Exercise - I (Conceptual Questions) Build Up Your Understanding

ELECTRIC CHARGE & METHODS OF CHARGING

1. Which of the following charges cannot 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

PEL001

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

PEL002

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

PEL003

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

PEL004

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) $r\sqrt{K}$

PEL005

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)

PEL006

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

PEL007

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

PEL008

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

PEL009

10. Two point charges of + 2 μC and + 6 μC repel 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)

PEL010

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

PEL011

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

PEL012

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) $Q_1 = Q_2 = \frac{Q}{2}$

PEL013

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 repulsion will :–

(1) increase (2) decrease

(3) remain same (4) become $\frac{10F}{9}$

PEL014

15. Two charges 4q and q are placed at a distance ℓ 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

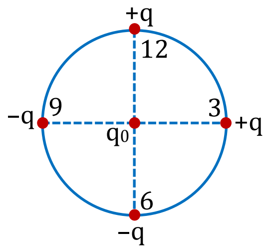
PEL015

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 them, 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

PEL016

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

PEL017

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

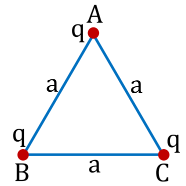
PEL018

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

PEL019

20. 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) $\frac{\sqrt{3}kq^2}{a^2}$

PEL020

ELECTRIC FIELD INTENSITY

21. 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

PEL021

22. A ring of radius R is charged 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) $\frac{KQ}{r^3}\left(r^2-R^2\right)^{1/2}$ (4) $\frac{KQr}{R^3}a$

PEL022

23. Two positive charges of 1 μC and 2 μC are placed 1 metre 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

PEL023

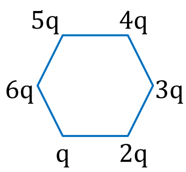
24. The electric field in a certain region is given by $\vec{E}=(\frac{K}{x^3})\hat{i}$. The dimensions of K are :–

(1) $MLT^{-3}A^{-1}$ (2) $ML^{-2}T^{-3}A^{-1}$

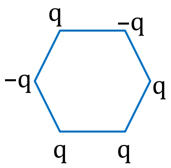
(3) $ML^4T^{-3}A^{-1}$ (4) $M^{\circ}L^{\circ}T^{\circ}A^{\circ}$

PEL024

25. 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 ?



I



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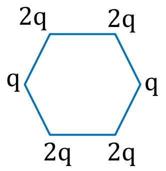
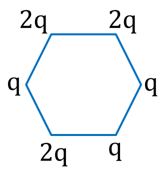


III

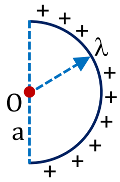


IV

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

PEL025

26. 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) $\frac{\lambda}{\pi\epsilon_0 a}$

PEL026

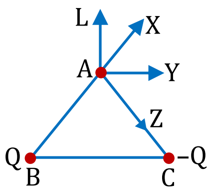
27. A semicircular ring of radius 0.5 m is uniformly charged with a total charge of 1.4×10^{-9} C. The electric field intensity at the centre of this ring is :–

(1) zero (2) 320 V/m.

(3) 64 V/m. (4) 32 V/m.

PEL027

28. 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

PEL028

29. -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

PEL029

30. Two small identical spheres, each of mass 1 g 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) $\tan^{-1}(0.6)$

PEL030

ELECTRIC FIELD LINES, ELECTRIC FLUX & GAUS'S THEOREM

31. 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) $\frac{k\lambda_1\lambda_2}{R}$

PEL031

32. 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

PEL032

33. A solid sphere of radius R, is charged uniformly with a total charge Q. Then the correct expression for electric field is. (r = distance from centre) :–

(1) $\frac{KQr}{R^3}$, where r < R

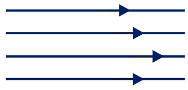
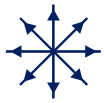
(2) $\frac{KQ}{r^2}$, where $r \geq R$

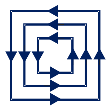
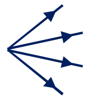
(3) it is zero, at all points

(4) (1) and (2) both

PEL033

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

(1) 
(2) 

(3) 
(4) 

PEL034

35. A sphere of radius R and 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) $\frac{2Q}{\epsilon_0}$

PEL035

36. A nonconducting solid 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

PEL036

37. 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

PEL037

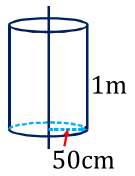
38. In a region of space the electric field is given by $\vec{E} = 8\hat{i} + 4\hat{j} + 3\hat{k}$. The electric flux through a surface of area of 100 units in the x–y plane is :–

(1) 800 units (2) 300 units

(3) 400 units (4) 1500 units

PEL038

39. 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) $\frac{100Q}{\epsilon_0}$

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

PEL039

40. Gaus's law is given by $\epsilon_0\oint_s \vec{E}.d\vec{s}$ = q, if 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

PEL040

41. 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

PEL041

42. 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) $\frac{\phi_2-\phi_1}{\varepsilon_0}$

PEL042

43. 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:–

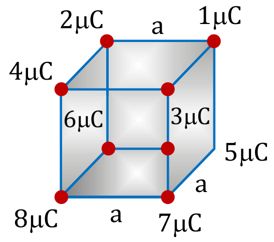
(1) 10 (2) 20

(3) $10\sqrt{2}$ (4) $2\sqrt{29}$

PEL043

44. 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

PEL044

45. 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 :–

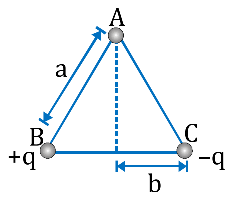
(1) $\frac{q}{\epsilon_0}$ (2) $\frac{q}{\pi\epsilon_0}$

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

PEL045

ELECTRIC POTENTIAL, EQUIPOTENTIAL SURFACE & RELATION BETWEEN FIELD & POTENTIAL

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

PEL046

47. 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

PEL047

48. 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) $\frac{1}{4\pi\epsilon_0}\cdot\frac{QX}{R^2}$ (4) zero

PEL048

49. 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

PEL049

50. 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

PEL050

51. 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

PEL051

52. 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) $E \neq 0$, V = 0
(3) E = 0, $V \neq 0$ (4) $E \neq 0$, $V \neq 0$

PEL052

53. 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 $\ell = 0$ is the centre of the ring, then the value of $\int_{\ell=\infty}^{\ell=0} -\vec{E}.d\ell$ is :–

(1) 2 V (2) – 2 V (3) –1 V (4) zero

PEL053

54. 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

PEL054

55. 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) $\frac{Q}{8\pi\epsilon_0 R}$
(3) $\frac{Q}{4\pi\epsilon_0 R}$ (4) $\frac{Q}{2\pi\epsilon_0 R}$

PEL055

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

(1) E = 0, V=0 (2) E = 0, $V \neq 0$
(3) $E \neq 0$, V=0 (4) E = 0, $V \neq 0$

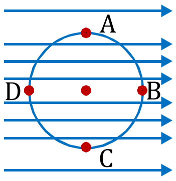
PEL056

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

(1) 5 V (2) 10 V (3) 15 V (4) 4V

PEL057

58. 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) $V_A = V_C$, $V_B > V_D$

PEL058

59. 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, B and C satisfy :-

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

PEL059

60. 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

PEL060

61. 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

PEL061

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

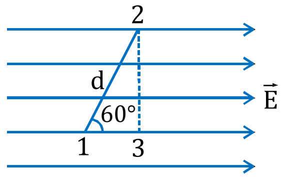
(1) σ/ε_0 (2) $\frac{\sigma}{\varepsilon_0}(R-r)$
(3) $\frac{\sigma}{\varepsilon_0}(R+r)$ (4) None of these

PEL062

63. 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

PEL063

64. The electric field $\vec{E}$ is constant in both magnitude and direction. Consider a path of length d at an angle $\theta = 60°$ 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) $\frac{E}{d}\sin 60°$

PEL064

65. 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 2 C situated at the origin will be :–
(1) 2 N (2) 6 N (3) 8 N (4) 20 N

PEL065

66. 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

PEL066

67. 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

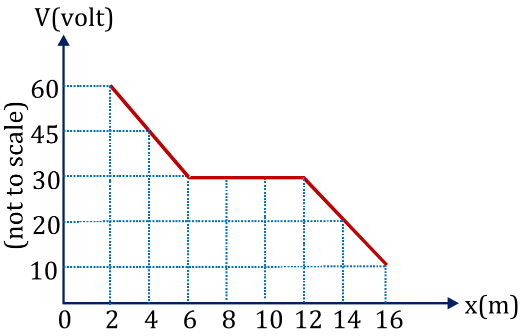
PEL067

68. 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) $\frac{V}{2r}$

PEL068

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

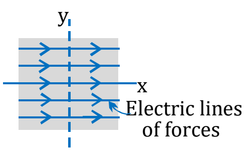


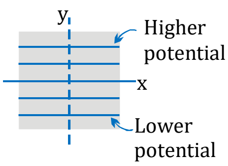
(1) 7.5 volt/meter (2) –7.5 volt/meter
(3) 5 volt/meter (4) –5 volt/meter

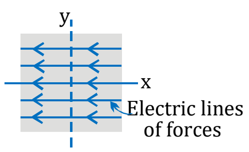
PEL069

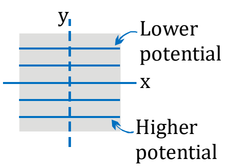
70. List I gives certain situations in which electric field is represented by electric lines of forces in x-y plane. List II gives corresponding representation of equipotential lines in x-y plane. Match the figures in List I with the figures in List II and indicate your answer.

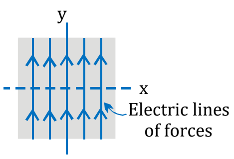
List - I **List - II**

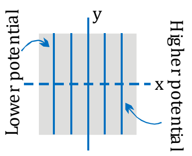
(P) 

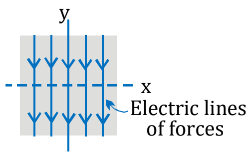
(1) 

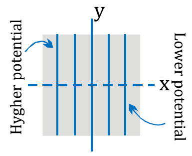
(Q) 

(2) 

(R) 

(3) 

(S) 

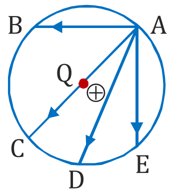
(4) 

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

PEL070

ELECTRICAL POTENTIAL ENERGY

71. 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

PEL071

72. 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.

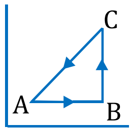
PEL072

73. 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

PEL073

74. 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

PEL074

75. 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

PEL075

76. 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

PEL076

77. 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

PEL077

MOTION OF CHARGED PARTICLE IN ELECTRIC FIELD AND ELECTRIC 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

PEL078

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) $\frac{m_e}{m_p}$

PEL079

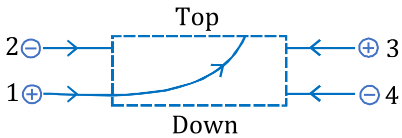
80. A particle of mass m and charge q is released from rest in an electric field E. Then the K.E. after time t will be :-
(1) $\frac{2E^2t^2}{mq}$ (2) $\frac{E^2q^2t^2}{2m}$
(3) $\frac{Eq^2m}{2t^2}$ (4) $\frac{Eqm}{2t}$

PEL080

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) $\frac{Y}{qE}$

PEL081

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

PEL082

83. For a dipole, the value 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) 10^{-3} debye (4) 3×10^{-20} debye

PEL083

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}

PEL084

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°

PEL085

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

PEL086

87. For a dipole q = 2 × 10^{-6} C ; d = 0.01m; find the maximum torque on the dipole if E = 5 × 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

PEL087

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 makes a small angle θ (< 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) $4\pi\sqrt{\frac{ML}{2qE}}$

PEL088

89. The electric potential at a point due to an electric dipole will be :-

(1) $k\frac{\vec{p}\cdot\vec{r}}{r^3}$ (2) $k\frac{\vec{p}\cdot\vec{r}}{r^2}$

(3) $k\frac{\vec{p}\times\vec{r}}{r^3}$ (4) $k\frac{\vec{p}\times\vec{r}}{r^2}$

PEL089

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) $\frac{F}{8}$

PEL090

91. A small electric dipole is of dipole moment p. The electric potential 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) $\frac{kp}{r^3}\sqrt{1+3\sin^2\theta}$

PEL091

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

PEL092

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

PEL093

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

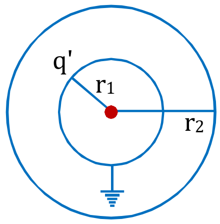
(2) is from B to A

(3) no charge flows

(4) depends on the radii of spheres

PEL094

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

PEL095

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.

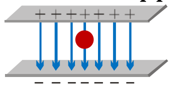
(2) the free charge tends to be in its minimum kinetic energy state.

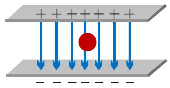
(3) the free charge tends to be in its maximum potential energy state.

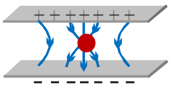
(4) the free charge tends to be in its maximum kinetic energy state.

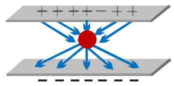
PEL096

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

(1) 

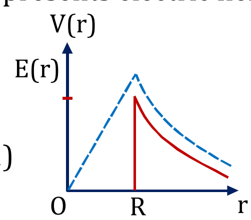
(2) 

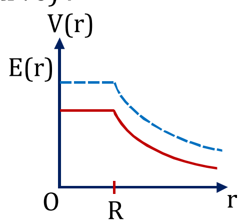
(3) 

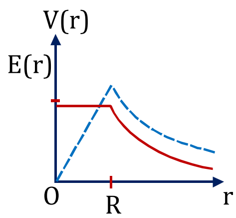
(4) 

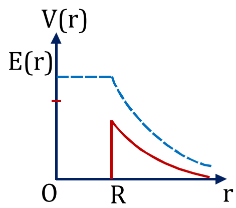
PEL097

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) 

PEL098

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere are respectively :-

(1) Zero and $\frac{Q}{4\pi \in_0 R^2}$

(2) $\frac{Q}{4\pi \in_0 R}$ and Zero

(3) $\frac{Q}{4\pi \in_0 R}$ and $\frac{Q}{4\pi \in_0 R^2}$

(4) Both are zero

PEL119

2. In a region, the potential is represented by V(x, y, z) = 6x – 8xy – 8y + 6yz, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulombs situated at the point (1, 1, 1) is :-

(1) $6\sqrt{5}$ N (2) 30 N

(3) 24 N (4) $4\sqrt{35}$ N

PEL120

AIPMT 2015

3. The electric field in a certain region is acting radially outward and is given by E = Ar. The charge contained in a sphere of radius 'a' centred at the origin of the field, will be given by :

(1) $A\,\varepsilon_0\,a^2$ (2) $4\,\pi\varepsilon_0\,Aa^3$

(3) $\varepsilon_0\,Aa^3$ (4) $4\,\pi\varepsilon_0\,Aa^2$

PEL121

Re-AIPMT 2015

4. If potential (in volts) in a region is expressed as V (x,y,z) = 6xy – y + 2yz, the electric field (in N/C) at point (1,1,0) is :

(1) $-(6\hat{i}+9\hat{j}+\hat{k})$ (2) $-(3\hat{i}+5\hat{j}+3\hat{k})$

(3) $-(6\hat{i}+5\hat{j}+2\hat{k})$ (4) $-(2\hat{i}+3\hat{j}+\hat{k})$

PEL122

NEET-II 2016

5. An electric dipole is placed at an angle of 30° with an electric field intensity 2×10^5 N/C. It experiences a torque equal to 4 Nm. The charge on the dipole, if the dipole length is 2 cm, is :-

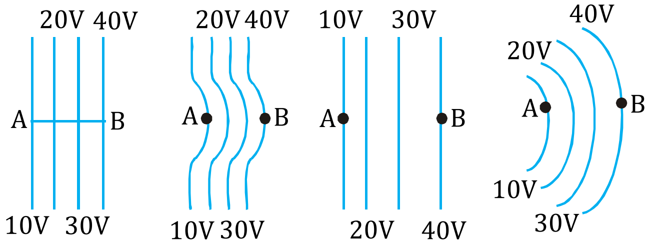
(1) 5 mC (2) 7 μC

(3) 8 mC (4) 2 mC

PEL123

NEET(UG)-2017

6. The diagrams below show regions of equipotentials :-



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

A positive charge is moved from A to B in each diagram.

(1) In all the four cases the work done is the same

(2) Minimum work is required to move q in figure (a)

(3) Maximum work is required to move q in figure (b)

(4) Maximum work is required to move q in figure (c)

PEL124

7. Suppose the charge of a proton and an electron differ slightly. One of them is – e, the other is (e + Δe). If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order of [Given mass of hydrogen $m_h = 1.67 \times 10^{-27}$ kg]

(1) 10^{-23} C (2) 10^{-37} C

(3) 10^{-47} C (4) 10^{-20} C

PEL125

NEET(UG)-2018

8. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E. The direction of electrical field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in through the same vertical distance h. The time of fall of the electron, in comparison to the time of fall of the proton is :-

(1) smaller

(2) 5 times greater

(3) 10 times greater

(4) equal

PEL126

NEET(UG)-2019

9. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre :

(1) increases as r increases for r < R and for r > R

(2) zero as r increases for r < R, decreases as r increases for r > R

(3) zero as r increases for r < R, increases as r increases for r > R

(4) decreases as r increases for r < R and for r > R

PEL127

10. Two parallel infinite line charges with linear charge densities $+\lambda$ C/m and $-\lambda$ C/m are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges?

(1) zero (2) $\frac{2\lambda}{\pi \in_0 R}$ N/C

(3) $\frac{\lambda}{\pi \in_0 R}$ N/C (4) $\frac{\lambda}{2\pi \in_0 R}$ N/C

PEL128

11. Two point charges A and B, having charges +Q and –Q respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then force between the charges becomes:

(1) F (2) $\frac{9F}{16}$

(3) $\frac{16F}{9}$ (4) $\frac{4F}{3}$

PEL129

NEET(UG)-2019 (Odisha)

12. A sphere encloses an electric dipole with charge $\pm 3 \times 10^{-6}$ C. What is the total electric flux across the sphere ?

(1) -3×10^{-6} Nm^2/C (2) zero

(3) 3×10^{-6} Nm^2/C (4) 6×10^{-6} Nm^2/C

PEL130

NEET(UG)-2020

13. A short electric dipole has a dipole moment of 16×10^{-9} C m. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is :

$$\left(\frac{1}{4\pi \in_0} = 9 \times 10^9 \, Nm^2/C^2\right)$$

(1) zero (2) 50 V

(3) 200 V (4) 400 V

PEL131

14. In a certain region of space with volume 0.2 m^3 the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is :

(1) 5 N/C (2) Zero

(3) 0.5 N/C (4) 1 N/C

PEL132

15. A spherical conductor of radius 10 cm has a charge of 3.2×10^{-7} C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere ?

$$\left(\frac{1}{4\pi \in_0} = 9 \times 10^9 \, Nm^2/C^2\right)$$

(1) 1.28×10^7 N/C (2) 1.28×10^4 N/C

(3) 1.28×10^5 N/C (4) 1.28×10^6 N/C

PEL133

NEET(UG)-2020 (Covid-19)

16. The electric field at a point on the equatorial plane at a distance r from the centre of a dipole having dipole moment $\vec{p}$ is given by

(r >> separation of two charges forming the dipole, $\in_0$ - permittivity of free space)

(1) $\vec{E} = \frac{\vec{p}}{4\pi \in_0 r^3}$ (2) $\vec{E} = \frac{2\vec{p}}{4\pi \in_0 r^3}$

(3) $\vec{E} = -\frac{\vec{p}}{4\pi \in_0 r^2}$ (4) $\vec{E} = -\frac{\vec{p}}{4\pi \in_0 r^3}$

PEL134

17. The acceleration of an electron due to the mutual attraction between the electron and a proton when they are 1.6 Å apart is,

($m_e \simeq 9 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C)

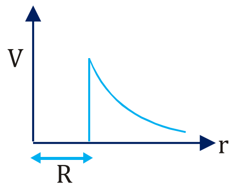
(Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ Nm^2 C^{-2})

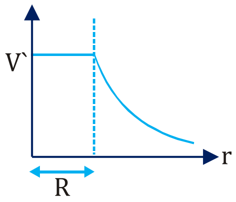
(1) 10^{24} m/s^2 (2) 10^{23} m/s^2

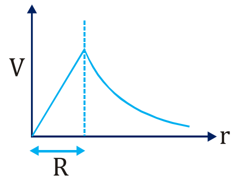
(3) 10^{22} m/s^2 (4) 10^{25} m/s^2

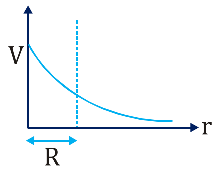
PEL135

18. The variation of electrostatic potential with radial distance *r* from the centre of a positively charged metallic thin shell of radius R is given by the graph

(1)


(2)


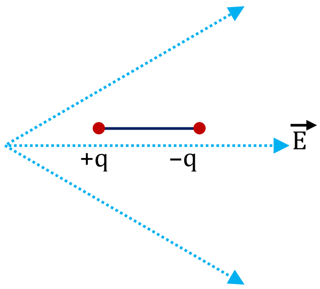
(3)


(4)


PEL136

NEET(UG)-2021

19. A dipole is placed in an electric field as shown. In which direction will it move ?



(1) towards the left as its potential energy will increase.
(2) towards the right as its potential energy will decrease.
(3) towards the left as its potential energy will decrease.
(4) towards the right as its potential energy will increase.

PEL137

20. Two charged spherical conductors of radius R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres (σ_1/σ_2) is:

(1) $\frac{R_1}{R_2}$ (2) $\frac{R_2}{R_1}$ (3) $\sqrt{\left(\frac{R_1}{R_2}\right)}$ (4) $\frac{R_1^2}{R_2^2}$

PEL138

21. Twenty seven drops of same size are charged at 220 V each. They combine to form a bigger drop. Calculate the potential of the bigger drop.

(1) 660 V (2) 1320 V
(3) 1520 V (4) 1980 V

PEL139

NEET(UG)-2022

22. The angle between the electric lines of force and the equipotential surface is :

(1) 45° (2) 90° (3) 180° (4) 0°

PEL140

23. Two point charges -q and +q are placed at a distance of L, as shown in the figure.

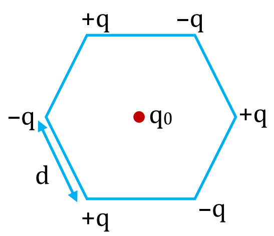
The magnitude of electric field intensity at a distance
R (R >>L) varies as :

(1) $\frac{1}{R^3}$ (2) $\frac{1}{R^4}$ (3) $\frac{1}{R^6}$ (4) $\frac{1}{R^2}$

PEL141

RE-NEET(UG)-2022

24. Six charges +q, -q, +q, -q, +q and -q are fixed at the corners of a hexagon of side d as shown in the figure. The work done in bringing a charge q_0 to the centre of the hexagon from infinity is : (ε_0 - permittivity of free space)



(1) Zero (2) $\frac{-q^2}{4\pi\varepsilon_0 d}$

(3) $\frac{-q^2}{4\pi\varepsilon_0 d}\left(3-\frac{1}{\sqrt{2}}\right)$ (4) $\frac{-q^2}{4\pi\varepsilon_0 d}\left(6-\frac{1}{\sqrt{2}}\right)$

PEL142

NEET(UG)-2023

25. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 NC^{-1}. It experiences a torque equal to 4 Nm. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.

(1) 6 mC (2) 4 mC (3) 2 mC (4) 8 mC

PEL170

26. If $\oint_s \vec{E}.\vec{dS} = 0$ over a surface, then:

(1) the magnitude of electric field on the surface is constant.

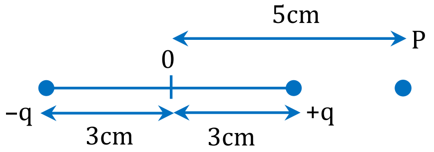
(2) all the charges must necessarily be inside the surface.

(3) the electric field inside the surface is necessarily uniform.

(4) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

PEL171

27. An electric dipole is placed as shown in the figure.



The electric potential (in 10^2 V) at point P due to the dipole is (ϵ_0 =permittivity of free space and $\frac{1}{4\pi\epsilon_0} = K$):

(1) $\left(\frac{5}{8}\right)qK$ (2) $\left(\frac{8}{5}\right)qK$

(3) $\left(\frac{8}{3}\right)qK$ (4) $\left(\frac{3}{8}\right)qK$

PEL172

RE-NEET(UG)-2023

28. According to Gauss law of electrostatics, electric flux through a closed surface depends on :

(1) the area of the surface

(2) the quantity of charges enclosed by the surface

(3) the shape of the surface

(4) the volume enclosed by the surface

PEL173

29. A charge Q μC is placed at the centre of a cube. The flux coming out from any one of its faces will be (in SI unit) :

(1) $\frac{Q}{\epsilon_0}\times 10^{-6}$ (2) $\frac{2Q}{3\epsilon_0}\times 10^{-3}$

(3) $\frac{Q}{6\epsilon_0}\times 10^{-3}$ (4) $\frac{Q}{6\epsilon_0}\times 10^{-6}$

PEL174

30. If a conducting sphere of radius R is charged. Then the electric field at a distance r(r > R) from the centre of the sphere would be, (V = potential on the surface of the sphere)

(1) $\frac{rV}{R^2}$ (2) $\frac{R^2V}{r^3}$ (3) $\frac{RV}{r^2}$ (4) $\frac{V}{r}$

PEL175

NEET(UG)-2024

31. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion (A) :- The potential (V) at any axial point, at 2 m distance (r) from the centre of the dipole of dipole moment vector $\vec{P}$ of magnitude,

4×10^{-6} C m, is $\pm 9 \times 10^3$ V.

(Take $\frac{1}{4\pi\epsilon_0} = 9\times 10^9$ SI Units)

Reason (R) :- $V = \pm\frac{2P}{4\pi\epsilon_0 r^2}$,, where r is the distance of any axial point, situated at 2 m from the centre of the dipole.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true and R is NOT the correct explanation of A.

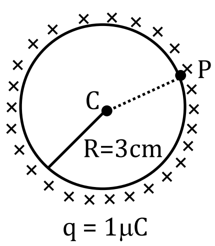
(3) A is true but R is false.

(4) A is false but R is true.

PEL176

32. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is :

(Take $\frac{1}{4\pi\epsilon_0} = 9\times 10^9$ SI units)



(1) 3×10^5 (2) 1×10^5

(3) 0.5×10^5 (4) zero

PEL177

RE-NEET(UG)-2024

33. A metal cube of side 5 cm is charged with 6μC. The surface charge density on the cube is :

(1) 0.125×10^{-3} C m^{-2}

(2) 0.25×10^{-3} C m^{-2}

(3) 4×10^{-3} C m^{-2}

(4) 0.4×10^{-3} C m^{-2}

PEL178

34. The value of electric potential at a distance of 9 cm from the point charge 4×10^{-7} C is $\left(\text{Given } \frac{1}{4\pi\varepsilon_0} = 9\times10^9\,\text{Nm}^2\text{C}^{-2}\right)$:

(1) 4×10^2 V

(2) 44.4 V

(3) 4.4×10^5 V

(4) 4×10^4 V

PEL179

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	4	2	3	4	1	2	1	2	3	2	2	3	2	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	4	3	2	2	2	4	2	1	1	3	4	4	2	4	3
Question	31	32	33	34											
Answer	3	4	4	4											

Exercise - III (Analytical Questions) Master Your Understanding

1. A ring with a uniform charge distribution with a total charge Q and radius R is placed in the yz plane with its centre at the origin then which of the following is incorrect about this situation:

(1) The electric field at the origin is zero

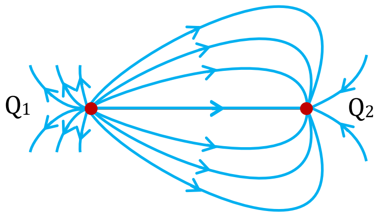
(2) The electric potential at the origin is $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$

(3) The electric field at the point (x, 0, 0) is $\frac{1}{4\pi\varepsilon_0}\frac{Q}{x^2}$

(4) The electric field at the point (x, 0, 0) is $\frac{1}{4\pi\varepsilon_0}\frac{Qx}{\left(R^2+x^2\right)^{3/2}}$

PEL143

2. A few electric field lines for a system of two charges Q_1 and Q_2 fixed at two different points on their axis are shown in the figure. With the figure what information about charges and electric field is incorrect.



(1) $|Q_1| > |Q_2|$

(2) $Q_1 \rightarrow$ +ve, $Q_2 \rightarrow$ –ve

(3) At a finite distance to the left of Q_1 the electric field is zero

(4) At a finite distance to the right of Q_2 the electric field is zero

PEL144

3. The figure shows, two point charges $q_1 = +2Q$ and $q_2 = -Q$. The charges divide the line joining them, in three parts I, II and III as shown in figure then which of the following statements is/are correct:

(1) Electric field may be zero in region III

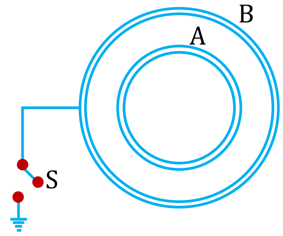
(2) Electric field may be zero in region I

(3) Electric field may be zero in region II

(4) Electric field can not be zero anywhere on this line

PEL145

4. Two concentric shells have radii R and 2R charges q_A and q_B and potentials 2V and (3/2)V respectively. Now shell B is earthed by closing the switch S and let charges on the shells be changed to q_A' and q_B'. Then incorrect option is:



(1) $|q_A|/|q_B|=1$

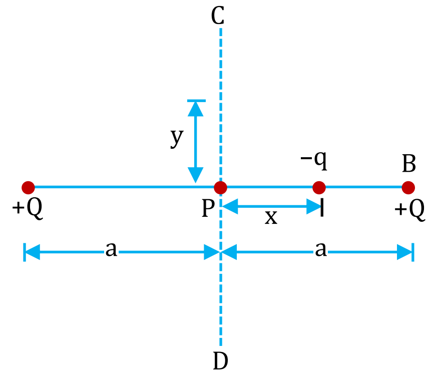
(2) $|q'_A|/|q'_B|= 1$

(3) Potential of B after earthing becomes zero.

(4) Potential difference between the shells depends on charge of inner sphere.

PEL146

5. For the arrangement shown in the Fig., the two positive charges, +Q each, are fixed. Mark out the correct statement regarding a third charged particle –q placed at mid point P that can be displaced along or perpendicular to the line connecting the charges,



(1) The particle will perform SHM for x << a.

(2) The particle will undergo oscillatory motion but not SHM about P for x comparable to a.

(3) The particle will perform SHM for y << a.

(4) The particle will undergo oscillatory motion but not SHM about P for y << a.

PEL147

6. Four charges Q_1, Q_2, Q_3 and Q_4 of same magnitude are fixed along the x axis at x = –2a, –a, +a and +2a, respectively. A positive charge q is placed on the positive y axis at a distance b > 0. Four options of the signs of these charges are given in List I. The direction of the forces on the charge q is given in List II. Match List I with List II and select the correct answer using the code given below the lists.

	List-I		List-II
P	Q_1, Q_2, Q_3, Q_4 all positive	1	+x
Q	Q_1, Q_2 positive, Q_3, Q_4 negative	2	–x
R	Q_1, Q_4 positive, Q_2, Q_3 negative	3	+y
S	Q_1, Q_3 positive, Q_2, Q_4 negative	4	–y

Codes:

(1) P-3, Q-1, R-4, S-2
(2) P-4, Q-2, R-3, S-1
(3) P-3, Q-1, R-2, S-4
(4) P-4, Q-2, R-1, S-3

PEL148

7. Match Column-I with Column-II

	Column-I		Column-II
I.	Electric field due to Infinite plane sheet of charge	a.	0
II.	Electric field due to Infinite conducting plane sheet of uniform thickness	b.	$\frac{\sigma}{2\varepsilon_0}$
III.	Electric field due to Non-conducting charged solid sphere at its surface	c.	$\frac{R\rho}{3\varepsilon_0}$
IV.	Electric field due to Non-conducting charged solid sphere at its centre	d.	$\frac{\sigma}{\varepsilon_0}$

(1) I-c, II-d, III-a, IV-b
(2) I-b, II-d, III-c, IV-a
(3) I-b, II-d, III-a, IV-c
(4) I-b, II-a, III-d, IV-c

PEL149

8. Match the facts given in Column I with the Column II :

	Column-I		Column-II
I.	Charge cannot exist	a.	without charge
II.	Mass can exist	b.	without mass
III.	Charge is	c.	not conserved
IV.	Mass is	d.	conserved

(1) I-b, II-a, III-d, IV-c (2) I-b, II-a, III-c, IV-d
(3) I-b, II-d, III-a, IV-c (4) I-b, II-c, III-d, IV-a

PEL150

9. Match Column-I with Column-II :-

	Column-I		Column-II
I.	ε_0	a.	$M^\circ L^\circ T^\circ A^\circ$
II.	ε_r	b.	$[M^1L^1T^{-2}]$
III.	E	c.	$[M^{-1}L^{-3}T^4A^2]$
IV.	F	d.	$[M^1L^1T^{-3}A^{-1}]$

(1) I-c, II-a, III-b, IV-d (2) I-a, II-c, III-b, IV-d
(3) I-b, II-c, III-a, IV-d (4) I-c, II-a, III-d, IV-b

PEL151

10. Electric potential on the surface of a uniformly charged solid sphere is V. Radius of the sphere is 1m. Match the following two columns.

	Column-I		Column-II
(a)	Electric potential at $r=\frac{R}{2}$	(p)	$\frac{V}{4}$
(b)	Electric potential at r = 2R	(q)	$\frac{V}{2}$
(c)	Electric field at $r=\frac{R}{2}$	(r)	$\frac{3V}{4}$
(d)	Electric field at r=2R	(s)	$\frac{11V}{8}$

(1) a-p, b-s, c-r, d-q (2) a-p, b-r, c-q, d-s
(3) a-s, b-q, c-q, d-p (4) a-q, b-q, c-r, d-s

PEL152

11. Given below are two statements :

Statement I : Two concentric conducting spherical shells are charged. The charge on the outer shell is varied keeping the charge on inner shell constant, as a result the electric potential difference between the two shells does not change.

Statement II : In the above situation, the electric field in the region between both the shells depends only on the charge existing on the inner shell.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

PEL153

12. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : If a charge is released from rest in an electric field, it will always start to move along an electric field line.

Reason (R) : Force on a charged particle is always in the direction of electric field.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEL154

13. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Electrostatic potential is a relative physical quantity.

Reason (R) : Electric potential difference is an absolute physical quantity.

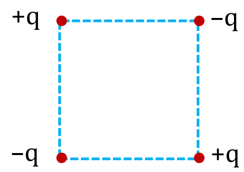
In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEL155

14. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): The electric potential and the electric field intensity at the centre of a square having four fixed point charges at their vertices as shown in figure are zero.



Reason (R) : If electric potential at a point is zero then the magnitude of electric field at that point must be zero.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEL156

15. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The tyres of aircrafts are slightly conducting.

Reason (R) : If a conductor is connected to ground, the extra charge induced on conductor will flow to ground.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEL157

16. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Any arbitrary displacement of charges inside a conducting shell does not introduce any change in the electrostatic field of the outer space.

Reason (R) : A closed conducting shell divides the entire space into the inner and outer parts which are completely independent of one another in respect of electric fields.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEL158

17. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : If a positive point charge is brought near an isolated neutral metal cube, the cube becomes negatively charged.

Reason (R) : If a positive point charge is brought near an isolated neutral metal cube, the cube remains neutral.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEL159

18. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : In a given situation of arrangement of charges, an additional charge is placed outside the Gaussian surface. In this situation, in the Gauss theorem $\oint \vec{E}\cdot d\vec{s} = \frac{q_{in}}{\epsilon_0}$, q_{in} remains unchanged whereas electric field $\vec{E}$ is changed.

Reason (R) : Electric field $\vec{E}$ at any point on the Gaussian surface is due to inside charge only.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEL160

19. If a body is charged by rubbing it with another body then weight of the system :–

(A) may increase slightly

(B) may decrease slightly

(C) must increase slightly

(D) remains precisely constant

(1) Only A (2) AB (3) D (4) C

PEL161

20. **Statement-I :** Coulombic force follows the principle of superposition.

Statement-II : Coulombic force is directly proportional to the charges on both particle.

(1) Statement–I is True, Statement–II is True; Statement–II is a correct explanation for Statement–I.

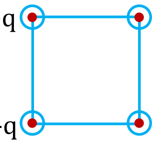
(2) Statement–I is True, Statement–II is True; Statement–II is not a correct explanation for Statement–I.

(3) Statement–I is True, Statement–II is False.

(4) Statement–I is False, Statement–II is True.

PEL162

21. **Statement-I :** The electric potential and the electric field intensity at the centre of a square having four point charges at their vertices (as shown) are zero.



Statement-II : Electric field is negative derivative of the potential.

(1) Statement-I is True, Statement-II is True; Statement-II **is** a correct explanation for Statement-I

(2) Statement-I is True, Statement-II is True; Statement-II **is NOT** a correct explanation for Statement-1

(3) Statement-I is True, Statement-II is False

(4) Statement-I is False, Statement-II is True.

PEL163

22. Two point charges 2 μC and 8 μC are placed at position x = 0 and x = 4 m respectively. The distance of the neutral point form the smaller charge is found to be at x= α/β. Find the value of $(\alpha + \beta)$.

(1) 7 (2) 5 (3) 4 (4) 3

PEL164

23. **Statement-I :** In a given situation of arrangement of charges, an extra charge is placed outside the Gaussion surface. In the Gauss Theorem

$$\oint \vec{E}.d\vec{s} = \frac{Q_{in}}{\epsilon_0}$$

remains unchanged where as electric field $\vec{E}$ at the site of the element is changed.

Statement-II : Electric field $\vec{E}$ at any point on the Gaussian surface is due to inside charge only.

(1) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.

(2) Statement-I is true, statement-II is true and statement-II is NOT the correct explanation for statement-I.

(3) Statement-I is true, statement-II is false.

(4) Statement-I is false, statement-II is true.

PEL165

24. Two concentric spherical shells are given charges:-

(A) Outer shell will be at higher potential if the charges given to both shells are negative

(B) Inner shell will be at higher potential if the charges given to both shells are positive

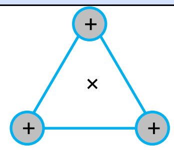
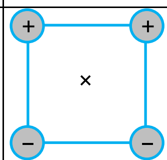
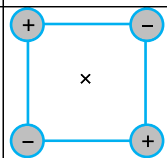
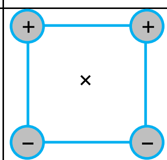
(C) Outer shell will always be at higher potential irrespective of the sign of charges given to two spheres

(D) No prediction can be made using given data.

(1) B (2) A,B (3) C (4) D

PEL166

25. In the following diagrams, all the charges have equal magnitude

Column-I		Column-II	
(A)	 Equilateral triangle	(P)	The potential is zero at the centre
(B)	 Square	(Q)	The electric field is zero at the centre
(C)	 Square		
(D)	 Rectangle		

(1) A → Q; B → P; C → P,Q; D → P

(2) A → P,Q; B → P; C → P,Q; D → Q

(3) A → Q; B → P,Q; C → P; D → P,Q

(4) A → P,Q; B → P; C → Q; D → P

PEL167

26. **Statement-I :** Work done by electric field on moving a positive charge on an equipotential surface is always zero. **Statement-II :** Electric lines of forces are perpendicular to equipotential surface.

(1) Statement–I is True, Statement–II is True; Statement–II is a correct explanation for Statement–I.

(2) Statement–I is True, Statement–II is True; Statement–II is not a correct explanation for Statement–I.

(3) Statement–I is True, Statement–II is False.

(4) Statement–I is False, Statement–II is True.

PEL168

27. **Statement-I** : Electric field outside the uniformly charged spherical shell (due to shell) is the same as that of a point charge at its center.

Statement-II : The centre of mass of uniform shell is at its center.

(1) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.

(2) Statement-I is true, statement-II is true and statement-II is NOT the correct explanation for statement-I.

(3) Statement-I is true, statement-II is false.

(4) Statement-I is false, statement-II is true.

PEL169

EXERCISE-III (Analytical Questions) **ANSWER KEY**

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	3	1	1	3	1	2	1	4	3	1	3	2	3	1
Question	16	17	18	19	20	21	22	23	24	25	26	27			
Answer	1	4	3	3	2	2	1	3	2	1	1	2			

Important Notes