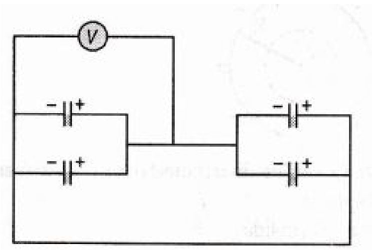
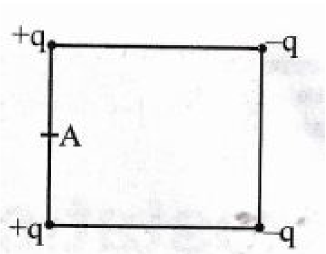
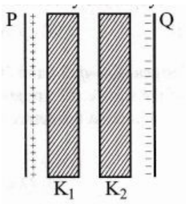
Ravi Maths Tuition Centre

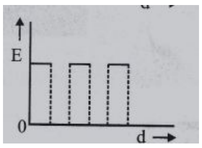
Time : 1 Mins | **ELECTRIC CHARGES FIELDS CAPACITANCE 1** | **Marks : 583**

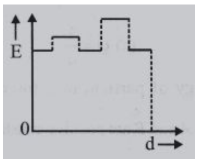
1. The electric potential at a point 6, y, r) is given by Z = $x^2y - xz^3 + 4$. The electric field $\vec{E}$ at that point is ______.
   a) $\vec{E} = \hat{i}2xy + \hat{j}\left(x^2 + y^2\right) + \hat{k}\left(3xz - y^2\right)$ b) $\vec{E} = \hat{i}z^3 + \hat{j}xyz + \hat{k}z^2$ c) $\vec{E} = \hat{i}\left(2xy - z^3\right) + \hat{j}xy^2 + \hat{k}3z^2x$
   d) $\vec{E} = \hat{i}\left(2xy + z^3\right) + \hat{j}x^2 + \hat{k}3xz^2$
2. Two parallel metal plates, having charges +Q and -Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will
   a) remains same b) becomes zero c) increases d) decreases
3. The four capacitors, each of 25 mF are connected as shown in figure. The DC voltmeter reads 200 V. The charge on each plate of capacitor is ______.
   

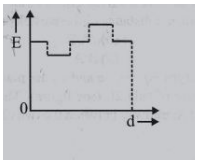
   a) $\pm 2 \times 10^{-3}$C b) $\pm 5 \times 10^{-3}$C c) $\pm 2 \times 10^{-2}$C d) $\pm 5 \times 10^{-2}$C
4. Four electric charges +q,+q, -q and -q are placed at the corners of a square of side 2L (see figure). The electric potential at point A, midway between the two charges +q and +q, is __________.
   

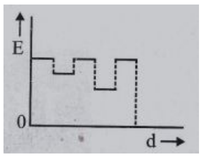
   a) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1 + \sqrt{5})$ b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1 + \frac{1}{\sqrt{5}}\right)$ c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1 - \frac{1}{\sqrt{5}}\right)$ d) Zero
5. A parallel plate condenser with oil (dielectric constant 2) between the plates has capacitance C. If oil is removed, the capacitance of capacitor becomes _______.
   a) $\sqrt{2}C$ b) 2C c) $\frac{C}{\sqrt{2}}$ d) $\frac{C}{2}$

6. The formation of a dipole is due to two equal and dissimilar point charges placed at a ___________.
a) short distance b) long distance c) above each other d) None of these
7. A hollow insulated conducting sphere is given a positive charge of l0 mC. What will be the electric field at the centre of the sphere if its radius is 2 m?
a) zero b) 5 mCm^{-2} c) 20 mCm^{-2} d) 8 mCm^{-2}
8. A series combination ofrr, capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then _______.
a) $\frac{2C_1}{n_1 n_2}$ b) $16\frac{n_2}{n_1}C_1$ c) $2\frac{n_2}{n_1}C_1$ d) $\frac{16C_1}{n_1 n_2}$
9. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field betwen the plates is E, is _______.
a) $\frac{1}{2}\varepsilon_0 E^2/Ad$ b) $e_0 E^2/\mathrm{Ad}$ c) $e_0 E^2 \mathrm{Ad}$ d) $\frac{1}{2}\varepsilon_0 E^2 Ad$
10. Two thin dielectric slabs of dielectric constants K_1 and K_2(K_1 < K_2) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by:


a) 

b) 

c) 

d) 

11. The capacitance of a parallel plate capacitor with air as medium is 6 mf. With the introduction of a dielectric medium, the capacitance becomes 30 mF. The permittivity of the medium is
$\left(\Sigma_0 = 8.85 \times 10^{-12} \mathrm{C}^2 \mathrm{N}^{-1} \mathrm{m}^{-2}\right)$
a) $5.00C^2N^{-1}m^{-2}$ b) $0.44 \times 10^{-13}C^2N^{-1}m^{-2}$ c) $1.77 \times 10^{-12}C^2N^{-1}m^{-2}$
d) $0.44 \times 10^{-10}C^2N^{-1}m^{-2}$
12. A pendulum bob of mass 30.7×10^{-6} kg and carrying a charge 2×10^{-8} C is at rest in a horizontal uniform electric field of 20000 V/m. The tension in the thread of the pendulum is (g = 9.8 m/s^2)
a) 3×10^4N b) 4×10^{-4}N c) 5×10^{-4} N d) 6×10^{-4}N
13. A parallel plate air capacitor of capacitance C is connected to a cell of emf Zand then disconnected from it.A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect.
a) The energy stored in the capacitor decreases K times.
b) The chance in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K} - 1\right)$

c) The charge on the capacitor is not conserved.

d) The potential difference between the plates decreases K times.

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

a) Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$ b) $\frac{Q}{4\pi\varepsilon_0 R}$ and Zero c) $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$ d) Both are zero

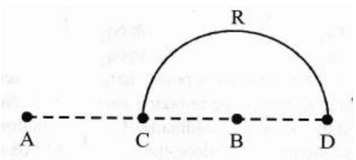
15. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is __________.

a) $\frac{1}{2}\varepsilon_0 E^2$ b) $E^2 Ad/\varepsilon_0$ c) $\frac{1}{2}\varepsilon_0 E^2 Ad$ d) ε_0 EAd

16. A bullet of mass 2 g is having a charge of 2mC. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of 10 m/s?

a) 50 V b) 5 KV c) 50 KV d) 5V

17. Charges +q and -q are placed at points A and, B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is _____.



a) $\frac{qQ}{2\pi\varepsilon_0 L}$ b) $\frac{qQ}{6\pi\varepsilon_0 L}$ c) $-\frac{qQ}{6\pi\varepsilon_0 L}$ d) $\frac{qQ}{4\pi\varepsilon_0 L}$

18. 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 coulomb situated at point (1, 1, 1) is ________.

a) $6\sqrt{5}$N b) 30 N c) 24 N d) $4\sqrt{35}$N

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

a) $\frac{\sigma}{\varepsilon_0}$ b) $\frac{\sigma}{\varepsilon_0}(R-r)$ c) $\frac{\sigma}{\varepsilon_0}(R+r)$ d) None of these

20. A parallel plate condenser has a uniform electric field E(V/ m) in the space between the plates. If the distance between the plates is d(m) and area of each plate is A(m^2) the energy joules) stored in the condenser is _______.

a) $E^2 Ad/\varepsilon_0$ b) $\frac{1}{2}\varepsilon_0 E^2$ c) ε_0EAd d) $\frac{1}{2}\varepsilon_0 E^2 Ad$

21. Three capacitors each of capacity 7mF are to be connected in such a way that the effective capacitance is 6mF. This can be done by __________.

a) connecting two in parallel and one in series b) connecting all of them in series

c) connecting all of them in parallel d) connecting two in series and one in parallel

22. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively.

a) zero and min. b) q.E and max. c) 2q.E and min. d) q.E and p.E

23. There is an electric field E in x-direction. If the work done on moving a charge of 0.2C through a distance of 2m along a line making an angle 60° with x-axis is 4J, then what is the value of E?

a) 3 N/C b) 4 N/C c) 5 N/C d) 20 N/C

24. The electric field strength in air at NTP is 3 x 106 V/m. The maximum charge that can be given to a spherical conductor of radius 3 m is __________.

a) 3 x 10^{4}C b) 3 x 10^{-3}C c) 3 x 10^{-2}C d) 3 x 10^{-1}C

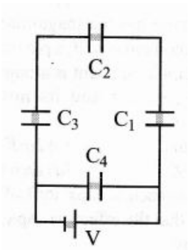
25. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 80 V. The potential at the centre of the sphere is _______.

a) zero b) 80 V c) 800 V d) 8 V

26. The capacity of a parallel plate condenser is 10 mF, when the distance between its plates is 8 cm. If the distance between the plates is reduced to 4 cm then the capacity of this parallel plate condenser will be _______.

a) 5 mF b) 10 mF c) 20 mF d) 40 mF

27. A network of four capacitors of capacity equal to C_1 = C, C_2 = 2C, C_3 = 3C and C_4 = 4C are connected to battery as shown in the figure. The ratio of the charges on C_2 and C_4 is ______.



a) $\frac{4}{7}$ b) $\frac{3}{22}$ c) $\frac{7}{4}$ d) $\frac{22}{3}$

28. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges, separated by a distance.

a) decreases K times b) increases K times c) remains unchanged d) becomes $\frac{1}{K^2}$ times

29. In bringing an electron towards another electron, the electrostatic potential energy of the system.

a) decreases b) increases c) remains same d) becomes zero

30. Four point charges -Q. -q, 2q and 2Q are placed, one at each corner of the square. The relation between e and q for which the potential at the centre of the square is zero is _______.

a) Q = -q b) $Q = -\frac{1}{q}$ c) Q = q d) $Q = \frac{1}{q}$

31. An electric dipole, consisting of two opposite charges of 2 x 10^{-6} C each separated by a distance 3 cm is placed in an electric field of 2 x 10^{5} N/C. Torque on the dipole is _______.

a) 12 x l0^{-1}N-m b) 12 x 10^{-2}Nm c) 12 x l0^{-3}N-m d) 12 x 10^{-4}Nm

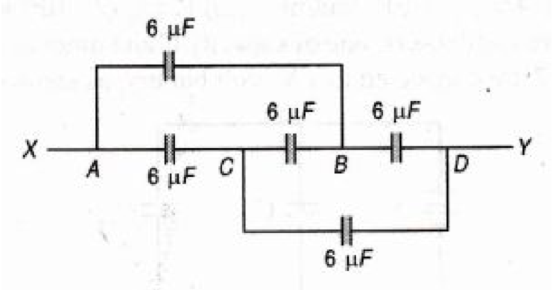
32. The electric potential at a point in free space due to a charge Q coulomb is Q x 10^{11} volts. The electric field at that point is ______.

a) $4\pi\varepsilon_0 Q \times 10^{22}$ volt /m b) $12\pi\varepsilon_0 Q \times 10^{20}$ volt /m c) $4\pi\varepsilon_0 Q \times 10^{20}$ volt /m d) $12\pi\varepsilon_0 Q \times 10^{22}$ volt /m

33. If the potential of a capacitor having capacity 6 mF is increased from 10 V to 20 V then increase in its energy will be __________.

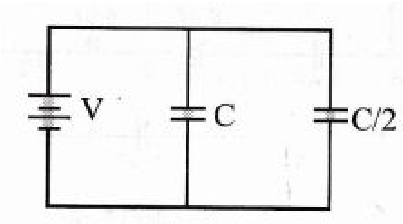
a) 4 x 10^{-4}J b) 4 x l0^{-14}J c) 9 x 10^{-4}J d) 12 x 10^{-6} J

34. The effective capacitance between points X and Y of figure shown is ______.



a) 6 mF b) 12 mF c) 18 mF d) 24 mF

35. Two condensers, one of capacity C and other of capacity C/2 are connected to a V-volt battery as shown.



The work done in charging fully both the condensers is _______.

a) $\frac{1}{4}CV^2$ b) $\frac{3}{4}CV^2$ c) $\frac{1}{2}CV^2$ d) 2CV^2

36. Intensity of an electric field (E) depends on distance r due to a dipole, is related as _____.

a) $E \propto \frac{1}{r}$ b) $E \propto \frac{1}{r^2}$ c) $E \propto \frac{1}{r^3}$ d) $E \propto \frac{1}{r^4}$

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

a) Zero as r increases for r < R, decreases as r increases for r>R

b) Zero as r increases for r < R, increases as r increases for r> R

c) Decreases as r increases for r < R and for r > R

d) Increases as r increases for r < R and for r > R

38. A parallel plate capacitor of capacitance 20 mF is being charged by a voltage source whose potential is changing at the rate of 3 V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively.

a) 60 mA, 60 mA b) 60 mA, zero c) Zero, zero d) Zero,60 mA

39. A capacitor C_1 is charged to a potential difference V. The charging battery is then removed and the capacitor is connected to an uncharged capacitor C_2. The potential difference across the combination is _____________.

a) $\frac{VC_1}{(C_1+C_2)}$ b) $V\left(1+\frac{C_2}{C_1}\right)$ c) $V\left(1+\frac{C_1}{C_2}\right)$ d) $\frac{VC_2}{(C_1+C_2)}$

40. A 4mF capacitor is charged to 400 V and then its plates are joined through a resistance of 1 kW. The heat produced in the resistance is _______.

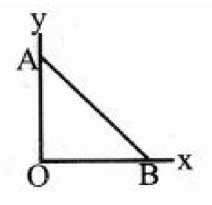
a) 0.16 J b) 1.28 J c) 0.6a J d) 0.32 J

41. In, a parallel plate capacitor, the distance between the plates is d and potential difference across the plates is V. Energy stored per unit volume between the plates of capacitor is ________.

a) $\frac{Q^2}{2V^2}$ b) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$ c) $\frac{1}{2}\frac{V^2}{\varepsilon_0 d^2}$ d) $\frac{1}{2}\varepsilon_0\frac{V^2}{d}$

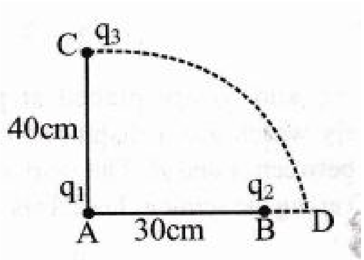
42. Point charges + 4 q, - q and + 4 q are kept on the x-axis at points x = 0, x = a and x = 2a, respectively. Then, _________.
a) only q is in stable equilibrium b) None of the charges in equilibrium
c) all the charges are in unstable equilibrium d) all the charges are in stable equilibrium

43. As per the diagram, a point charge +q is placed at the origin O, Work done in taking another point charge - Q from the point A [coordinates (0, a)] to another point B [coordinates (a, 0)] along the straight pathAB is:



a) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\frac{a}{\sqrt{2}}$ b) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\sqrt{2}a$ c) zero d) $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$

44. Two charges q_1 and q_2 are placed 30cm apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where K is ______.



a) $8q_1$ b) $6q_1$ c) $8q_2$ d) $6q_2$

45. Three concentric spherical shells have radii a, b and c (a < b < c) and have surface charge densities s, -s and s respectively. If V_A, V_B and V_C denotes the potentials of the three Shells, then for c = a+b,we have ______.
a) $V_C = V_B \neq V_A$ b) $V_C \neq V_B \neq V_A$ c) $V_C = V_B = V_A$ d) $V_C = V_A \neq V_B$

46. Energy stored in a capacitor is ________.
a) $\frac{1}{2}QV$ b) QV c) $\frac{1}{QV}$ d) $\frac{2}{QV}$

47. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulating handle. As a result the potential difference between the plates.
a) does not change b) becomes zero c) increases d) decreases

48. 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 _______.
a) 5 N/C b) Zero c) 0.5 N/C d) 1 N/C

49. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be ______.
a) $3C, \frac{V}{3}$ b) $\frac{C}{3}, 3V$ c) 3C, 3V d) $\frac{C}{3}, \frac{V}{3}$

50. A charge 4 is placed at the centre of the line joining two exactly equal positive charges Q. The system of three charges will be in equilibrium if q is equal to ________.

a) $-\frac{Q}{4}$ b) +Q c) -Q d) $\frac{Q}{2}$

51. A solid spherical conductor is given a charge. The electrostatic potential of the conductor is ______.

a) constant throughout the conductor b) largest at the centre c) largest on the surface d) largest somewhere between the centre and the surface

52. Each corner of a cube of side / has a negative charge, -q. The electrostatic potential energy of a charge q at the centre of the cube is _______.

a) $-\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ b) $\frac{\sqrt{3}q^2}{4\pi\varepsilon_0 l}$ c) $\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ d) $-\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 l}$

53. A condenser of capacity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is

a) $\left(\frac{C\left(V_1^2-V_2^2\right)}{L}\right)^{1/2}$ b) $\left(\frac{C\left(V_1-V_2\right)^2}{L}\right)^{1/2}$ c) $\frac{C\left(V_1^2-V_2^2\right)}{L}$ d) $\frac{C\left(V_1-V_2\right)}{L}$

54. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released. The kinetic energy attained by the particle after moving a distance y is _______.

a) qEy^2 b) qE^2y c) qEy d) q^2Ey

55. A point charge + q is placed at mid-point of a cube of side L. The electric flux emerging from the cube is ________.

a) $\frac{q}{\varepsilon_0}$ b) $\frac{6qL^2}{\varepsilon_0}$ c) $\frac{q}{6qL^2}$ d) zero

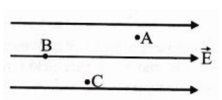
56. A point Q lies on the perpendicular bisector of an electric dipole of dipole moment p. If the distance of Q from the dipole is r, (much larger than the size of the dipole) then electric field at Q is proportional to _______.

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

57. The potential energy of particle in a force field is $U = \frac{A}{r^2} - \frac{B}{r}$ where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particle is _________.

a) B/2A b) 2A/B c) A/B d) B/A

58. A, B and C are three points in a uniform electric field. The electric potential is



a) maximum at B b) maximum at C c) same at all the three points A, B and C d) maximum at A

59. Two spherical conductors I and B of radii 1 mm and 2 mm are separated by a distance of 5 cm and are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium condition, the ratio of the magnitude of the electric fields at the surfaces of spheres

A and B is _______.

a) 4:1 b) 1:2 c) 2:1 d) 1:4

60. When an electric dipole p is placed in a uniform electric field E,then at what angle between p and E the value of torque will be maximum?

a) 90^o b) 0^o c) 180^o d) 45^o

61. Number of electrons present in a negative charge of 8 C is ____________

a) 5 x10^{19} b) 2.5 x 10^{19} c) 12.8 x 10^{19} d) 1.6 x 10^{19}

62. Which of the following statement is correct? $\int E \cdot ds = 0$ over a surface, then

a) the electric field inside the surface and on it is zero.

b) the electric field inside the surface is necessarily uniform.

c)

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

d) all charges must not necessarily be outside the surface.

63. There are two charges +1 μC and +5 μC. The ratio of the forces acting on them will be

a) 1 : 5 b) 1 : 1 c) 5 : 1 d) 1 : 25

64. The electric potential V at any point (x, y, z) all in metres in space is given by $V = 4x^2$ volt. The electric field at the point (1,0,2) in volt/metre is:

a) 8 along positive X-axis b) 16 along negative X-axis c) 16 along positive X-axis

d) 8 along negative X-axis

65. An object of mass 1kg contains 4 x 10^{20} atoms. If one electron is removed from every atom of the solid, the charge gained by the solid of 1g is _______

a) 2.8 C b) 6.4 x 10^{-2} C c) 3.6 x 10^{-3} C d) 9.2 x 10^{-4} C

66. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is given by

a) $2\pi R^2 E$ b) πr^2 c) $\frac{\pi \boldsymbol{R}^2 - \pi \boldsymbol{R}}{\boldsymbol{E}}$ d) Zero

67. The mean free path of electrons in a metal is 4×10^{-8} m. The electric field which can give on an average 2 eV energy to an electron in the metal will be in units of V/m.

a) 5×10^{-11} b) 8×10^{-11} c) 5×10^{7} d) 8×10^{7}

68. An electric charge q is placed at the centre of a cube of side a. The electric flux on one of its faces will be

a) $\frac{q}{6\varepsilon_0}$ b) $\frac{q}{\varepsilon_0 a^2}$ c) $\frac{q}{4\pi\varepsilon_0 a^2}$ d) $\frac{q}{\varepsilon_0}$

69. A charge Q is divided into two parts of q and Q - q. If the coulomb repulsion between them when they are separated is to be maximum, the ratio of Q/q should be

a) 2 : 1 b) 1/2 c) 4 : 1 d) 1/4

70. Four equal charges q are placed at the four corners A, B, C, D of a square of length a. The magnitude of the force on the charge at B will be

a) $\frac{3q^2}{4\pi\varepsilon_0 a^2}$ b) $\frac{4q^2}{4\pi\varepsilon_0 a^2}$ c) $\frac{(1+2\sqrt{2})q^2}{2\times 4\pi\varepsilon_0 a^2}$ d) $\frac{\left(\frac{2+1}{\sqrt{2}}\right)q^2}{4\pi\varepsilon_0 a^2}$

71. The intensity of electric field at the surface of conducting hollow sphere is 10 NC^{-1} and its radius is 10 cm. The value of electric field at the centre of sphere is
a) zero b) 10 NC^{-1} c) 1 NC^{-1} d) 100 NC^{-1}

72. Two similar spheres having +Q and -Q charges are kept at a certain distance. F force acts between the two. If at the middle of two spheres, another similar sphere having +Q charge is kept, then it experiences a force in magnitude and direction as
a) zero having no direction. b) SF towards +Q charge. c) SF towards -Q charge.
d) 4F towards +Q charge

73. An electric dipole of moment $'p'$ is placed in an electric field of intensity ' E '. The dipole acquires a position such that the axis of the dipole makes an angle q with the direction of the field. Assuming that the potential energy of the dipole to be zero when $= 90^\circ$, the torque and the potential energy of the dipole will respectively be:
a) $pE\sin q, -pE\cos q$ b) $pE\sin q, -2pE\cos q$ c) $pE\sin q, 2pE\cos q$ d) $pE\cos q, -pE\cos q$

74. A charge q is located at the centre of a cube. The electric flux through any face is
_______________ .
a) $\frac{q}{6\left(4\pi\varepsilon_0\right)}$ b) $\frac{2\pi q}{6\left(4\pi\varepsilon_0\right)}$ c) $\frac{4\pi q}{6\left(4\pi\varepsilon_0\right)}$ d) $\frac{\pi q}{6\left(4\pi\varepsilon_0\right)}$

75. Total electric flux coming out of a unit positive charge put in air is
a) E_o b) ε_0^{-1} c) $(4\ pE_0)^{-1}$ d) $4\pi\ E_0$

76. Which of the following statement is correct? The electric field at a point is
a) always continuous b) continuous if there is a charge at that point.
c) discontinuous only if there is a negative charge at that point.
d) discontinuous if there is a charge at that point

77. 

In given figures, OP = OQ = 15 cm, OA = OB = 2.5 mm Magnitudes of electric field at P and Q are respectively
a) 2.6×10^5 NC^{-1}, 2.6×10^5 NC^{-1} b) 1.3×10^5 NC^{-1}, 1.3×10^5 NC^{-1}
c) 2.6×10^5 NC^{-1}, 1.3×10^5 NC^{-1} d) 1.3×10^5 NC^{-1}, 2.6×10^5 NC^{-1}

78. In general, metallic ropes are suspended from the carriers to the ground which take inflammable material. The reason is

a) their speed is controlled b) to keep the gravity of the carrier nearer to the earth
c) to keep the body of the carrier in contact with the earth
d) nothing should be placed under the carrier

79. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force $\vec{F}$ between the two is (where $K = \frac{1}{4K\varepsilon_0}$)
a) $K\frac{e^2}{r^3}\vec{r}$ b) $K\frac{e^2}{r^2}\hat{r}$ c) $-K\frac{e^2}{r^3}\hat{r}$ d) $-K\frac{e^2}{r^3}\vec{r}$

80. Two parallel infinite line charges with linear charge densities $+\lambda\mathrm{C/m}$ and $-\lambda\mathrm{C/m}$ are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges?
a) $\frac{2\lambda}{\pi\varepsilon_0\mathrm{R}}\mathrm{N/C}$ b) $\frac{\lambda}{\pi\varepsilon_0\mathrm{R}}\mathrm{N/C}$ c) $\frac{\lambda}{2\pi\varepsilon_0\mathrm{R}}\mathrm{N/C}$ d) Zero

81. Two equal and opposite charges each of 2C are placed at a distance of 0.04 m. Dipole moment of the system will be
a) 6 x 10^{-8} C-m b) 8 x 10^{-2} C-m c) 1.5 x 10^{2} C-m d) 8 x 10^{-6} C-m

82. ABC is an equilateral triangle. Three charges +q are placed at each comer. The electric intensity at O will be

a) $1.\,q/4\pi\varepsilon_0.\,r^2$ b) $1.\,q/4\pi\varepsilon_0 r$ c) Zero d) $1.\,3q/4\pi\varepsilon_0 r^2$

83. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is:
a) $\frac{E}{2}$ b) zero c) E d) $\frac{E}{2}$

84. Gauss's law will be invalid if
a) there is magnetic monopoles b) the inverse square law is not exactly true.
c) the velocity of light is not a universal constant. d) none of these

85. Two charges of equal magnitudes kept at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is
a) $\frac{F}{8}$ b) $\frac{F}{4}$ c) 4 F d) $\frac{F}{16}$

86. Gauss' law is true only if force due to charges varies as
a) r^{-1} b) r^{-2} c) r^{-3} d) r^{-4}

87. A short electric dipole has a dipole moment of 16×10^9 cm. 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:

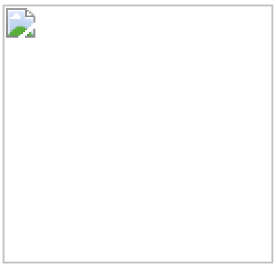
$$\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \mathrm{Nm}^2/\mathrm{C}^2\right)$$

a) zero b) 50 V c) 200 V d) 400 V

88. In the following configuration of charges, force on charge q_2 by q_1 is given by (here, $r = r_{21} = (r_2 - r_1)$)

a) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} \cdot \hat{\mathbf{r}}_{21}$ b) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\left(-\hat{\mathbf{r}}_{21}\right)$ c) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^3} \cdot \hat{\mathbf{r}}_{21}$ d) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^3} \cdot \left(-\hat{\mathbf{r}}_{21}\right)$

89. A positive charge Q is uniformly distributed along a circular ring of radius R. A small test charge q is placed at the centre of the ring.



Which of the following statement is not correct?

a)

If q > 0 and is displaced away from the centre in the plane of the ring, it will be pushed back towards the centre.

b)

If q < 0 and is displaced away from the centre in the plane of the ring, it will never return to the centre and will continue moving till it hits the ring.

c) If q < 0, it will perform SHM for small displacement along the axis.

d)

q at the centre of the ring is in an unstable equilibrium within the plane of the ring for q > 0.

90. An electric dipole is kept in a non-uniform electric field. It experiences

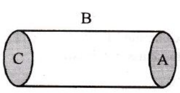
a) a force and a torque b) a force but not a torque c) a torque but not a force.

d) neither a force nor a torque

91. What is the flux through a cube of side ' a ' if a point charge of q is at one of its corner:

a) $\frac{2q}{\varepsilon_0}$ b) $\frac{q}{8\varepsilon_0}$ c) $\frac{q}{\varepsilon_0}$ d) $\frac{q}{2\varepsilon_0}6a^2$

92. A hollow cylinder has a charge q coulomb within it. If, f is the electric flux in units of voltmeter, associated with the curved surface B, the flux linked with the plane surface A in units of voltmeter will be:



a) $\frac{q}{\varepsilon_0} - \phi$ b) $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$ c) $\frac{q}{2\varepsilon_0}$ d) $\frac{\phi}{3}$

93. In charging by induction

a) body to be charged must be an insulator

b) body to be charged must be a semiconductor

c) body to be charged must be a conductor
d) any type of body can be charged by induction

94. The number of electrons that must be removed from an electrically neutral silver dollar to give it a charge of + 2.4 C is
a) 2.5×10^{19} b) 1.5×10^{19} c) 1.5×10^{-19} d) 2.5×10^{-19}

95. In an electric field E, the torque acting on a dipole moment p is
a) p·E b) p x E c) zero d) E x p

96. Unit of electric field is
a) N/m b) C/N c) N/C d) J/N

97. Five charges q_1 q_2, q_3, q_4 and q_5 are fixed at their positions as shown in Figure, S is a Gaussian surface. The Gauss' law is given by $\int_S E \cdot dS = \frac{q}{\varepsilon_0}$ Which of the following statements is correct?

a)
E on the LHS of the above equation will have a contribution from q_1, q_5 and q_1, q_5 and q_3 while q on the RHS will have a contribution from q_2 and q_4 only.
b)
E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_2 and q_3 only
c)
E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_1, q_3, and q_5 only.
d) Both E on the LHS and q on the RHS will have contributions from q_2 and q_4 only

98. A charge Q mc is placed at the centre of a cube, the flux coming out from any surface will be:
a) $\frac{Q}{6\varepsilon_0} \times 10^{-6}$ b) $\frac{Q}{6\varepsilon_0} \times 10^{-3}$ c) $\frac{Q}{24\varepsilon_0}$ d) $\frac{Q}{8\varepsilon_0}$

99. Charge on a body is q1 and it is used to charge another body by induction. Charge on second body is found to be q2 after charging. Then
a) $\frac{q_1}{q_2} = 1$ b) $\frac{q_1}{q_2} < 1$ c) $\frac{q_1}{q_2} \le 1$ d) $\frac{q_1}{q_2} \ge 1$

100. Electric field at a point varies as r^o for
a) an electric dipole b) a point charge c) a plane infinite sheet of charge
d) a line charge of infinite length

101. If charges q, q and -q are placed at vertices of an equilateral triangle of side l. If F_1,F_2 and F_3 are the forces on the charges respectively, then
a) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = \sqrt{3}\frac{kq^2}{l^2}$ b) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = 0$ c) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = 3\sqrt{2}\frac{kq^2}{l^2}$
d) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = \sqrt{2}\frac{kq^2}{l^2}$

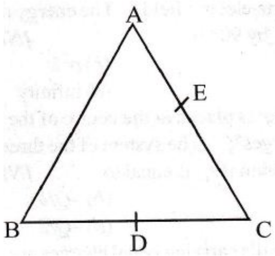
102. A point positive charge is brought near an isolated conducting sphere (figure). The electric field is best given by

a) b) c) d)

103. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to its weight is given by

a) e^2g/m^2 b) mge c) mg/e d) e/mg

104. Three charges, each +q, are placed at the corners of an isosceles triangle ABC of sides BC and AC, 2a. D and E are the mid points of BC and CA. The work done in taking a charge Q from D to E is:



a) $\frac{3qQ}{8\pi\varepsilon_0 a}$ b) $\frac{qQ}{4\pi\varepsilon_0 a}$ c) zero d) $\frac{3qQ}{4\pi\varepsilon_0 a}$

105. In figure two positive charges q_2 and q_3 fixed along the y-axis, exert a net electric force in the + x- direction on a charge q_1 fixed along the x-axis. If a positive charge Q is added at (x, 0), the force on q_1

a) shall increase along the positive x-axis b) shall decrease along the positive x-axis

c) shall point along the negative x-axis

d) shall increase but the direction changes because of the intersection of Q with q_2 and q_3

106. For a given surface, the $\oint \mathbf{E} \cdot d\mathbf{S} = 0$ From this, we can conclude that

a) E is necessarily zero on the surface. b) E is perpendicular to the surface at every point

c) the total flux through the surfaceis zero d) the flux is only going out of the surface

107. What is the angle between the electric dipole moment and the electric field strength due to it on the equatorial line?

a) 0^o b) 90^o c) 180^o d) None of these

108. Electric field of a system of charges does not depend on

a) position of charges forming the system

b) distance of point (at which fieldis being observed) from the charges forming system

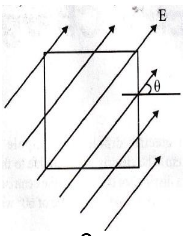
c) value of test charge used to find out the field

d) separation of charges forming the system

109. Force between two charges varies with distance between them as

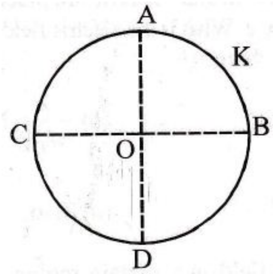
a) b) c) d)

110. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(volt/\mathrm{m})$ acting along the same plane at an angle q with the horizontal side of the square as shown in figure. The electric flux linked to the surface, in units of volt. m, is:



a) EL^2 b) $EL^2 \cos\theta$ c) $EL^2 \sin\theta$ d) zero

111. A thin conducting ring of radius R is given a charge +Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is:



a) E along Ko b) E along OK c) E along KO d) 3 E along OK

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

$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \mathrm{Nm}^2/\mathrm{C}^2\right)$$

a) $1.28 \times 10^7\ \mathrm{N/C}$ b) $1.28 \times 10^4\ \mathrm{N/C}$ c) $1.28 \times 10^5\ \mathrm{N/C}$ d) $1.28 \times 10^6\ \mathrm{N/C}$

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

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

114. A charge q is placed at the centre of the line joining two equal charges Q and Q. The system of the three charges will be ill equilibrium, if q is equal to

a) -Q /2 b) -Q/ 4 c) +Q/ 4 d) +Q/ 2

115. Three point charges +q, -q and +q are placed at points (x=0, y=a, z=0),(x=0, y=0, z=0) and (x=a, y=0, z=0) respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are:

a) $\sqrt{2}qa$ along the line joining points (x=0, y=0, z=0) and (x=a, y=a, z=0)

b) qa along the line joining points (x=0, y=0, z=0 and (x=a, y=a, z=0)

c) $\sqrt{2}$qa along +ve x direction, d) $\sqrt{2}$qa along +ve y direction,

116. Unit of electric field intensity is

a) N/m b) C/N c) N/C d) J/N

117. Four charges are arranged at the comers of a square ABCD, as shown. The force on the charge kept at the centre O is

a) zero b) along the diagonal AC c) along the diagonal BD d) perpendicular to side AB

118. If a dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$, then torque acting on it is given by:

a) $\vec{\tau} = \vec{p} \cdot \vec{E}$ b) $\vec{\tau} = \vec{p} \times \vec{E}$ c) $\vec{\tau} = \vec{p} + \vec{E}$ d) $\vec{\tau} = \vec{p} - \vec{E}$

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

a) perpendicular to the diameter b) parallel to the diameter

c) at an angle tilted towards the diameter d) at an angle tilted away from the diameter

120. A charge on a sphere of radius 2 cm is 2 μC while charge on sphere of radius 5 cm is 5μC. Find the ratio of an electric field on distance of 10 crn from centre of the sphere.

a) 1 : 1 b) 2 : 5 c) 5 : 2 d) 4 : 25

121. A force of 2.25 N acts on a chrage of 15 x 10^{-4} C. The intensity of electric field at that point is

a) 150 NC^{-1} b) 15 NC^{-1} c) 1500 NC^{-1} d) 1.5 NC^{-1}

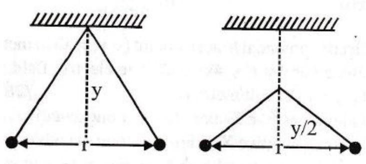
122. Radius of a hollow sphere is R and a charge q is placed at the centre of hollow sphere. If the radius of sphere becomes half and charge also becomes half, then the value of emergent total flux from the surface of sphere is

a) $4q/\varepsilon_0$ b) $2q/\varepsilon_0$ c) $q/2\varepsilon_0$ d) q/ε_0

123. Two identical metallic spheres having charges +4q and -2q are placed with their centres r distance apart. Force of attraction between the spheres is F. If the two spheres are brought in contact and then placed at the same distance r apart, the force between them

a) F b) F/2 c) F/4 d) F/8

124. Two pith balls carrying equal charges are suspended from a common point by strings of equal length. The equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become



a) $\left(\frac{r}{\sqrt[3]{2}}\right)$ b) $\left(\frac{2r}{\sqrt{3}}\right)$ c) $\left(\frac{2r}{3}\right)$ d) $\left(\frac{r}{\sqrt{2}}\right)^2$

125. Which of the following graphs shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere?

a) b) c) d)

126. A point charge q is placed at a distance a/2 directly above the centre of a square of side a. The electric flux through the square is

a) q/ε_0 b) $\boldsymbol{q}/\pi\varepsilon_0$ c) $q/4\varepsilon_0$ d) $q/6\varepsilon_0$

127. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then

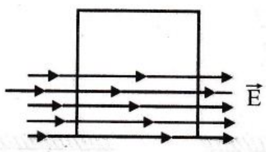
a) mass of A and mass of B still remain equal b) mass of A increases

c) mass of B decreases d) mass of B increases

128. An electric dipole of moment p is placed in the position of stable equilibrium in uniform electric field of intensity E. It is rotated through an angle 9 from the initial position. The potential energy of electric dipole in the final position is

a) $pE\cos\theta$ b) $pE\sin\theta$ c) $pE(1-\cos\theta)$ d) $-pE\cos\theta$

129. A square surface of side L metres is in the plane of the paper. A uniform electric field $\vec{E}(volt/\mathrm{m})$, also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The electric flux in SI units associated with the surface is:



a) $\mathrm{EL}^2/2$ b) zero c) EL^2 d) $\mathrm{E}^2/\left(2\mathrm{e}_0\right)$

130. When a glass rod is rubbed with silk, it

a) gains electrons from silk. b) gives electrons to silk c) gains protons from silk

d) gives protons to silk.

131. A point charge + q is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is

a) directed perpendicular to the plane and away from the plane.

b) directed perpendicular to the plane but towards the plane

c) directed radially away from the point charge d) directed radially towards the point charge

132. The surface densities on the surfaces of two charged spherical conductors of radii R_1 and R_2 are equal. The ratio of electric intensities on the surfaces are

a) R_1^2/R_2^2 b) R_2^2/R_1^2 c) R_1/R_2 d) 1:1

133. Two charges + 1 μ Cand +4μ C are situated at a distance in air. The ratio of the forces acting on them is

a) 1 : 4 b) 4 : 1 c) 1 : 1 d) 1 : 16

134. The electric flux in a charged spherical conductor is
a) zero inside and outside the sphere
b) maximum inside the sphere and zero outside the sphere
c)
zero inside the sphere and decreases outside the sphere with increase of square of distance.
d) maximum inside the sphere and decreases outside the sphere with increase of distance.

135. The unit of intensity of electric field is
a) N/m b) C/N c) N/C d) J/N

136. The electric field in a certain region is acting radially outward and is given by E=Ar. A charge contained in a sphere of radius ' a ' centred at the origin of the field, will be given by:
a) $A\varepsilon_0 a_1^2$ b) $4\pi\varepsilon_0 Aa^3$ c) $\varepsilon_0 Aa^3$ d) $4\pi\varepsilon_0 \mathrm{Aa}^2$

137. A charge ' q ' is placed at the centre of the line joining two equal charges ' Q '. The system of the three charges will be in equilibrium if ' q ' is equal to:
a) Q/2 b) -Q/4 c) Q/4 d) -Q/2

138. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will _______________ .
a) increase four times b) be reduced to half c) remain the same d) be doubled

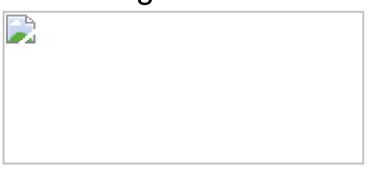
139. The electric flux through the surface

a) in Fig. (iv) is the largest b) in Fig. (iii) is the least
c) in Fig. (ii) is same as Fig. (iii) but is smaller than Fig. (iv) d) is the same for all the figures

140. In a system, 'n' electric dipole are placed in a closed surface. The value of emergent electric flux from enclosed surface is
a) $\frac{q}{\varepsilon_0}$ b) $\frac{2q}{\varepsilon_0}$ c) $-\frac{2q}{\varepsilon_0}$ d) zero

141. Two metallic spheres of radii 1 m and 3 cm are given charges of $-1\times10^{-2}\mathrm{C}$ and $5\times10^{-2}\mathrm{C}$, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is:
a) $2\times10^{-2}\mathrm{C}$ b) $3\times10^{-2}\mathrm{C}$ c) $4\times10^{-2}\mathrm{C}$ d) $1\times10^{-2}\mathrm{C}$

142. In the diagram shown below,



a) field strength at P is less than field strength at Q b) field strength at P and Q are equal
c) field is more strong at P and less strong at Q d) cannot be tell from the figure

143. An electric dipole of dipole moment p is aligned parallel to a uniform electric field E. The energy required to rotate the dipole by 90° is _______________ .

a) pE^2 b) p^2E c) pE d) Infinity

144. SI unit of electrical permittivity is

a) N-m ^{2}C^{-2} b) Am $^{-2}$ c) NC^{-1} d) C^{2}N^{-1}m^{-2}

145. The SI unit of electric flux is

a) $\frac{\text{volt}}{\text{metre}}$ b) $\frac{\text{newton}}{\text{coulomb}}$ c) $\frac{\text{newton} \times \text{metre}^2}{\text{coulomb}}$ d) $\text{volt} \times \text{metre}^2$

146. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge of an electron)

a) $\frac{4\pi\varepsilon_0 F d^2}{e^2}$ b) $\sqrt{\frac{4\pi\varepsilon_0 F e^2}{d^2}}$ c) $\sqrt{\frac{4\pi\varepsilon_0 F d^2}{e^2}}$ d) $\sqrt{\frac{4\pi\varepsilon_0 F d^2}{q^2}}$

147. Electric charges q,q,-2q are placed at the corners of an equilateral $\triangle$ABC of side l. The magnitude of electric dipole moment of the system is

a) ql b) 2ql c) $\sqrt{3}$ ql d) 4ql

148. The electric intensity due to a dipole of length 10 cm and having a charge of 500 mC, at a point on the axis at a distance 20 cm from one of the charges in air, is _____________ .

a) 6.25×10^7 N/C b) 9.28×10^7 N/C c) 13.1×10^{11} N/C d) 20.5×10^7 N/C

149. For the dipole shown,

Dipole moment is given by

a) p= q x 2a$\hat{p}$ b) $\mathbf{p} = \frac{1}{2} q \times 2a\hat{\mathbf{p}}$ c) p=- q x 2a$\hat{p}$ d) p=4q x 2a$\hat{p}$

150. The electric field inside a spherical shell of uniform surface charge density is

a) zero. b) constant, less than zero.

c) directly proportional to the distance from the centre. d) none of the these

151. Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct?

a) The dipole will not experience any force.

b) The dipole will experience a force towards right.

c) The dipole will experience a force towards left.

d) The dipole will experience a force upwards.

152. 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:

a) $\frac{9\,F}{16}$ b) $\frac{16\,F}{9}$ c) $\frac{4\,F}{3}$ d) F

153. An electric dipole of moment $\vec{p}$ is lying along a uniform electric field $\vec{E}$. The work done in rotating the dipole by $90°$ is __________ .

a) $\frac{pE}{2}$ b) 2pE c) pE d) $\sqrt{2}pE$

154. The electric field intensity due to an infinite cylinder of radius R and having charge q per unit length at a distance r(r > R) from its axis is

a) directly proportional to r^2. b) directly proportional to r^3. c) inversely proportional to r.
d) inversely proportional to r^2.