9 \times 10^9$ SI units)



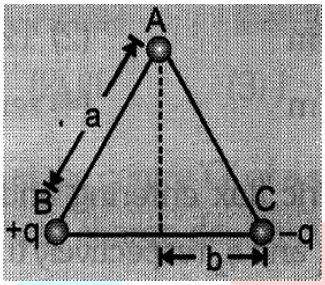
(1) $162\pi \times 10^{-3}$ NM^2/C (2) $162\pi \times 10^{3}$ Nm^2/C
(3) $162\pi \times 10^{-6}$ Nm^2/C (4) $162\pi \times 10^{6}$ Nm^2/C

44. A point charge is placed at a distance $\frac{a}{2}$ perpendicular to the plane and above the centre of a square of side a. The electric flux through the square is :-

(1) $\frac{q}{\epsilon_0}$ (2) $\frac{q}{\pi\epsilon_0}$ (3) $\frac{q}{4\epsilon_0}$ (4) $\frac{q}{6\epsilon_0}$

ELECTRIC POTENTIAL, EQUIPOTENTIAL SURFACE & RELATION BETWEEN FIELD & POTENTIAL

45. As shown in the fig. charges +q and –q are placed at the vertices B and C of an isosceles triangle. The potential at the vertex A is :-



(1) $\frac{1}{4\pi\epsilon_0}.\frac{2q}{\sqrt{a^2+b^2}}$ (2) zero (3) $\frac{1}{4\pi\epsilon_0}.\frac{q}{\sqrt{a^2+b^2}}$ (4) $\frac{1}{4\pi\epsilon_0}.\frac{-q}{\sqrt{a^2+b^2}}$

46. At any point on the perpendicular bisector of the line joining two equal and opposite charges :-
(1) the electric field is zero
(2) the electric potential is zero
(3) the electric potential decreases with increasing distance from their mid point
(4) the electric field is perpendicular to the line joining the charges

47. What is the electric potential at a distance 'x' from the centre, inside a conducting sphere having a charge Q and radius R ?

(1) $\frac{1}{4\pi\epsilon_0}\frac{Q}{R}$ (2) $\frac{1}{4\pi\epsilon_0}\frac{Q}{x}$ (3) $\frac{1}{4\pi\epsilon_0}\frac{QX}{R^2}$ (4) zero

48. Certain positive charge is given to a conductor. Then its potential :-
(1) is maximum at the surface
(2) is maximum at the centre
(3) remains same throughout the conductor
(4) is maximum somewhere between the surface and the centre

49. Potential inside a charged spherical shell is :-
(1) uniform
(2) proportional to the distance from the centre
(3) inversely proportional to the distance
(4) inversely proportional to square of distance from the centre

50. A solid conducting sphere having a charge Q is surrounded by an uncharged concentric conducting spherical shell. Let the potential difference between the surface of the solid sphere and the outer surface of the shell be V. If the shell is now given a charge –3Q the new potential difference between the same two surfaces is :-

(1) v (2) 2V (3) 4V (4) –2V

51. Four charges 2C, –3C, –4C and 5C respectively are placed at the four corners of a square. Which of the following statements is true for the point of intersection of the diagonals ?

(1) E = 0, V = 0 (2) E ≠ 0, V = 0 (3) E = 0, V ≠ 0 (4) E ≠ 0, V ≠ 0

52. A non-conducting ring is of radius 0.5 m. 1.11×10^{-10} coulombs charge is non-uniformly distributed over the circumference of ring which produces electric field E around itself. If λ=0 is the centre of the ring, then the value of $\int_{l=\infty}^{l=0} \vec{E}.d\vec{l}$ is :-

(1) 2 V (2) – 2 V (3) –1 V (4) zero

53. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 volts. The electric field at the centre of the sphere will be :-

(1) 50 volt/meter (2) 10 volt/meter (3) 5 volt/meter (4) zero

54. The potential at a distance R/2 from the centre of a conducting sphere of radius R containing charge Q will be:-

(1) 0 (2) $\frac{Q}{8\pi \in_0 R}$ (3) 0 (4) $\frac{Q}{2\pi \in_0 R}$

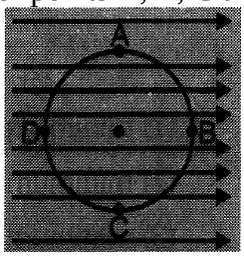
55. Four charges +Q, –Q, +Q and –Q are situated at the comers of a square; in a sequence then at the centre of the square :-

(1) E = 0, V = 0 (2) E = 0, V ≠ 0 (3) E ≠ 0, V = 0 (4) E = 0, V ≠ 0

56 Electric field at a distance x from the origin is given as E = $\frac{100N - m^2/C}{x^2}$. Then potentia1 difference between the points situated at x = 10 m and x = 20 m is :-

(l) 5 V (2) 10 V (3) 15 V (4) 4V

57. A circle of radius R is drawn in a uniform electric field E as shown in the fig. V_A, V_B, V_C and V_D are respectively the potentials of points A, B, C and D on the circle then :-



(1) $V_A > V_C$, $V_B = V_D$ (2) $V_A < V_C$, $V_B = V_D$

(3) $V_A = V_C$, $V_B < V_D$ (4) $V_A = V_C$, $V_B > V_D$

58. A uniform electric field pointing in positive x-direction exists in a region. Let A be the origin, B be the point on the x-axis at x = +1 cm and C be the point on the y-axis at y = +1 cm. Then the potentials at the points A, Band C satisfy :-

(1) $V_A < V_B$ (2) $V_A > V_B$ (3) $V_A < V_C$ (4) $V_A > V_C$

59. The electric potential V is given as a function of distance x (metre) by $V = (5x^2 – 10x – 9)$ volts. The value of electric field at x = 1 m is :-

(1) 20 V/m (2) 6 V/m (3) 11 V/m (4) zero

60. The electric potential and electric field at a point due to a point charge are 600 V and 200 N/C respectively. Then magnitude of the point charge should be :-

(1) 3 μC (2) 30 μC (3) 0.2 μC (4) 0.5 μC

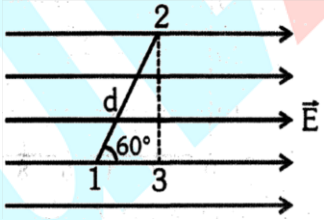
61. Two concentric spheres of radii Rand r have similar charges with equal surface charge densities (σ). What is the electric potential at their common centre?

(1) σ / ε_0 (2) $\frac{\sigma}{\varepsilon_0}(R - r)$ (3) $\frac{\sigma}{\varepsilon_0}(R + r)$ (4) None of these

62. Three charges 2q, –q, –q are located at the vertices of an equilateral triangle. At the centre of the triangle :-

(1) the field is zero but potential is non-zero (2) the field is non-zero but potential is zero
(3) both field and potential are zero (4) both field and potential are non-zero

63. The electric field $\vec{E}$ is constant in both magnitude and direction. Consider a path of length d at an angle θ = 60° with respect to field lines as shown in figure. The potential difference between points 1 and 2 is :-



(1) $\frac{E}{d \sin 60°}$ (2) $Ed \cos 60°$ (3) $\frac{Ed}{\cos 60°}$ (4) $\frac{E}{d} \sin 60°$

64. The electric potential in a certain region is expressed by $V = 6x – 8xy^2 – 8y + 6yz – 4z^2$ volts. The magnitude of the force acting on a charge of 2C situated at the origin will be :-

(1) 2 N (2) 6 N (2) 8 N (4) 20 N

65. Which statement is true ?

(i) A ring of radius R carries a uniformly distributed charge +Q. A point charge –q is placed on the axis of the ring at a distance 2R from its centre and released. The particle executes simple harmonic motion along the axis of the ring.

(ii) Electrons move from a region of higher potential to that of lower potential

(1) only (i) (2) only (ii) (3) (i), (ii) (4) none of them

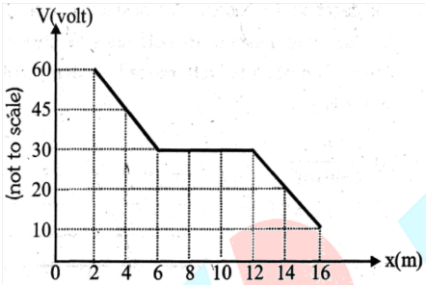
66. Two conducting spheres of radii r_1 and r_2 have same electric field near their surfaces. The ratio of their electric potentials is :-

(1) r_1^2 / r_2^2 (2) r_2^2 / r_1^2 (3) r_1 / r_2 (4) r_2 / r_1

67. A charged hollow metal sphere has a radius r. if the potential difference between its surface and a point at distance 3r from the centre is V, the electric intensity at a distance 3r from the centre is :-

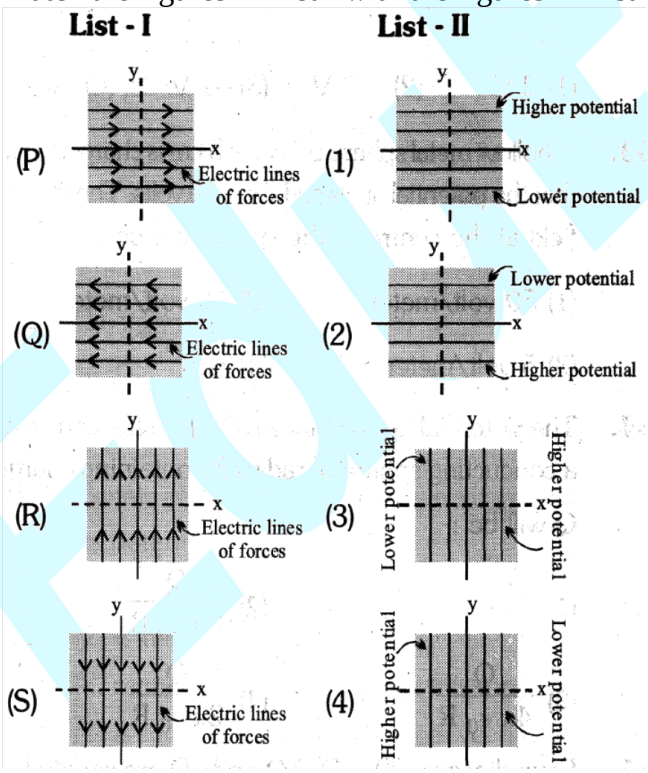
(1) $\frac{V}{6r}$ (2) $\frac{V}{4r}$ (3) $\frac{V}{3r}$ (4) $\frac{V}{2r}$

68. The variation of potential with distance x from a fixed point is shown in figure. The electric field at x = 13 m is



(1) 7.5 volt/meter (2) –7.5 volt/meter (3) 5 volt/meter (4) –5 volt/meter

69. List I give certain situations in which electric field is represented by electric lines of forces in x–y plane. List II gives corresponding representation of equipotential lines in x–y plane. Match the figures in List I with the figures in List II and indicate your answer.

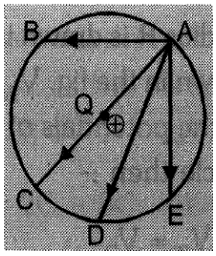


Coded	P	Q	R	S
(1)	1	2	3	4
(2)	4	3	2	1
(3)	3	4	2	1

(4) 2 1 3 4

ELECTRICAL POTENTIAL ENERGY

70. In the electric field of charge Q, another charge is carried from A to B, A to C, A to D and A to E, then work done will be :-

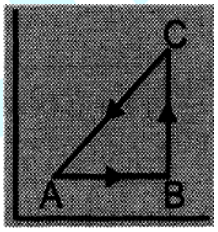


(1) minimum along the path AB (2) minimum along the path AD
(3) minimum along the path AE (4) zero along each path

71. Choose the incorrect statement:-
(1) the potential energy per unit positive charge in an electric field at some point is called the electric potential.
(2) the work required to be done to move a point charge from one point to another in an electric field depends on the position of the points
(3) the potential energy of the system will increase if a positive charge is moved against the Coulombian force
(4) the value of fundamental charge is not equivalent to the electronic charge.

72. A charge of 10 esu is placed at a distance of 2 cm from a charge of 40 esu and 4 cm from another charge of –20 esu. The potential energy of the charge 10 esu is :- (in ergs)
(1) 87.5 (2) 112.5 (3) 150 (4) zero

73. As shown in figure, on bringing a charge Q from point A to B and from B to C, the work done are 2 joules and –3 joules respectively. The work done in bringing the charge from C to A will be



(1) – 1 joule (2) 1 joule (3) 2 joules (4) 5 joules

74. 15 joule of work has to be done against an existing electric field to take a charge of 0.01 C from A to B. Then the potential difference ($V_B - V_A$) is :-
(1) 1500 volts (2) –1500 volts (3) 0.15 volts (4) none of these

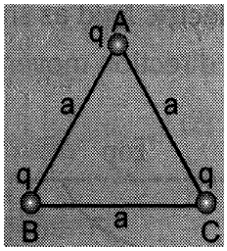
75. A 5 C charge experiences a force of 2000 N when moved between two points along the field separated by a distance of 2 cm in a uniform electric field. The potential difference between the two points is :-
(1) 8 volts (2) 80 volts (3) 800 volts (4) 8000 volts

76. When the separation between two charges is increased the electric potential energy of the system of charges :-

(1) increases (2) decreases

(3) remains the same (4) may increase or decrease

77. In the fig. force on charge at A in the direction normal to BC will be :-



(1) $-\frac{kq}{a^2}$ (2) $-\frac{kq^2}{2a^2}$ (3) $\frac{kq^2}{2a^2}$ (4) $\frac{\sqrt{3}kq^2}{a^2}$

MOTION OF CHARGED PARTICLE IN ELECTRIC FIELD AND ELECTIRC DIPOLE

78. An electron enters an electric field with its velocity in the direction of the electric field lines then :-

(1) the path of the electron will be a circle

(2) the path of the electron will be a parabola

(3) the velocity of the electron will decrease just after the entry

(4) the velocity of the electron will increase just after the entry

79. An electron and a proton are set free in a uniform electric field. The ratio of their accelerations is :-

(1) unity (2) zero (3) $\frac{m_p}{m_e}$ (4) $\frac{m_e}{m_p}$

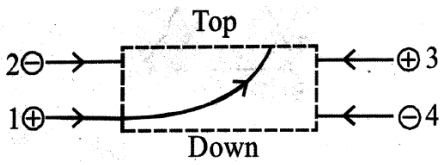
80. A particle of mass m and charge q is released from rest in an electric field E. Then the K.E. after time t will be :-

(1) $\frac{2E^2t^2}{mq}$ (2) $\frac{E^2q^2t^2}{2m}$ (3) $\frac{Eq^2m}{2t^2}$ (4) $\frac{Eqm}{2t}$

81. A charge q is projected into a uniform electric field E; work done when it suffers a displacement Y along the field direction is :-

(1) qEY (2) $\frac{qY}{E}$ (3) $\frac{qE}{Y}$ (4) $\frac{Y}{qE}$

82. The figure below shows the path of a positively charged particle 1 through a rectangular region of uniform electric field as shown in the figure. What are the direction movement of particles 2, 3 and 4 ?



(1) Down, top, down (2) Down, down, top

(3) Top, top, down (4) Top, down down

83. For a dipole, the of each charge is 10^{-10} stat coulomb and their separation is 1Å, then its dipole moment is :-
(1) one debye (2) 2 debye (3) $I0^{-3}$ debye (4) $3 \times I0^{-20}$ debye

84. The electric potential and field at a point due to an electric dipole are proportional to :-
(1) r, r^{-1} (2) r^{-1}, r^{-2} (3) r^{-2}, r^{-3} (4) r^{-2}, r^{-2}

85. When an electric dipole $\vec{p}$ is kept in a uniform electric field $\vec{E}$ then for what value of angle between $\vec{p}$ and $\vec{E}$, will the torque be maximum ?
(1) 90° (2) 0° (3) 180° (4) 45°

86. What will be the ratio of electric field at a point on the axis and an equidistant point on the equatorial line of a dipole :-
(1) 1 : 2 (2) 2 : 1 (3) 4 : 1 (4) 1 : 4

87. For a dipole $q = 2 \times 10^{-6}$ C ; d = 0.01m; find the maximum torque on the dipole if $E = 5 \times 10^5$ N/C :-
(1) 1×10^{-3} Nm^{-1} (2) 10×10^{-3} Nm^{-1} (3) 10×10^{-3} Nm (4) 1×10^{-4} Nm

88. Two particles each of mass M is attached to the two ends of a massless rigid non-conducting rod of length L. The two particles carry charges. +q and –q respectively. This arrangement is held in a region of uniform electric field E such that the rod make a small angle $\theta(< 5°)$ with the field direction. The time period of rod is (rod oscillates about its centre of mass) :-
(1) $2\pi\sqrt{\frac{ML}{2qE}}$ (2) $\pi\sqrt{\frac{ML}{2qE}}$ (3) $\frac{\pi}{2}\sqrt{\frac{ML}{2qE}}$ (4) $4\pi\sqrt{\frac{ML}{2qE}}$

89. The electric potential at a point due to an electric dipole will be :-
(1) $k\frac{\vec{p}.\vec{r}}{r^3}$ (2) $k\frac{\vec{p}.\vec{r}}{r^2}$ (3) $k\frac{\vec{p}\times\vec{r}}{r^3}$ (4) $k\frac{\vec{p}\times\vec{r}}{r^2}$

90. The force on a charge situated on the axis of a dipole is F; if the charge is shifted to double the distance, the force acting will be :-
(1) zero (2) $\frac{F}{2}$ (3) $\frac{F}{4}$ (4) $\frac{F}{8}$

91. A small electric dipole is of dipole moment p. The electric polential at a distance 'r' from its centre and making an angle θ from the axis of dipole will be :-
(1) $\frac{kp\sin\theta}{r^2}$ (2) $\frac{kp\cos\theta}{r^2}$ (3) $\frac{kp}{r^3}\sqrt{1+3\cos^2\theta}$ (4) $\frac{kp}{r^3}\sqrt{1+3\sin^2\theta}$

92. If an electric dipole is placed in an electric field generated by a point charge then :-
(1) the net electric force on the dipole must be zero
(2) the net electric force on the dipole may be zero

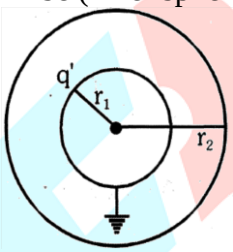
(3) the torque on the dipole due to the field must be zero
(4) the torque on the dipole due to the field may be zero

CONDUCTORS

93. Two conductors are of same shape and size. One of copper and the other of aluminium (less conducting) are placed in an uniform electric field. The charge induced in aluminium :-
(1) will be less than that in copper (2) will be more than that in copper
(3) will be equal to that in copper (4) cannot be compared with that of copper

94. A big hollow metal sphere A is charged to 100 volts and another smaller hollow sphere B is charged to 50 volts. If B is put inside A and joined with a metallic wire, then the direction of charge flow :-
(1) is from A to B (2) is from B to A
(3) no charge flows (4) depends on the radii of spheres

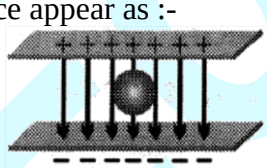
95. Two concentric conducting spheres are of radii r_1 and r_2. The outer sphere is given a charge q. The charge q on the inner sphere will be (inner sphere is grounded) :-



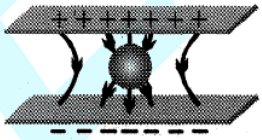
(1) q (2) –q (3) $-q\frac{r_1}{r_2}$ (4) Zero

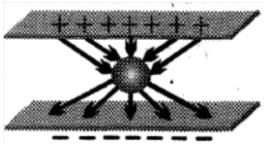
96. A charge given to any conductor resides on its outer surface, because :-
(1) the free charge tends to be in its minimum potential energy state.
(2) the free charge tends to be in its minimum kinetic energy state.
(3) the free charge tends to be in its maximum potential energy state.
(4) the free charge tends to be in its maximum kinetic energy state.

97. An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force appear as :-

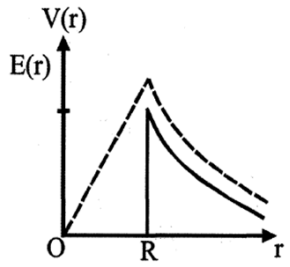
(1) 

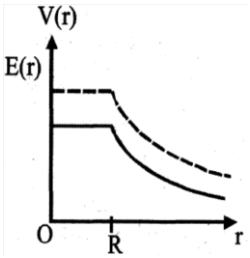
(2) 

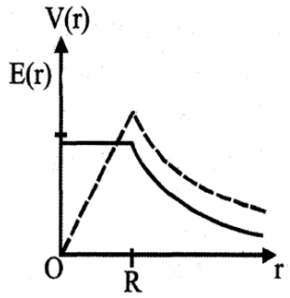
(3) 

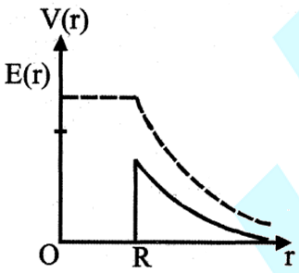
(4) 

98. Consider a conducting spherical shell of radius R with its centre at the origin, carrying uniform positive surface charge density. The variation of the magnitude of the electric field $|\vec{E}(r)|$ and the electric potential V(r) with the distance r from the centre, is best represented by the graph (Here dotted line represents potential curve and bold line represents electric field curve) :-

(1) 

(2) 

(3) 

(4) 

ANSWER KEY

EXERCISE-I (Conceptual Question)

1.	(4)	**2.**	(4)	**3.**	(4)	**4.**	(1)	**5.**	(3)	**6.**	(4)	**7.**	(2)
8.	(1)	**9.**	(1)	**10.**	(1)	**11.**	(1)	**12.**	(1)	**13.**	(4)	**14.**	(2)
15.	(2)	**16.**	(3)	**17.**	(2)	**18.**	(1)	**19.**	(2)	**20.**	(2)	**21.**	(3)
22.	(2)	**23.**	(3)	**24.**	(2)	**25.**	(3)	**26.**	(4)	**27.**	(2)	**28.**	(2)
29.	(1)	**30.**	(2)	**31.**	(3)	**32.**	(4)	**33.**	(3)	**34.**	(1)	**35.**	(1)
36.	(1)	**37.**	(2)	**38.**	(2)	**39.**	(2)	**40.**	(3)	**41.**	(2)	**42.**	(1)
43.	(2)	**44.**	(4)	**45.**	(2)	**46.**	(2)	**47.**	(1)	**48.**	(3)	**49.**	(1)
50.	(1)	**51.**	(2)	**52.**	(1)	**53.**	(4)	**54.**	(3)	**55.**	(1)	**56.**	(1)
57.	(3)	**58.**	(2)	**59.**	(4)	**60.**	(3)	**61.**	(3)	**62.**	(2)	**63.**	(2)
64.	(4)	**65.**	(4)	**66.**	(3)	**67.**	(1)	**68.**	(3)	**69.**	(2)	**70.**	(4)
71.	(4)	**72.**	(3)	**73.**	(2)	**74.**	(1)	**75.**	(1)	**76.**	(4)	**77.**	(4)
78.	(3)	**79.**	(3)	**80.**	(2)	**81.**	(1)	**82.**	(1)	**83.**	(1)	**84.**	(3)
85.	(1)	**86.**	(2)	**87.**	(3)	**88.**	(1)	**89.**	(1)	**90.**	(4)	**91.**	(2)
92.	(4)	**93.**	(3)	**94.**	(2)	**95.**	(3)	**96.**	(1)	**97.**	(3)	**98.**	(4)