Ordinary Thinking

Objective Questions

Charge and Coulomb's Law

1. The law, governing the force between electric charges is known as **[CPMT 1972; MP PMT 2004]**

(1) Ampere's law (2) Ohm's law

(3) Faraday's law (4) Coulomb's law

2. When the distance between the charged particles is halved, the force between them becomes **[MNR 1986]**

(1) One-fourth (2) Half

(3) Double (4) Four times

3. There are two charges +1 microcoulombs and +5 microcoulombs. The ratio of the forces acting on them will be **[CPMT 1979]**

(1) 1 : 5 (2) 1 : 1

(3) 5 : 1 (4) 1 : 25

4. A charge q_1 exerts some force on a second charge q_2. If third charge q_3 is brought near, the force of q_1 exerted on q_2 **[NCERT 1971]**

(1) Decreases

(2) Increases

(3) Remains unchanged

(4) Increases if q_3 is of the same sign as q_1 and decreases if q_3 is of opposite sign

5. F_g and F_e represents gravitational and electrostatic force respectively between electrons situated at a distance 10 *cm*. The ratio of F_g / F_e is of the order of **[NCERT 1978; CPMT 1978]**

(1) 10^{42} (2) 10

(3) 1 (4) 10^{-43}

6. The ratio of the forces between two small spheres with constant charge (*a*) in air (*b*) in a medium of dielectric constant *K* is **[MNR 1998]**

(1) 1 : *K* (2) *K* : 1

(3) $1 : K^2$ (4) $K^2 : 1$

7. A soap bubble is given a negative charge, then its radius **[MNR 1988; CPMT 1997; RPMT 1997; DCE 2000; BVP 2003]**

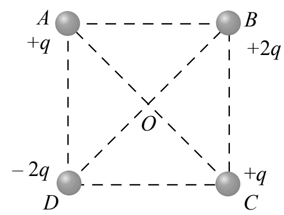
(1) Decreases

(2) Increases

(3) Remains unchanged

(4) Nothing can be predicted as information is insufficient

8. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure. The force on the charge kept at the centre *O* is **[NCERT 1983; BHU 1999]**



(1) Zero (2) Along the diagonal AC

(3) Along the diagonal BD (4)Perpendicular to side AB

9. In the absence of other conductors, the surface charge density

(1) Is proportional to the charge on the conductor and its surface area

(2) Inversely proportional to the charge and directly proportional to the surface area

(3) Directly proportional to the charge and inversely proportional to the surface area

(4) Inversely proportional to the charge and the surface area

10. The minimum charge on an object is

(1) 1 *coulomb* (2) 1 *stat coulomb*

(3) 1.6×10^{-19} *coulomb* (4) 3.2×10^{-19} *coulomb*

11. Out of gravitational, electromagnetic, Vander Waals, electrostatic and nuclear forces; which two are able to provide an attractive force between two neutrons **[NCERT 1978]**

(1) Electrostatic and gravitational

(2) Electrostatic and nuclear

(3) Gravitational and nuclear

(4) Some other forces like Vander Waals

12. A total charge Q is broken in two parts Q_1 and Q_2 and they are placed at a distance R from each other. The maximum force of repulsion between them will occur, when [MP PET 1990]

(1) $Q_2 = \frac{Q}{R}, Q_1 = Q - \frac{Q}{R}$ (2) $Q_2 = \frac{Q}{4}, Q_1 = Q - \frac{2Q}{3}$

(3) $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{4}$ (4) $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

13. Three charges $4q, Q$ and q are in a straight line in the position of 0, $l/2$ and l respectively. The resultant force on q will be zero, if $Q =$ [CPMT 1980]

(1) $-q$ (2) $-2q$

(3) $-\frac{q}{2}$ (4) $4q$

14. An isolated solid metallic sphere is given $+Q$ charge. The charge will be distributed on the sphere [MP PET 1987]

(1) Uniformly but only on surface

(2) Only on surface but non-uniformly

(3) Uniformly inside the volume

(4) Non-uniformly inside the volume

15. Two small spheres each having the charge $+Q$ are suspended by insulating threads of length L from a hook. This arrangement is taken in space where there is no gravitational effect, then the angle between the two suspensions and the tension in each will be [IIT 1986]

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

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

16. Two charges each of $1\,coulomb$ are at a distance $1\,km$ apart, the force between them is [CPMT 1977; DPMT 1999]

(1) 9×10^3 *Newton* (2) 9×10^{-3} *Newton*

(3) 1.1×10^{-4} *Newton* (4) 10^4 *Newton*

17. $+2C$ and $+6C$ two charges are repelling each other with a force of $12\,N$. If each charge is given $-2C$ of charge, then the value of the force will be [CPMT 1979; Kerala PMT 2002]

(1) $4\,N$ (Attractive) (2) $4\,N$ (Repulsive)

(3) $8\,N$ (Repulsive) (4) Zero

18. Dielectric constant of pure water is 81. Its permittivity will be [CPMT 1984]

(1) 7.12×10^{-10} *MKS* units (2) 8.86×10^{-12} *MKS* units

(3) 1.02×10^{13} *MKS* units (4) Cannot be calculated

19. There are two metallic spheres of same radii but one is solid and the other is hollow, then [KCET 1994; BHU 1999]

(1) Solid sphere can be given more charge

(2) Hollow sphere can be given more charge

(3) They can be charged equally (maximum)

(4) None of the above

20. In general, metallic ropes are suspended on the carriers which take inflammable material. The reason is

(1) There speed is controlled

(2) To keep the centre of gravity of the carrier nearer to the earth

(3) To keep the body of the carrier in contact with the earth

(4) Nothing should be placed under the carrier

21. Three equal charges are placed on the three corners of a square. If the force between q_1 and q_2 is F_{12} and that between q_1 and q_3 is F_{13}, the ratio of magnitudes $\frac{F_{12}}{F_{13}}$ is [MP PET 1993]

(1) $1/2$ (2) 2

(3) $1/\sqrt{2}$ (4) $\sqrt{2}$

22. ABC is a right angled triangle in which $AB = 3\,cm$ and $BC = 4\,cm$. And $\angle ABC = \pi/2$. The three charges $+15, +12$ and $-20\,e.s.u.$ are placed respectively on A, B and C. The force acting on B is

(1) 125 *dynes* (2) 35 *dynes*

(3) $25\ dynes$ (4) Zero

23. With the rise in temperature, the dielectric constant K of a liquid

(1) Increases (2) Decreases

(3) Remains unchanged (4) Charges erratically

24. Two charges q_1 and q_2 are placed in vacuum at a distance d and the force acting between them is F. If a medium of dielectric constant 4 is introduced around them, the force now will be [MP PMT 1994]

(1) $4F$ (2) $2F$

(3) $\frac{F}{2}$ (4) $\frac{F}{4}$

25. Force of attraction between two point charges Q and $-Q$ separated by $d\,metre$ is F_e. When these charges are placed on two identical spheres of radius $R = 0.3\,d$ whose centres are $d\,metre$ apart, the force of attraction between them is [AIIMS 1995]

(1) Greater than F_e (2) Equal to F_e

(3) Less than F_e (4) Less than F_e

26. When 10^{14} electrons are removed from a neutral metal sphere, the charge on the sphere becomes [Manipal MEE 1995]

(1) $16\,\mu C$ (2) $-16\,\mu C$

(3) $32\,\mu C$ (4) $-32\,\mu C$

27. A force F acts between sodium and chlorine ions of salt (sodium chloride) when put $1\,cm$ apart in air. The permittivity of air and dielectric constant of water are ε_0 and K respectively. When a piece of salt is put in water electrical force acting between sodium and chlorine ions $1\,cm$ apart is [MP PET 1995]

(1) $\frac{F}{K}$ (2) $\frac{FK}{\varepsilon_0}$

(3) $\frac{F}{K\varepsilon_0}$ (4) $\frac{F\varepsilon_0}{K}$

28. A conductor has $14.4 \times 10^{-19}\,coulombs$ positive charge. The conductor has

(Charge on electron $= 1.6 \times 10^{-19}\,coulombs$)

(1) 9 electrons in excess (2)27 electrons in short

(3) 27 electrons in excess (4)9 electrons in short

29. The value of electric permittivity of free space is [MP PET 1996; RPET 2001]

(1) $9 \times 10^9\,NC^2/m^2$ (2) $8.85 \times 10^{-12}\,Nm^2/C^2\,sec$

(3) $8.85 \times 10^{-12}\,C^2/Nm^2$ (4) $9 \times 10^9\,C^2/Nm^2$

30. Two similar spheres having $+q$ and $-q$ charge are kept at a certain distance. F force acts between the two. If in the middle of two spheres, another similar sphere having $+q$ charge is kept, then it experience a force in magnitude and direction as [MP PET 1996]

(1) Zero having no direction

(2) $8F$ towards $+q$ charge

(3) $8F$ towards $-q$ charge

(4) $4F$ towards $+q$ charge

31. 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 $\frac{Q}{q}$ should be [MP PET 1997]

(1) 2 (2) $1/2$

(3) 4 (4) $1/4$

32. Number of electrons in one coulomb of charge will be [MP PMT/PET 1998; Pb. PMT 1999; AIIMS 1999; RPET 2001]

(1) 5.46×10^{29} (2) 6.25×10^{18}

(3) $1.6 \times 10^{+19}$ (4) 9×10^{11}

33. When air is replaced by a dielectric medium of constant k, the maximum force of attraction between two charges separated by a distance [CBSE PMT 1999]

(1) Decreases k times (2) Remains unchanged

(3) Increases k times (4) Increases k^{-1} times

34. A glass rod rubbed with silk is used to charge a gold leaf electroscope and the leaves are observed to diverge. The electroscope thus

charged is exposed to X-rays for a short period. Then **[AMU 1995]**

(1) The divergence of leaves will not be affected

(2) The leaves will diverge further

(3) The leaves will collapse

(4) The leaves will melt

35. 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 **[AMU 1995; RPET 2000; CPMT 2000]**

(1) Mass of A and mass of B still remain equal

(2) Mass of A increases

(3) Mass of B decreases

(4) Mass of B increases

36. The force between two charges $0.06\,m$ apart is $5\,N$. If each charge is moved towards the other by $0.01\,m$, then the force between them will become **[SCRA 1994]**

(1) $7.20\,N$ (2) $11.25\,N$

(3) $22.50\,N$ (4) $45.00\,N$

37. Two charged spheres separated at a distance d exert a force F on each other. If they are immersed in a liquid of dielectric constant 2, then what is the force (if all conditions are same) **[AIIMS 1997; MH CET 2003]**

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

(3) $2F$ (4) $4F$

38. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of $40\,N$. If a charge of $-5\mu C$ is added to each of them, then the force between them will become **[SCRA 1998; JIPMER 2000]**

(1) $-10\,N$ (2) $+10\,N$

(3) $+20\,N$ (4) $-20\,N$

39. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is **[Karnataka CET (Engg./Med.) 1999]**

(1) – 1.6 C (2) + 1.6 C

(3) 10^{+19} C (4) 10^{-19} C

40. Electric charges of $1\mu C, -1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side 10 cm. The resultant force on the charge at C is **[EAMCET (Engg.) 2000]**

(1) 0.9 N (2) 1.8 N

(3) 2.7 N (4) 3.6 N

41. Charge on α-particle is

(1) $4.8\times10^{-19}\,C$ (2) $1.6\times10^{-19}\,C$

(3) $3.2\times10^{-19}\,C$ (4) $6.4\times10^{-19}\,C$

42. Two small conducting spheres of equal radius have charges $+10\mu C$ and $-20\mu C$ respectively and placed at a distance R from each other experience force F_1. If they are brought in contact and separated to the same distance, they experience force F_2. The ratio of F_1 to F_2 is **[MP PMT 2001]**

(1) 1 : 8 (2) – 8 : 1

(3) 1 : 2 (4) – 2 : 1

43. Two charges each equal to $2\mu C$ are 0.5m apart. If both of them exist inside vacuum, then the force between them is **[CPMT 2001]**

(1) 1.89 N (2) 2.44 N

(3) 0.144 N (4) 3.144 N

44. Two charges are at a distance 'd' apart. If a copper plate (conducting medium) of thickness $\frac{d}{2}$ is placed between them, the effective force will be **[UPSEAT 2001; J & K CET 2005]**

(1) $2F$ (2) $F/2$

(3) 0 (4) $\sqrt{2}F$

45. Two electrons are separated by a distance of 1Å. What is the coulomb force between them

(1) 2.3×10^{-8} N (2) 4.6×10^{-8} N

(3) 1.5×10^{-8} N (4) None of these

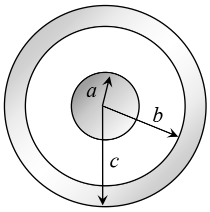
46. Two copper balls, each weighing 10g are kept in air 10 cm apart. If one electron from every 10^6 atoms is transferred from one ball to the other, the coulomb force between them is (atomic weight of copper is 63.5) **[KCET 2002]**

(1) $2.0\times10^{10}\,N$ (2) $2.0\times10^{4}\,N$

(3) $2.0\times10^{8}\,N$ (4) $2.0\times10^{6}\,N$

47. A solid conducting sphere of radius a has a net positive charge $2Q$. A conducting spherical shell of inner radius b and outer radius c is concentric with the solid sphere and has a net charge – Q. The surface charge density on the inner and outer surfaces of the spherical shell will be

[AMU 2002]



(1) $-\frac{2Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$

(2) $-\frac{Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$

(3) $0, \frac{Q}{4\pi c^2}$

(4) None of the above

48. Three charges each of magnitude q are placed at the corners of an equilateral triangle, the electrostatic force on the charge placed at the center is (each side of triangle is L)

[DPMT 2002]

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

(3) $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{L^2}$ (4) $\frac{1}{12\pi\varepsilon_0}\frac{q^2}{L^2}$

49. Two charges placed in air repel each other by a force of $10^{-4}\,N$. When oil is introduced between the charges, the force becomes $2.5\times10^{-5}\,N$. The dielectric constant of oil is

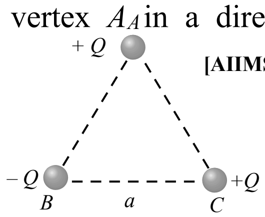
[MP PET 2003]

(1) 2.5 (2) 0.25

(3) 2.0 (4) 4.0

50. Three charges are placed at the vertices of an equilateral triangle of side 'a' as shown in the following figure. The force experienced by the charge placed at the vertex A_A in a direction normal to BC is

[AIIMS 2003]



(1) $Q^2/(4\pi\varepsilon_0 a^2)$

(2) $-Q^2/(4\pi\varepsilon_0 a^2)$

(3) Zero

(4) $Q^2/(2\pi\varepsilon_0 a^2)$

51. Two particle of equal mass m and charge q are placed at a distance of 16 cm. They do not experience any force. The value of $\frac{q}{m}$ is

(1) l (2) $\sqrt{\frac{\pi\varepsilon_0}{G}}$

(3) $\sqrt{\frac{G}{4\pi\varepsilon_0}}$ (4) $\sqrt{4\pi\varepsilon_0 G}$

52. When a glass rod is rubbed with silk, it [MP PET 2003]

(1) Gains electrons from silk (2) Gives electrons to silk

(3) Gains protons from silk (4) Gives protons to silk

53. 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 $K=\frac{1}{4\pi\varepsilon_0}$) [CBSE PMT 2003]

(1) $-K\frac{e^2}{r^3}\hat{r}$ (2) $K\frac{e^2}{r^3}\vec{r}$

(3) $-K\frac{e^2}{r^3}\vec{r}$ (4) $K\frac{e^2}{r^2}\hat{r}$

54. A body has – 80 *micro coulomb* of charge. Number of additional electrons in it will be

(1) 8×10^{-5} (2) 80×10^{-17}

(3) 5×10^{14} (4) 1.28×10^{-17}

55. Two point charges placed at a certain distance r in air exert a force F on each other. Then the distance r' at which these charges will exert the same force in a medium of dielectric constant k is given by [EAMCET 1990; MP PMT 2001]

(1) r (2) r/k

(3) $r/\sqrt{k}$ (4) $r\sqrt{k}$

56. Dielectric constant for metal is

(1) Zero (2) Infinite

(3) 1 (4) Greater than 1

57. A charge of Q *coulomb* is placed on a solid piece of metal of irregular shape. The charge will distribute itself

[MP PMT 1991]

(1) Uniformly in the metal object

(2) Uniformly on the surface of the object

(3) Such that the potential energy of the system is minimised

(4) Such that the total heat loss is minimised

58. Five balls numbered 1 to 5 are suspended using separate threads. Pairs (1, 2), (2, 4) and (4, 1) show electrostatic attraction, while pair (2, 3) and (4, 5) show repulsion. Therefore ball 1 must be [MP PET 2003] [NCERT 1980; MP PMT 2003]

(1) Positively charged (2) Negatively charged

(3) Neutral (4) Made of metal

59. 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 [MP PMT 1994; DPMT 2001]

(1) $\frac{3q^2}{4\pi\varepsilon_0 a^2}$ (2) $\frac{4q^2}{4\pi\varepsilon_0 a^2}$

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

60. Two identical conductors of copper and aluminium are placed in an identical electric fields. The magnitude of induced charge in the aluminium will be [AIIMS 1999]

(1) Zero (2) Greater than in copper

(3) Equal to that in copper (4) Less than in copper

61. Two spherical conductors B and C having equal radii and carrying equal charges in them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that of B but uncharged is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is [AIEEE 2004]

(1) $F/4$ (2) $3F/4$

(3) $F/8$ (4) $3F/8$

62. When a body is earth connected, electrons from the earth flow into the body. This means the body is….. [KCET 2004]

(1) Unchanged (2) Charged positively

(3) Charged negatively (4) An insulator

63. The charges on two sphere are $+7\mu C$ and $-5\mu C$ respectively. They experience a force F. If each of them is given and additional charge of $-2\mu C$, the new force of attraction will be [RPET 2002]

(1) F (2) $F/2$

(3) $F/\sqrt{3}$ (4) $2F$

64. The ratio of electrostatic and gravitational forces acting between electron and proton separated by a distance $5\times10^{-11}m$, will be (Charge on electron = 1.6×10^{-19} C, mass of electron = 9.1×10^{-31} kg, mass of proton = $1.6\times10^{-27}kg$, $G=6.7\times10^{-11}$ Nm^2/kg^2) [RPET 1997; Pb PMT 2003]

(1) 2.36×10^{39} (2) 2.36×10^{40}

(3) 2.34×10^{41} (4) 2.34×10^{42}

65. Two point charges 3×10^{-6} C and 8×10^{-6} C repel each other by a force of 6×10^{-3} N. If each of them is given an additional charge -6×10^{6} C, the force between them will be [DPMT 2003]

(1) 2.4×10^{-3} N (attractive) (2) 2.4×10^{-9} N (attractive)

(3) 1.5×10^{-3} N (repulsive) (4) 1.5×10^{-3} N (attractive)

66. Two equally charged, identical metal spheres A and B repel each other with a force 'F'. The spheres are kept fixed with a distance 'r' between them. A third identical, but uncharged sphere C is brought in contact with A and then placed at the mid-point of the line joining A and B. The magnitude of the net electric force on C is [UPSEAT 2004; DCE 2005]

(1) F (2) $3F/4$

(3) $F/2$ (4) $F/4$

67. Two charges of equal magnitudes and 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 [DCE 2004]

(1) $F/8$ (2) $F/4$

(3) $4F$ (4) $F/16$

68. An infinite number of charges, each of charge 1 μC, are placed on the x-axis with co-ordinates x = 1, 2, 4, 8, ...∞. If a charge of 1 C is kept at the origin, then what is the net force acting on 1 C charge [DCE 2004]

(1) 9000 N (2) 12000 N

(3) 24000 N (4) 36000 N

69. The number of electrons in 1.6 C charge will be

[RPET 2004]

(1) 10^{19} (2) 10^{20}

(3) 1.1×10^{19} (4) 1.1×10^{2}

70. Four metal conductors having different shapes

1. A sphere 2. Cylindrical

3. Pear 3. Lightning conductor

are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

[KCET 2005]

(1) 1 (2) 2

(3) 3 (4) 4

71. Identify the wrong statement in the following. Coulomb's law correctly describes the electric force that [KCET 2005]

(1) Binds the electrons of an atom to its nucleus

(2) Binds the protons and neutrons in the nucleus of an atom

(3) Binds atoms together to form molecules

(4) Binds atoms and molecules together to form solids

Electric Field and Potential

1. 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

[IIT 1987; CBSE PMT 1995; Bihar MEE 1995; CPMT 1999; MP PET 1999; MP PMT 1999, 2000; RPET 1999; KCET 2001; AIEEE 2002; AFMC 2002; Kerala PMT 2004; J & K CET 2004]

(1) $-\frac{Q}{2}$ (2) $-\frac{Q}{4}$

(3) $+\frac{Q}{4}$ (4) $+\frac{Q}{2}$

2. Inside a hollow charged spherical conductor, the potential

[CPMT 1971; MP PMT 1986; RPMT 1997]

(1) Is constant

(2) Varies directly as the distance from the centre

(3) Varies inversely as the distance from the centre

(4) Varies inversely as the square of the distance from the centre

3. Two small spheres each carrying a charge q are placed r metre apart. If one of the spheres is taken around the other one in a circular path of radius r, the work done will be equal to [CPMT 1975, 91, 2001; NCERT 1980, 83; EAMCET 1994; MP PET 1995; MNR 1998; Pb. PMT 2000]

(1) Force between them $\times r$

(2) Force between them $\times 2\pi r$

(3) Force between them $/ 2\pi r$

(4) Zero

4. The electric charge in uniform motion produces

[CPMT 1971]

(1) An electric field only

(2) A magnetic field only

(3) Both electric and magnetic field

(4) Neither electric nor magnetic field

5. Two charged spheres of radii 10 *cm* and 15 *cm* are connected by a thin wire. No current will flow, if they have

[MP PET 1991; CPMT 1975]

(1) The same charge on each

(2) The same potential

(3) The same energy

(4) The same field on their surfaces

6. The electric field inside a spherical shell of uniform surface charge density is [CPMT 1982; MP PET 1994; RPET 2000]

(1) Zero

(2) Constant, less than zero

(3) Directly proportional to the distance from the centre

(4) None of the above

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

[IIT 1992; RPET 1999; MP PMT 2001]

(1) 8 along negative $X-$axis

(2) 8 along positive $X-$axis

(3) 16 along negative $X-$axis

(4) 16 along positive $Z-$axis

8. A hollow metal sphere of radius 5 cm is charged so that the potential on its surface is 10 V. The potential at the centre of the sphere is

[IIT 1983; MNR 1990; MP PET/PMT 2000; DPMT 2004]

(1) 0 V (2) 10 V

(3) Same as at point 5 cm away from the surface

(4) Same as at point 25 cm away from the surface

9. If a unit positive charge is taken from one point to another over an equipotential surface, then

[KCET 1994; CPMT 1997; CBSE PMT 2000]

(1) Work is done on the charge

(2) Work is done by the charge

(3) Work done is constant

(4) No work is done

10. Electric lines of force about negative point charge are

[MP PMT 1987]

(1) Circular, anticlockwise (2) Circular, clockwise

(3) Radial, inward (4) Radial, outward

11. Charges of $+\frac{10}{3}\times 10^{-9}\,C$ are placed at each of the four corners of a square of side $8\,cm$. The potential at the intersection of the diagonals is

[BIT 1993]

(1) $150\sqrt{2}\,volt$ (2) $1500\sqrt{2}\,volt$

(3) $900\sqrt{2}\,volt$ (4) $900\,volt$

12. A uniform electric field having a magnitude E_0 and direction along the positive $X-$axis exists. If the potential V is zero at $x=0$, then its value at $X=+x$ will be

[MP PMT 1987]

(1) $V_{(x)}=+xE_0$ (2) $V_x=-xE_0$

(3) $V_x=+x^2E_0$ (4) $V_x=-x^2E_0$

13. Three charges $2q, -q, -q$ are located at the vertices of an equilateral triangle. At the centre of the triangle

[MP PET 1985; J & K CET 2004]

(1) The field is zero but potential is non-zero

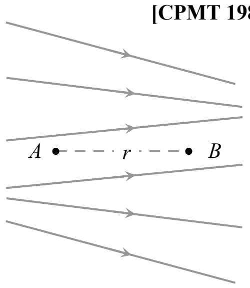
(2) The field is non-zero but potential is zero

(3) Both field and potential are zero

(4) Both field and potential are non-zero

14. Figure shows the electric lines of force emerging from a charged body. If the electric field at *A* and *B* are E_A and E_B respectively and if the displacement between *A* and *B* is r then

[CPMT 1986, 88]

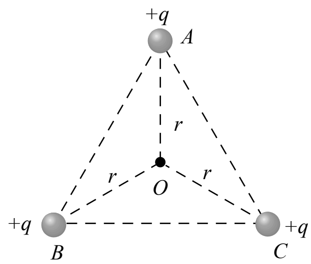


(1) $E_A > E_B$ (2) $E_A < E_B$

(3) $E_A = \frac{E_B}{r}$ (4) $E_A = \frac{E_B}{r^2}$

15. ABC is an equilateral triangle. Charges $+q$ are placed at each corner. The electric intensity at O will be

[CPMT 1985; AIEEE 2002]



(1) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

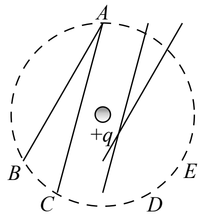
(2) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

(3) Zero

(4) $\frac{1}{4\pi\varepsilon_0}\frac{3q}{r^2}$

16. In the electric field of a point charge q, a certain charge is carried from point A to B, C, D and E. Then the work done

[NCERT 1980]



(1) Is least along the path AB

(2) Is least along the path AD

(3) Is zero along all the paths AB, AC, AD and AE

(4) Is least along AE

17. 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

[CPMT 1975, 80; AFMC 2001; BCECE 2003]

(1) mge (2) $\frac{mg}{e}$

(3) $\frac{e}{mg}$ (4) $\frac{e^2}{m^2}g$

18. A conductor with a positive charge

(1) Is always at $+ve$ potential

(2) Is always at zero potential

(3) Is always at negative potential

(4) May be at $+ve$, zero or $-ve$ potential

19. An electron and a proton are in a uniform electric field, the ratio of their accelerations will be **[NCERT 1984; MP PET 2002]**

(1) Zero (2) Unity

(3) The ratio of the masses of proton and electron

(4) The ratio of the masses of electron and proton

20. Two parallel plates have equal and opposite charge. When the space between them is evacuated, the electric field between the plates is $2 \times 10^5\ V/m$. When the space is filled with dielectric, the electric field becomes $1 \times 10^5\ V/m$. The dielectric constant of the dielectric material **[MP PET 1989]**

(1) 1/2 (2) 1

(3) 2 (4) 3

21. The insulation property of air breaks down at $E = 3 \times 10^6$ *volt/metre*. The maximum charge that can be given to a sphere of diameter $5m$ is approximately (in coulombs) **[MP PMT 1990]**

(1) 2×10^{-2} (2) 2×10^{-3}

(3) 2×10^{-4} (4) 2×10^{-5}

22. The distance between the two charges $25\mu C$ and $36\mu C$ is $11 cm$ At what point on the line joining the two, the intensity will be zero

(1) At a distance of $5\ cm$ from $25\mu C$

(2) At a distance of $5\ cm$ from $36\mu C$

(3) At a distance of $10\ cm$ from $25\mu C$

(4) At a distance of $11\ cm$ from $36\mu C$

23. Two spheres A and B of radius $4cm$ and $6cm$ are given charges of $80\mu c$ and $40\mu c$ respectively. If they are connected by a fine wire, the amount of charge flowing from one to the other is **[MP PET 1991]**

(1) $20\mu C$ from A to B (2) $16\mu C$ from A to B

(3) $32\mu C$ from B to A (4) $32\mu C$ from A to B

24. A charge particle is free to move in an electric field. It will travel **[IIT 1979]**

(1) Always along a line of force

(2) Along a line of force, if its initial velocity is zero

(3) Along a line of force, if it has some initial velocity in the direction of an acute angle with the line of force

(4) None of the above

25. If E is the electric field intensity of an electrostatic field, then the electrostatic energy density is proportional to **[MP PMT 2003]**

(1) E (2) E^2

(3) $1/E^2$ (4) E^3

26. A metallic sphere has a charge of $10\mu C$. A unit negative charge is brought from A to B both $100\ cm$ away from the sphere but *A* being east of it while B being on west. The net work done is

(1) Zero (2) $2/10$ *joule*

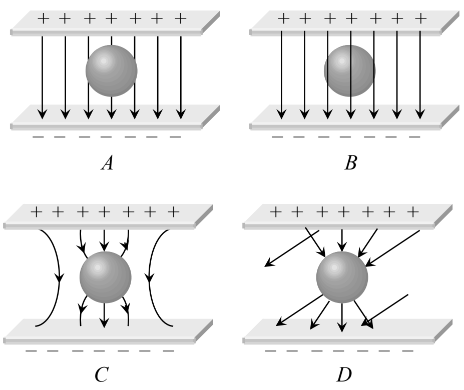
(3) $-2/10$ *joule* (4) $-1/10$ *joule*

27. Two charges $+4e$ and $+e$ are at a distance x apart. At what distance, a charge q must be placed from charge $+e$ so that it is in equilibrium

(1) $x/2$ (2) $2x/3$

(3) $x/3$ (4) $x/6$

28. An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force look like **[MP PMT 1985; KCET 2004]**



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

29. The intensity of electric field required to balance a proton of mass $1.7 \times 10^{-27} kg$ and charge $1.6 \times 10^{-19} C$ is nearly

(1) $1 \times 10^{-7}\ V/m$ (2) $1 \times 10^{-5}\ V/m$
(3) $1 \times 10^{7}\ V/m$ (4) $1 \times 10^{5}\ V/m$

30. On rotating a point charge having a charge *q* around a charge *Q* in a circle of radius *r*. The work done will be

[CPMT 1990, 97; MP PET 1993; AIIMS 1997; DCE 2003; KCET 2005]

(1) $q \times 2\pi r$ (2) $\frac{q \times 2\pi Q}{r}$
(3) Zero (4) $\frac{Q}{2\varepsilon_0 r}$

31. Two point charges Q and – 3*Q* are placed at some distance apart. If the electric field at the location of Q is E then at the locality of $-3Q$, it is **[BIT 1987]**

(1) $-E$ (2) $E/3$
(3) $-3E$ (4) $-E/3$

32. The number of electrons to be put on a spherical conductor of radius $0.1 m$ to produce an electric field of $0.036 N/C$ just above its surface is **[MNR 1994; KCET (Engg.) 1999; MH CET (Med.) 2001]**

(1) 2.7×10^5 (2) 2.6×10^5
(3) 2.5×10^5 (4) 2.4×10^5

33. Two plates are $2 cm$ apart, a potential difference of $10\ volt$ is applied between them, the electric field between the plates is

[MP PET 1994; DPMT 2002]

(1) $20\ N/C$ (2) $500\ N/C$
(3) $5\ N/C$ (4) $250\ N/C$

34. The intensity of the electric field required to keep a water drop of radius $10^{-5} cm$ just suspended in air when charged with one electron is approximately **[MP PMT 1994]**

(1) $260\ volt/cm$ (2) $260\ newton/coulomb$
(3) $130\ volt/cm$ (4) $130\ newton/coulomb$

$(g = 10\ newton/kg, e = 1.6 \times 10^{-19}\ coulomb)$

35. Conduction electrons are almost uniformly distributed within a conducting plate. When placed in an electrostatic field $\vec{E}$, the electric field within the plate **[MP PMT 1994]**

(1) Is zero
(2) Depends upon E
(3) Depends upon $\vec{E}$
(4) Depends upon the atomic number of the conducting element

36. Three particles, each having a charge of $10 \mu C$ are placed at the corners of an equilateral triangle of side $10 cm$. The electrostatic potential energy of the system is (Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2/C^2$) **[MP PMT 1994]**

(1) Zero (2) Infinite
(3) $27 J$ (4) $100 J$

37. The electric field near a conducting surface having a uniform surface charge density σ is given by **[MP PMT 1994]**

(1) $\frac{\sigma}{\varepsilon_0}$ and is parallel to the surface
(2) $\frac{2\sigma}{\varepsilon_0}$ and is parallel to the surface
(3) $\frac{\sigma}{\varepsilon_0}$ and is normal to the surface
(4) $\frac{2\sigma}{\varepsilon_0}$ and is normal to the surface

38. There is an electric field E in *X*-direction. If the work done on moving a charge $0.2 C$ through a distance of $2 m$ along a line making an angle $60°$ with the *X*-axis is 4.0, what is the value of E **[CBSE PMT 1995]**

(1) $\sqrt{3}\ N/C$ (2) $4\ N/C$
(3) $5\ N/C$ (4) None of these

39. Four equal charges Q are placed at the four corners of a square of each side is 'a'. Work done in removing a charge – *Q* from its centre to infinity is **[AIIMS 1995]**

(1) 0 (2) $\frac{\sqrt{2}Q^2}{4\pi\varepsilon_0 a}$
(3) $\frac{\sqrt{2}Q^2}{\pi\varepsilon_0 a}$ (4) $\frac{Q^2}{2\pi\varepsilon_0 a}$

40. A particle A has charge $+q$ and a particle B has charge $+4q$ with each of them having the same mass m. When allowed to fall from rest through the same electric potential difference, the ratio of their speed $\frac{v_A}{v_B}$ will become

[BHU 1995; MNR 1991; UPSEAT 2000; Pb PET 2004]

(1) $2:1$ (2) $1:2$

(3) $1:4$ (4) $4:1$

41. Deutron and $\alpha-$particle are put $1\mathring{A}$ apart in air. Magnitude of intensity of electric field due to deutron at $\alpha-$particle is

[MP PET 1995]

(1) Zero

(2) 2.88×10^{11} *newton*/ *coulomb*

(3) 1.44×10^{11} *newton*/ *coulomb*

(4) 5.76×10^{11} *newton*/ *coulomb*

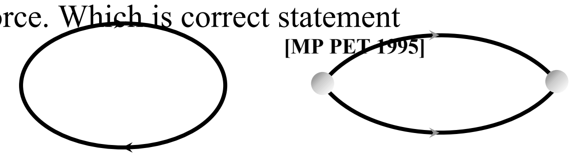
42. Angle between equipotential surface and lines of force is

[MP PET 1995]

(1) Zero (2) 180°

(3) 90° (4) 45°

43. Below figures (1) and (2) represent lines of force. Which is correct statement **[MP PET 1995]**



(1) (2)

(1) Figure (1) represents magnetic lines of force

(2) Figure (2) represents magnetic lines of force

(3) Figure (1) represents electric lines of force

(4) Both figure (1) and figure (2) represent magnetic lines of force

44. The unit of electric field is not equivalent to **[MP PMT 1995]**

(1) N/C (2) J/C

(3) V/m (4) $J/C-m$

45. A flat circular disc has a charge $+Q$ uniformly distributed on the disc. A charge $+q$ is thrown with kinetic energy E towards the disc along its normal axis. The charge q will

[MP PMT 1995]

(1) Hit the disc at the centre

(2) Return back along its path after touching the disc

(3) Return back along its path without touching the disc

(4) Any of the above three situations is possible depending on the magnitude of E

46. At a certain distance from a point charge the electric field is $500\,V/m$ and the potential is $3000\,V$. What is this distance **[MP PMT 1995; Pb. PMT 2001; AFMC 2001]**

(1) $6\,m$ (2) $12\,m$

(3) $36\,m$ (4) $144\,m$

47. The magnitude of electric field E in the annular region of a charged cylindrical capacitor **[IIT 1996]**

(1) Is same throughout

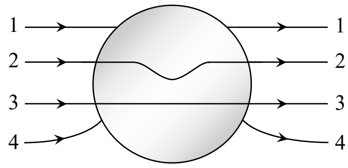
(2) Is higher near the outer cylinder than near the inner cylinder

(3) Varies as $1/r$, where r is the distance from the axis

(4) Varies as $1/r^2$, where r is the distance from the axis

48. A metallic solid sphere is placed in a uniform electric field. The lines of force follow the path(s) shown in figure as

[IIT 1996]



(1) 1 (2) 2

(3) 3 (4) 4

49. The distance between a proton and electron both having a charge 1.6×10^{-19} *coulomb*, of a hydrogen atom is 10^{-10} *metre*. The value of intensity of electric field produced on electron due to proton will be **[MP PET 1996]**

(1) $2.304\times10^{-10}\,N/C$ (2) $14.4\,V/m$

(3) $16\,V/m$ (4) $1.44\times10^{11}\,N/C$

50. What is the magnitude of a point charge due to which the electric field $30\,cm$ away has the magnitude 2 *newton*/ *coulomb* $[1/4\pi\varepsilon_0=9\times10^9\,Nm^2/C^2]$

[MP PMT 1996]

(1) 2×10^{-11} *coulomb* (2) 3×10^{-11} *coulomb*

(3) 5×10^{-11} *coulomb* (4) 9×10^{-11} *coulomb*

51. Two charge $+q$ and $-q$ are situated at a certain distance. At the point exactly midway between them

(1) Electric field and potential both are zero

(2) Electric field is zero but potential is not zero

(3) Electric field is not zero but potential is zero

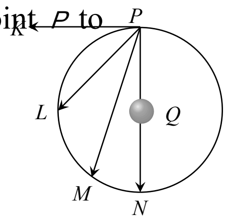
(4) Neither electric field nor potential is zero

52. Two positive charges of 20 *coulomb* and Q *coulomb* are situated at a distance of $60\,cm$. The neutral point between them is at a distance of $20\,cm$ from the $20\,coulomb$ charge. Charge Q is

(1) $30\,C$ (2) $40\,C$

(3) $60\,C$ (4) $80\,C$

53. In the figure the charge Q is at the centre of the circle. Work done is maximum when another charge is taken from point P to



(1) K

(2) L

(3) M

(4) N

54. A mass $m = 20\,g$ has a charge $q = 3.0\,mC$. It moves with a velocity of $20\,m/s$ and enters a region of electric field of $80\,N/C$ in the same direction as the velocity of the mass. The velocity of the mass after 3 seconds in this region is

(1) $80\,m/s$ (2) $56\,m/s$

(3) $44\,m/s$ (4) $40\,m/s$

55. Four identical charges $+50\,\mu C$ each are placed, one at each corner of a square of side $2\,m$. How much external energy is required to bring another charge of $+50\,\mu C$ from infinity to the centre of the square

$\left(\text{Given}\ \frac{1}{4\pi\varepsilon_0} = 9\times10^9\ \frac{Nm^2}{C^2}\right)$

(1) $64\,J$ (2) $41\,J$

(3) $16\,J$ (4) $10\,J$

56. In Millikan's oil drop experiment an oil drop carrying a charge Q is held stationary by a potential difference $2400\,V$ between the plates. To keep a drop of half the radius stationary the potential difference had to be made $600\,V$. What is the charge on the second drop **[MP PET 1997]**

(1) $\frac{Q}{4}$ (2) $\frac{Q}{2}$

(3) Q (4) $\frac{3Q}{2}$

57. A charge of $5\,C$ experiences a force of $5000\,N$ when it is kept in a uniform electric field. What is the potential difference between two points separated by a distance of $1\,cm$

[MP PET 1997]

(1) $10\,V$ (2) $250\,V$

(3) $1000\,V$ (4) $2500\,V$

58. Two insulated charged conducting spheres of radii $20\,cm$ and $15\,cm$ respectively and having an equal charge of $10\,C$ are connected by a copper wire and then they are separated. Then

[MP PET 1997]

(1) Both the spheres will have the same charge of $10\,C$

(2) Surface charge density on the $20\,cm$ sphere will be greater than that on the $15\,cm$ sphere

(3) Surface charge density on the $15\,cm$ sphere will be greater than that on the $20\,cm$ sphere

(4) Surface charge density on the two spheres will be equal

59. Equal charges q are placed at the vertices A and B of an equilateral triangle ABC of side a. The magnitude of electric field at the point C is

[MP PMT 1997]

(1) $\frac{q}{4\pi\varepsilon_0 a^2}$ (2) $\frac{\sqrt{2}\,q}{4\pi\varepsilon_0 a^2}$

(3) $\frac{\sqrt{3}\,q}{4\pi\varepsilon_0 a^2}$ (4) $\frac{q}{2\pi\varepsilon_0 a^2}$

60. Two equal charges q are placed at a distance of $2a$ and a third charge $-2q$ is placed at the midpoint. The potential energy of the system is

[MP PMT 1997]

(1) $\frac{q^2}{8\pi\varepsilon_0 a}$ (2) $\frac{6q^2}{8\pi\varepsilon_0 a}$

(3) $-\frac{7q^2}{8\pi\varepsilon_0 a}$ (4) $\frac{9q^2}{8\pi\varepsilon_0 a}$

61. Two point charges $100\mu C$ and $5\mu C$ are placed at points A and B respectively with $AB = 40\,cm$. The work done by external force in displacing the charge $5\mu C$ from B to C, where $BC = 30\,cm$, angle $ABC = \frac{\pi}{2}$ and $\frac{1}{4\pi\varepsilon_0} = 9\times10^9\,Nm^2/C^2$ **[MP PMT 1997]**

(1) $9\,J$ (2) $\frac{81}{20}J$

(3) $\frac{9}{25}J$ (4) $-\frac{9}{4}J$

62. The unit of intensity of electric field is **[MP PMT/PET 1998]**

(1) $Newton/Coulomb$ (2) $Joule/Coulomb$

(3) $Volt-metre$ (4) $Newton/metre$

63. Equal charges are given to two spheres of different radii. The potential will **[MP PMT/PET 1998; MH CET 2000]**

(1) Be more on the smaller sphere

(2) Be more on the bigger sphere

(3) Be equal on both the spheres

(4) Depend on the nature of the materials of the spheres

64. An alpha particle is accelerated through a potential difference of $10^6\,volt$. Its kinetic energy will be

[MP PMT/PET 1998]

(1) $1\,MeV$ (2) $2\,MeV$

(3) $4\,MeV$ (4) $8\,MeV$

65. A charge of $5\,C$ is given a displacement of $0.5\,m$. The work done in the process is $10\,J$. The potential difference between the two points will be **[MP PET 1999]**

(1) $2\,V$ (2) $0.25\,V$

(3) $1\,V$ (4) $25\,V$

66. The electric potential V is given as a function of distance x (metre) by $V = (5x^2 + 10x - 9)\,volt$. Value of electric field at $x = 1$ is **[MP PET 1999]**

(1) $20\,V/m$ (2) $6\,V/m$

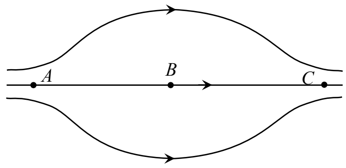
(3) $11\,V/m$ (4) $-23\,V/m$

67. Two metal pieces having a potential difference of $800\,V$ are $0.02\,m$ apart horizontally. A particle of mass $1.96\times10^{-15}\,kg$ is suspended in equilibrium between the plates. If e is the elementary charge, then charge on the particle is **[MP PET 1999]**

(1) e (2) $3e$

(3) $6e$ (4) $8e$

68. The figure shows some of the electric field lines corresponding to an electric field. The figure suggests **[MP PMT 1999]**



(1) $E_A > E_B > E_C$ (2) $E_A = E_B = E_C$

(3) $E_A = E_C > E_B$ (4) $E_A = E_C < E_B$

69. Two spheres of radius a and b respectively are charged and joined by a wire. The ratio of electric field of the spheres is **[CPMT 1999; JIPMER 2000; RPET 2000]**

(1) a/b (2) b/a

(3) a^2/b^2 (4) b^2/a^2

70. 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

[CBSE PMT 1998; Kerala PMT 2005]

(1) qEy^2 (2) qE^2y

(3) qEy (4) q^2Ey

71. A hollow insulated conducting sphere is given a positive charge of $10\mu C$. What will be the electric field at the centre of the sphere if its radius is 2 meters **[CBSE PMT 1998]**

(1) Zero (2) $5\mu Cm^{-2}$

(3) $20\mu Cm^{-2}$ (4) $8\mu Cm^{-2}$

72. An electron of mass m_e initially at rest moves through a certain distance in a uniform electric field in time t_1. A proton of mass m_p also initially at rest takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio of t_2/t_1 is nearly equal to **[IIT 1997 Cancelled]**

(1) 1 (2) $(m_p/m_e)^{1/2}$

(3) $(m_e/m_p)^{1/2}$ (4) 1836

73. A cube of side b has a charge q at each of its vertices. The electric field due to this charge distribution at the centre of this cube will be **[KCET 1994, 2000]**

(1) q/b^2 (2) $q/2b^2$

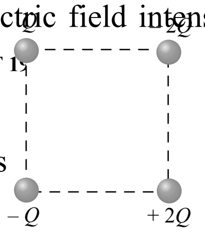
(3) $32q/b^2$ (4) Zero

74. A charged water drop whose radius is $0.1\,\mu m$ is in equilibrium in an electric field. If charge on it is equal to charge of an electron, then intensity of electric field will be $(g = 10\,ms^{-1})$ **[RPET 1997]**

(1) $1.61\,N/C$ (2) $26.2\,N/C$

(3) $262\,N/C$ (4) $1610\,N/C$

75. Four charges are placed on corners of a square as shown in figure having side of $5\,cm$. If Q is one microcoulomb, then electric field intensity at centre will be **[RPET 1999]**



(1) $1.02 \times 10^7\,N/C$ upwards

(2) $2.04 \times 10^7\,N/C$ downwards

(3) $2.04 \times 10^7\,N/C$ upwards

(4) $1.02 \times 10^7\,N/C$ downwards

76. A sphere of radius $1\,cm$ has potential of $8000\,V$, then energy density near its surface will be **[RPET 1999]**

(1) $64 \times 10^5\,J/m^3$ (2) $8 \times 10^3\,J/m^3$

(3) $32\,J/m^3$ (4) $2.83\,J/m^3$

77. Point charges $+4q, -q$ and $+4q$ are kept on the $x-$axis at points $x = 0, x = a$ and $x = 2a$ respectively, then **[CBSE PMT 1992]**

(1) Only q is in stable equilibrium

(2) None of the charges are in equilibrium

(3) All the charges are in unstable equilibrium

(4) All the charges are in stable equilibrium

78. Two point charges of $20\,\mu C$ and $80\,\mu C$ are $10\,cm$ apart. Where will the electric field strength be zero on the line joining the charges from $20\,\mu C$ charge **[RPET 1997]**

(1) $0.1\,m$ (2) $0.04\,m$

(3) $0.033\,m$ (4) $0.33\,m$

79. How much kinetic energy will be gained by an $\alpha-$particle in going from a point at $70\,V$ to another point at $50\,V$ **[RPET 1997]**

(1) $40\,eV$ (2) $40\,keV$

(3) $40\,MeV$ (4) $0\,eV$

80. If a charged spherical conductor of radius $10\,cm$ has potential V at a point distant $5\,cm$ from its centre, then the potential at a point distant $15\,cm$ from the centre will be **[SCRA 1998; JIPMER 2001, 02]**

(1) $\frac{1}{3}V$ (2) $\frac{2}{3}V$

(3) $\frac{3}{2}V$ (4) $3V$

81. Two unlike charges of magnitude q are separated by a distance $2d$. The potential at a point midway between them is

(1) Zero (2) $\frac{1}{4\pi\varepsilon_0}$

(3) $\frac{1}{4\pi\varepsilon_0}.\frac{q}{d}$ (4) $\frac{1}{4\pi\varepsilon_0}.\frac{2q}{d^2}$

82. What is the potential energy of the equal positive point charges of $1\mu C$ each held 1 *m* apart in air **[AMU 1999]**

(1) $9 \times 10^{-3}\,J$ (2) $9 \times 10^{-3}\,eV$

(3) $2eV/m$ (4) Zero

83. An oil drop having charge $2e$ is kept stationary between two parallel horizontal plates 2.0 *cm* apart when a potential difference of 12000 volts is applied between them. If the density of oil is 900 kg/m^3, the radius of the drop will be **[AMU 1999]**

(1) $2.0 \times 10^{-6}\,m$ (2) $1.7 \times 10^{-6}\,m$

(3) $1.4 \times 10^{-6}\,m$ (4) $1.1 \times 10^{-6}\,m$

84. The ratio of momenta of an electron and an α-particle which are accelerated from rest by a potential difference of 100 *volt* is

(1) 1 (2) $\sqrt{\frac{2m_e}{m_\alpha}}$

(3) $\sqrt{\frac{m_e}{m_\alpha}}$ (4) $\sqrt{\frac{m_e}{2m_\alpha}}$

85. A proton is accelerated through 50,000 *V*. Its energy will increase by **[JIPMER 1999]**

(1) 5000 *eV* (2) $8 \times 10^{-15}\,J$

(3) 5000 *J* (4) 50,000 *J*

86. When a proton is accelerated through $1V$, then its kinetic energy will be

(1) 1840 eV (2) 13.6 eV

(3) 1 eV (4) 0.54 eV

87. An electron enters between two horizontal plates separated by $2mm$ and having a potential difference of $1000V$. The force on electron is

(1) $8\times10^{-12} N$ (2) $8\times10^{-14} N$

(3) $8\times10^{9}\ N$ (4) $8\times10^{14}\ N$

88. Two metal spheres of radii R_1 and R_2 are charged to the same potential. The ratio of charges on the spheres is

[KCET 1999]

(1) $\sqrt{R_1}:\sqrt{R_2}$ (2) $R_1 : R_2$

(3) $R_1^2 : R_2^2$ (4) $R_1^3 : R_2^3$

89. Electric charges of $+10\mu C, +5\mu C, -3\mu C$ and $+8\mu C$ are placed at the corners of a square of side $\sqrt{2}\ m$. the potential at the centre of the square is

[KCET (Engg./Med.) 1999]

(1) 1.8 V (2) $1.8\times10^{6}\ V$

(3) $1.8\times10^{5} V$ (4) $1.8\times10^{4} V$

90. What is the magnitude of a point charge which produces an electric field of 2 N/coulomb at a distance of 60 cm $(1/4\pi\varepsilon_0 = 9\times10^9\ N-m^2/C^2)$ **[MP PET 2000; RPET 2001]**

(1) $8\times10^{-11} C$ (2) $2\times10^{-12} C$

(3) $3\times10^{-11} C$ (4) $6\times10^{-10} C$

91. The electric field due to a charge at a distance of 3 m from it is 500 N/coulomb. The magnitude of the charge is $\left[\frac{1}{4\pi\varepsilon_0} = 9\times10^9\ \frac{N-m^2}{coulomb^2}\right]$ **[MP PMT 2000]**

(1) 2.5 *micro-coulomb* (2) 2.0 *micro-coulomb*

(3) 1.0 *micro-coulomb* (4) 0.5 *micro-coulomb*

92. Two charges of $4\mu C$ each are placed at the corners A and B of an equilateral triangle of side length 0.2 m in air. The electric potential at C is $\left[\frac{1}{4\pi\varepsilon_0} = 9\times10^9\ \frac{N\text{-}m^2}{C^2}\right]$

[EAMCET (Med.) 2000]

(1) $9\times10^{4} V$ (2) $18\times10^{4} V$

[CBSE PMT 1999] (3) $36\times10^{4} V$ (4) $36\times10^{-4} V$

93. Electric field strength due to a point charge of $5\mu C$ at a distance of 80 cm from the charge is **[CBSE PMT**

(1) $8\times10^{4} N/C$ (2) $7\times10^{4} N/C$

(3) $5\times10^{4} N/C$ **[JIPMER 1999]** (4) $4\times10^{4} N/C$

94. Ten electrons are equally spaced and fixed around a circle of radius R. Relative to $V = 0$ at infinity, the electrostatic potential V and the electric field E at the centre C are

[AMU 2000]

(1) $V\neq0$ and $\vec{E}\neq0$ (2) $V\neq0$ and $\vec{E}=0$

(3) $V=0$ and $\vec{E}=0$ (4) $V=0$ and $\vec{E}\neq0$

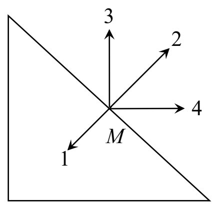
95. Two positive point charges of $12\mu C$ and $8\mu C$ are $10cm$ apart. The work done in bringing them 4 cm closer is

[AMU 2000]

(1) 5.8 J (2) 5.8 eV

(3) 13 J (4) 13 eV

96. Three identical point charges, as shown are placed at the vertices of an isosceles right angled triangle. Which of the numbered vectors coincides in direction with the electric field at the mid-point M of the hypotenuse **[AMU 2000]**



(1) 1 (2) 2

(3) 3 (4) 4

97. The displacement of a charge Q in the electric field $E = e_1\hat{i} + e_2\hat{j} + e_3\hat{k}$ is $\hat{r} = a\hat{i} + b\hat{j}$. The work done is

[EAMCET (Engg.) 2000]

(1) $Q(ae_1 + be_2)$ (2) $Q\sqrt{(ae_1)^2 + (be_2)^2}$

(3) $Q(e_1 + e_2)\sqrt{a^2 + b^2}$ (4) $Q(\sqrt{e_1^2 + e_2^2})\,(a+b)$

98. The potential at a point, due to a positive charge of $100\mu C$ at a distance of $9m$, is

(1) $10^4\ V$ (2) $10^5\ V$

(3) $10^6\ V$ (4) $10^7\ V$

99. There is a solid sphere of radius 'R' having uniformly distributed charge. What is the relation between electric field 'E' (inside the sphere) and radius of sphere 'R' is

[Pb. PMT 2000]

(1) $E \propto R^{-2}$ (2) $E \propto R^{-1}$

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

100. Two charges $+5\mu C$ and $+10\mu C$ are placed 20 cm apart. The net electric field at the mid-Point between the two charges is

(1) 4.5×10^6 N/C directed towards $+5\mu C$

(2) 4.5×10^6 N/C directed towards $+10\mu C$

(3) 13.5×10^6 N/C directed towards $+5\mu C$

(4) 13.5×10^6 N/C directed towards $+10\mu C$

101. Which of the following is deflected by electric field

[CPMT 2000]

(1) X-rays (2) γ -rays

(3) Neutrons (4) α -particles

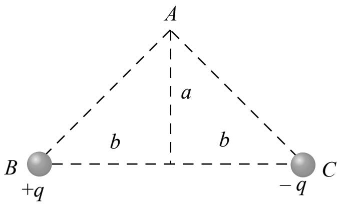
102. As shown in the figure, charges $+q$ and $-q$ are placed at the vertices B and C of an isosceles triangle. The potential at the vertex A is

(1) $\frac{1}{4\pi\varepsilon_0} \cdot \frac{2q}{\sqrt{a^2+b^2}}$

(2) Zero

(3) $\frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{\sqrt{a^2+b^2}}$

(4) $\frac{1}{4\pi\varepsilon_0} \cdot \frac{(-q)}{\sqrt{a^2+b^2}}$



103. Consider the points lying on a straight line joining two fixed opposite charges. Between the charges there is

[Roorkee 2000]

(1) No point where electric field is zero

(2) Only one point where electric field is zero

(3) No point where potential is zero

(4) Only one point where potential is zero

[KCET (Med.) 2000]

104. A charged particle of mass $5 \times 10^{-5}\,kg$ is held stationary in space by placing it in an electric field of strength $10^7\,NC^{-1}$ directed vertically downwards. The charge on the particle is

[EAMCET 2000]

(1) $-20 \times 10^{-5}\mu C$ (2) $-5 \times 10^{-5}\mu C$

(3) $5 \times 10^{-5}\mu C$ (4) $20 \times 10^{-5}\mu C$

105. Three charges $Q, +q$ and $+q$ are placed at the vertices of a right-angled isosceles triangle as shown. The net electrostatic energy of the configuration is zero if Q is equal to

[IIT-JEE (Screening) 2000]

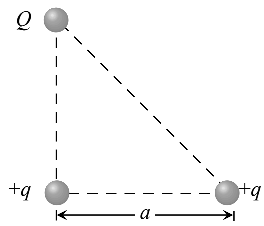
(1) $\frac{-q}{1+\sqrt{2}}$

(2) $\frac{-2q}{2+\sqrt{2}}$

[KCET (Med.) 2000]

(3) $-2q$

(4) $+q$

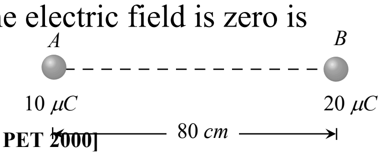


106. Two electric charges $12\mu C$ and $-6\mu C$ are placed 20 cm apart in air. There will be a point P on the line joining these charges and outside the region between them, at which the electric potential is zero. The distance of P from $-6\mu C$ charge is **[EAMCET 2000]**

(1) 0.10 m (2) 0.15 m

(3) 0.20 m (4) 0.25 m

107. In the given figure distance of the point from A where the electric field is zero is

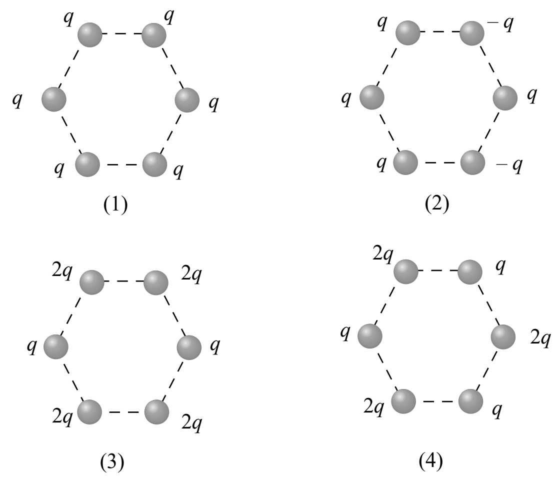


[MP PET 2000]

(1) 20 cm (2) 10 cm

(3) 33 cm (4) None of these

108. Figures below show regular hexagons, with charges at the vertices. In which of the following cases the electric field at the centre is not zero **[AMU 2000]**



(1) 1 (2) 2

(3) 3 (4) 4

109. An electron is moving towards *x*-axis. An electric field is along *y*-direction then path of electron is **[RPET 2000]**

(1) Circular (2) Elliptical

(3) Parabola (4) None of these

110. An electron enters in an electric field with its velocity in the direction of the electric lines of force. Then **[MP PMT 2000]**

(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

(4) The velocity of the electron will increase

111. An electron of mass m and charge e is accelerated from rest through a potential difference V in vacuum. The final speed of the electron will be

[MP PMT 2000; AMU (Engg.) 2000]

(1) $V\sqrt{e/m}$ (2) $\sqrt{eV/m}$

(3) $\sqrt{2eV/m}$ (4) $2eV/m$

112. The radius of a soap bubble whose potential is $16V$ is doubled. The new potential of the bubble will be

[Pb. PMT 2000]

(1) $2V$ (2) $4V$

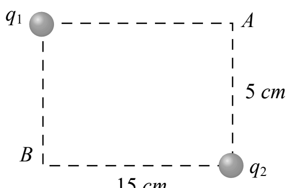
(3) $8V$ (4) $16V$

113. The dimension of (1/2) $\varepsilon_0 E^2$ (ε_0 : permittivity of free space; E: electric field) is **[IIT-JEE (Screening) 2000; KCET 2000]**

(1) MLT^{-1} (2) ML^2T^{-2}

(3) $ML^{-1}T^{-2}$ (4) ML^2T^{-1}

114. In the rectangle, shown below, the two corners have charges $q_1 = -5\mu C$ and $q_2 = +2.0\mu C$. The work done in moving a charge $+3.0\mu C$ from B to A is (take $1/4\pi\varepsilon_0 = 10^{10}\ N\text{-}m^2/C^2$)



(1) 2.8 J (2) 3.5 J

(3) 4.5 J (4) 5.5 J

115. A cube of a metal is given a positive charge Q. For the above system, which of the following statements is true

[MP PET 2001]

(1) Electric potential at the surface of the cube is zero

(2) Electric potential within the cube is zero

(3) Electric field is normal to the surface of the cube

(4) Electric field varies within the cube

116. If q is the charge per unit area on the surface of a conductor, then the electric field intensity at a point on the surface is **[MP PET 2001; UPSEAT 2001]**

(1) $\left(\frac{q}{\varepsilon_0}\right)$ normal to surface

(2) $\left(\frac{q}{2\varepsilon_0}\right)$ normal to surface

(3) $\left(\frac{q}{\varepsilon_0}\right)$ tangential to surface

(4) $\left(\frac{q}{2\varepsilon_0}\right)$ tangential to surface

117. A hollow conducting sphere of radius R has a charge $(+Q)$ on its surface. What is the electric potential within the sphere at a distance $r = \frac{R}{3}$ from its centre **[MP PMT 2001; UPSEAT 2001; MP PET 2001, 02; Orissa JEE 2005]**

(1) Zero (2) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$

(3) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$ (4) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$

118. A spherical conductor of radius $2m$ is charged to a potential of 120 V. It is now placed inside another hollow spherical conductor of radius

6*m*. Calculate the potential to which the bigger sphere would be raised **[KCET 2001]**

(1) 20 *V* (2) 60 *V*

(3) 80 *V* (4) 40 *V*

119. A charge $(-q)$ and another charge $(+Q)$ are kept at two points *A* and *B* respectively. Keeping the charge $(+Q)$ fixed at *B*, the charge $(-q)$ at *A* is moved to another point *C* such that *ABC* forms an equilateral triangle of side *l*. The net work done in moving the charge $(-q)$ is **[MP PET 2001]**

(1) $\frac{1}{4\pi\varepsilon_0}\frac{Qq}{l}$ (2) $\frac{1}{4\pi\varepsilon_0}\frac{Qq}{l^2}$

(3) $\frac{1}{4\pi\varepsilon_0}Qql$ (4) Zero

120. A particle of mass '*m*' and charge '*q*' is accelerated through a potential difference of *V volt*, its energy will be **[MP PET 2001]**

(1) qV (2) mqV

(3) $\left(\frac{q}{m}\right)V$ (4) $\frac{q}{mV}$

121. Two spheres *A* and *B* of radius '*a*' and '*b*' respectively are at same electric potential. The ratio of the surface charge densities of *A* and *B* is **[MP PMT 2001]**

(1) $\frac{a}{b}$ (2) $\frac{b}{a}$

(3) $\frac{a^2}{b^2}$ (4) $\frac{b^2}{a^2}$

122. Potential at a point *x*-distance from the centre inside the conducting sphere of radius *R* and charged with charge *Q* is **[MP PMT 2001]**

(1) $\frac{Q}{R}$ (2) $\frac{Q}{x}$

(3) $\frac{Q}{x^2}$ (4) xQ

123. Electric field intensity at a point in between two parallel sheets with like charges of same surface charge densities (σ) is **[MP PMT 2001]**

(1) $\frac{\sigma}{2\varepsilon_0}$ (2) $\frac{\sigma}{\varepsilon_0}$

(3) Zero (4) $\frac{2\sigma}{\varepsilon_0}$

124. In an hydrogen atom, the electron revolves around the nucleus in an orbit of radius $0.53\times10^{-10}m$. Then the electrical potential produced by the nucleus at the position of the electron is **[Pb. PMT 2001]**

(1) – 13.6 *V* (2) – 27.2 *V*

(3) 27.2 *V* (4) 13.6 *V*

125. Consider two point charges of equal magnitude and opposite sign separated by a certain distance. The neutral point due to them

(1) Does not exist

(2) Will be in mid way between them

(3) Lies on the perpendicular bisector of the line joining the two

(4) Will be closer to the negative charge

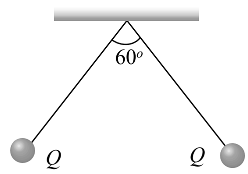
126. Two small spherical balls each carrying a charge $Q = 10\mu C$ (10 *micro-coulomb*) are suspended by two insulating threads of equal lengths 1*m* each, from a point fixed in the ceiling. It is found that in equilibrium threads are separated by an angle 60^o between them, as shown in the figure. What is the tension in the threads (Given: $\frac{1}{(4\pi\varepsilon_0)} = 9\times10^9 \, Nm/C^2$) **[MP PET 2001; Pb PET**

(1) 18 *N*

(2) 1.8 *N*

(3) 0.18 *N*

(4) None of the above



127. A ball of mass 1 *g* and charge $10^{-8}\,C$ moves from a point *A*. where potential is 600 *volt* to the point *B* where potential is zero. Velocity of the ball at the point *B* is 20 *cm/s*. The velocity of the ball at the point *A* will be **[KCET 2001]**

(1) 22.8 *cm/s* (2) 228 *cm/s*

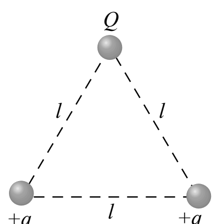
(3) 16.8 *m/s* (4) 168 *m/s*

128. The acceleration of an electron in an electric field of magnitude 50 *V/cm*, if *e/m* value of the electron is 1.76×10^{11} *C/kg*, is

(1) $8.8\times10^{14}\,m/sec^2$ (2) $6.2\times10^{13}\,m/sec^2$

(3) $5.4\times10^{12}\,m/sec^2$ (4) Zero

129. Three charges $Q, (+q)$ and $(+q)$ are placed at the vertices of an equilateral triangle of side *l* as



shown in the figure. If the net electrostatic energy of the system is zero, then Q is equal to

(1) $\left(-\frac{q}{2}\right)$

(2) $(-q)$

(3) $(+q)$

(4) Zero

130. A positively charged particle moving along x-axis with a certain velocity enters a uniform electric field directed along positive y-axis. Its

(1) Vertical velocity changes but horizontal velocity remains constant

(2) Horizontal velocity changes but vertical velocity remains constant

(3) Both vertical and horizontal velocities change

(4) Neither vertical nor horizontal velocity changes

131. Electric potential at any point is $V = -5x + 3y + \sqrt{15}z$, then the magnitude of the electric field is **[MP PET 2002]**

(1) $3\sqrt{2}$ (2) $4\sqrt{2}$

(3) $5\sqrt{2}$ (4) 7

132. The work done in bringing a 20 *coulomb* charge from point A to point B for distance 0.2m is 2J. The potential difference between the two points will be (in *volt*)

[RPET 1999; MP PMT 2002; AIEEE 2002]

(1) 0.2 (2) 8

(3) 0.1 (4) 0.4

133. A hollow sphere of charge does not produce an electric field at any **[MNR 1985; RPET 2001; DPMT 2002; Kerala PMT 2004; Pb PET 2004; Orissa PMT 2004]**

(1) Point beyond 2 metres (2) Point beyond 10 metres

(3) Interior point (4) Outer point

134. If $4 \times 10^{20}\, eV$ energy is required to move a charge of 0.25 *coulomb* between two points. Then what will be the potential difference between them **[MHCET 2002]**

(1) 178 V (2) 256 V

(3) 356 V (4) None of these

[MP PET 2001]

135. Kinetic energy of an electron accelerated in a potential difference of 100 V is **[AFMC 1999; MP PMT 200**

(1) $1.6 \times 10^{-17} J$ (2) $1.6 \times 10^{21} J$

(3) $1.6 \times 10^{-29} J$ (4) $1.6 \times 10^{-34} J$

136. A drop of $10^{-6}\, kg$ water carries $10^{-6}\, C$ charge. What electric field should be applied to balance its weight (assume $g = 10 m/s^2$)

[AMU (Engg.) 2001]

(1) 10 V/m upward (2) 10 V/m downward

(3) 0.1 V/m downward (4) 0.1 V/m upward

137. A charged particle of mass 0.003 *gm* is held stationary in space by placing it in a downward direction of electric field of $6 \times 10^4\, N/C$. Then the magnitude of the charge is

[Orissa JEE 2002]

(1) $5 \times 10^{-4}\, C$ (2) $5 \times 10^{-10}\, C$

(3) $-18 \times 10^{-6}\, C$ (4) $-5 \times 10^{-9}\, C$

138. Two point charges $+9e$ and $+e$ are at 16 *cm* away from each other. Where should another charge q be placed between them so that the system remains in equilibrium

[MP PET 2002]

(1) 24 *cm* from $+9e$ (2) 12 *cm* from $+9e$

(3) 24 *cm* from $+e$ (4) 12 *cm* from $+e$

139. If 3 charges are placed at the vertices of equilateral triangle of charge 'q' each. What is the net potential energy, if the side of equilateral Δ is l *cm* **[AIEEE 2002]**

(1) $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{l}$ (2) $\frac{1}{4\pi\varepsilon_0}\frac{2q^2}{l}$

(3) $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{l}$ (4) $\frac{1}{4\pi\varepsilon_0}\frac{4q^2}{l}$

140. The distance between charges $5 \times 10^{-11}\, C$ and $-2.7 \times 10^{-11}\, C$ is 0.2 m. The distance at which a third charge should be placed in order that it will not experience any force along the line joining the two charges is

[Kerala PET 2002]

(1) 0.44 m (2) 0.65 m

(3) 0.556 m (4) 0.350 m

141. If identical charges $(-q)$ are placed at each corner of a cube of side b, then electric potential energy of charge $(+q)$ which is placed at centre of the cube will be **[CBSE PMT 2002]**

(1) $\frac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$ (2) $\frac{-8\sqrt{2}q^2}{\pi\varepsilon_0 b}$

(3) $\frac{-4\sqrt{2}q^2}{\pi\varepsilon_0 b}$ (4) $\frac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$

142. An electron having charge 'e' and mass 'm' is moving in a uniform electric field E. Its acceleration will be **[AIIMS 2002]**

(1) $\frac{e^2}{m}$ (2) $\frac{E^2e}{m}$

(3) $\frac{eE}{m}$ (4) $\frac{mE}{e}$

143. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of paper. The deflection of cathode rays is towards **[CPMT 2002]**

(1) East (2) South

(3) West (4) North

144. An α-particle is accelerated through a potential difference of $200V$. The increase in its kinetic energy is **[UPSEAT 2002]**

(1) 100 eV (2) 200 eV

(3) 400 eV (4) 800 eV

145. A simple pendulum of period T has a metal bob which is negatively charged. If it is allowed to oscillate above a positively charged metal plate, its period will **[AIEEE 2002; CBSE PMT 2001]**

(1) Remains equal to T (2) Less than T

(3) Greater than T (4) Infinite

146. A charged particle of mass m and charge q is released from rest in a uniform electric field E. Neglecting the effect of gravity, the kinetic energy of the charged particle after 't' second is **[KCET 2003]**

(1) $\frac{Eq^2m}{2t^2}$ (2) $\frac{2E^2t^2}{mq}$

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

147. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of 1 kV, its kinetic energy will be **[AIIMS 2003;**

(1) 1840 keV (2) 1/1840 keV

(3) 1 keV (4) 920 keV

148. A conducting sphere of radius $R = 20\,cm$ is given a charge $Q = 16\mu C$. What is $\vec{E}$ at centre

(1) $3.6\times10^6\,N/C$ (2) $1.8\times10^6\,N/C$

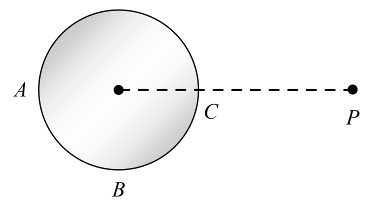
(3) Zero (4) $0.9\times10^6\,N/C$

149. A thin spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a point p a distance $\frac{R}{2}$ from the centre of the shell is **[AIEEE 2003]**

(1) $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$ (2) $\frac{2Q}{4\pi\varepsilon_0 R}$

(3) $\frac{2Q}{4\pi\varepsilon_0 R} - \frac{2q}{4\pi\varepsilon_0 R}$ (4) $\frac{2Q}{4\pi\varepsilon_0 R} + \frac{q}{4\pi\varepsilon_0 R}$

150. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure. Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then **[Orissa JEE 2003]**



(1) $V_C > V_B$ (2) $V_B > V_C$

(3) $V_A > V_B$ (4) $V_A = V_C$

151. A point charge is kept at the centre of a metallic insulated spherical shell. Then

(1) Electric field out side the sphere is zero

(2) Electric field inside the sphere is zero

(3) Net induced charge on the sphere is zero

(4) Electric potential inside the sphere is zero

152. An electron moving with the speed 5×10^{6} per sec is shooted parallel to the electric field of intensity $1\times10^{3}\ N/C$. Field is responsible for the retardation of motion of electron. Now evaluate the distance travelled by the electron before coming to rest for an instant (mass of $e = 9\times10^{-31}\ Kg$. charge $= 1.6\times10^{-19}\ C$)

(1) 7 *m* (2) 0.7 *mm*

(3) 7 *cm* (4) 0.7 *cm*

[MP PMT 2003]

153. An electron enters in high potential region V_2 from lower potential region V_1 then its velocity [MP PMT 2003]

(1) Will increase

(2) Will change in direction but not in magnitude

(3) No change in direction of field

(4) No change in direction perpendicular to field

154. The electric potential at the surface of an atomic nucleus (Z = 50) of radius 9.0×10^{-13} *cm* is

[CPMT 1990; Pb. PMT 2002; BVP 2003; MP PET 2004]

(1) 80 *volts* (2) 8×10^{6} *volts*

(3) 9 *volts* (4) 9×10^{5} *volts*

155. A pellet carrying charge of 0.5 coulombs is accelerated through a potential of 2,000 *volts*. It attains a kinetic energy equal to [NCERT 1973; CPMT 1973; JIPMER 2002]

(1) 1000 *ergs* (2) 1000 *joules*

(3) 1000 *kWh* (4) 500 *ergs*

156. A particle has a mass 400 times than that of the electron and charge is double than that of a electron. It is accelerated by 5*V* of potential difference. Initially the particle was at rest, then its final kinetic energy will be

[MP PMT 1990; DPMT 1999]

(1) 5 *eV* (2) 10 *eV*

(3) 100 *eV* (4) 2000 *eV*

157. An electron (charge = 1.6×10^{-19} *coulomb*) is accelerated through a potential of 1,00,000 *volts*. The energy required by the electron is

(1) 1.6×10^{-24} *joule* (2) 1.6×10^{-14} *erg*

(3) 0.53×10^{-14} *joule* (4) 1.6×10^{-14} *joule*

158. The charge given to a hollow sphere of radius 10 *cm* is 3.2×10^{-19} *coulomb*. At a distance of 4 *cm* from its centre, the electric potential will be

(1) 28.8×10^{-9} *volts* (2) 288 *volts*

(3) 2.88 *volts* (4) Zero

[MP PMT 2003]

159. Work done in moving a positive charge on an equipotential surface is [BCECE 2004]

(1) Finite, positive but not zero

(2) Finite, negative but not zero

(3) Zero

(4) Infinite

160. A charge of 10 *e.s.u.* is placed at a distance of 2 *cm* from a charge of 40 *e.s.u.* and 4 *cm* from another charge of 20 *e.s.u.* The potential energy of the charge 10 *e.s.u.* is (in *ergs*)

[CPMT 1976; MP PET 1989]

(1) 87.5 (2) 112.5

(3) 150 (4) 250

161. A table tennis ball which has been covered with conducting paint is suspended by a silk thread so that it hang between two plates, out of which one is earthed and other is connected to a high voltage generator. This ball

(1) Is attracted towards high voltage plate and stays there

(2) Hangs without moving

(3) Swing backward and forward hitting each plate in turn

(4) Is attracted to earthed plate and stays there

162. A sphere of 4 *cm* radius is suspended within a hollow sphere of 6 *cm* radius. The inner sphere is charged to potential 3 *e.s.u.* and the outer sphere is earthed. The charge on the inner sphere is [MP PMT 1991]

(1) 54 *e.s.u.* (2) $\frac{1}{4}$ *e.s.u.*

(3) 30 *e.s.u.* (4) 36 *e.s.u.*

[MP PET 1989]

163. State which of the following is correct [CPMT 1974, 80]

(1) *Joule = coulomb × volt* (2) *Joule = coulomb/volt*

(3) *Joule = volt × ampere* (4) *Joule = volt/ampere*

164. When a positive q charge is taken from lower potential to a higher potential point, then its potential energy will

(1) Decrease (2) Increases

(3) Remain unchanged (4) Become zero

165. When a negative charge is taken at a height from earth's surface, then its potential energy

(1) Decreases (2) Increases

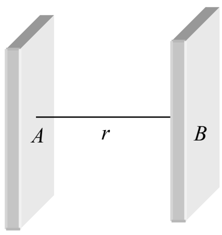
(3) Remains unchanged (4) Will become infinity

166. When a charge of 3 *coulombs* is placed in a uniform electric field, it experiences a force of 3000 *Newton*. Within this field, potential difference between two points separated by a distance of 1 c*m* is **[MP PMT 1986; 2000]**

(1) 10 *volts* (2) 90 *volts*

(3) 1000 *volts* (4) 3000 *volts*

167. There are two equipotential surface as shown in figure. The distance between them is *r*. The charge of –*q* coulomb is taken from the surface *A* to *B*, the resultant work done will be



(1) $W = \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$

(2) $W = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

(3) $W = -\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

(4) W = zero

168. When one electron is taken towards the other electron, then the electric potential energy of the system **[RPET 1999; CBSE PMT 1993, 99; Pb. PMT 1999; BHU 2000, 02]**

(1) Decreases (2) Increases

(3) Remains unchanged (4) Becomes zero

169. A hollow metal sphere of radius 5*cm* is charged such that the potential on its surface is 10*V*. The potential at a distance of 2*cm* from the centre of the sphere **[MP PET 1992; MP PMT 1996]**

(1) Zero (2) 10 *V*

(3) 4 *V* (4) 10/3 *V*

170. The work done in carrying a charge of $5\mu C$ from a point *A* to a point *B* in an electric field is 10*mJ*. The potential difference $(V_B - V_A)$ is then **[Harya**

(1) + 2*kV* (2) – 2 *kV*

(3) + 200 *V* (4) – 200 *V*

171 **[DPMT 2002]** Value of potential at a point due to a point charge is **[MP PET 1996]**

(1) Inversely proportional to square of the distance

(2) Directly proportional to square of the distance

(3) Inversely proportional to the distance

(4) Directly proportional to the distance

172. Electric potential of earth is taken to be zero because earth is a good **[AIIMS 1998; BHU 2002]**

(1) Insulator (2) Conductor

(3) Semiconductor (4) Dielectric

173. There is 10 units of charge at the centre of a circle of radius 10*m*. The work done in moving 1 unit of charge around the circle once is **[MP PMT 1986; CPMT 1986,88]** **[EAMCET (Med.) 1995; AIIMS 2000; Pb. PMT 2000]**

(1) Zero (2) 10 units

(3) 100 units (4) 1 unit

174. Two parallel plates separated by a distance of $5mm$ are kept at a potential difference of $50\,V$. A particle of mass $10^{-15}\,kg$ and charge $10^{-11}\,C$ enters in it with a velocity $10^7\,m/s$. The acceleration of the particle will be **[MP PMT 1997]**

(1) $10^8\,m/s^2$ (2) $5 \times 10^5\,m/s^2$

(3) $10^5\,m/s^2$ (4) $2 \times 10^3\,m/s^2$

175. Three point charges are placed at the corners of an equilateral triangle. Assuming only electrostatic forces are acting

(1) The system can never be in equilibrium

(2) The system will be in equilibrium if the charges rotate about the centre of the triangle

(3) The system will be in equilibrium if the charges have different magnitudes and different signs

(4) The system will be in equilibrium if the charges have the same magnitudes but different signs

176. If an insulated non-conducting sphere of radius R has charge density ρ. The electric field at a distance r from the centre of sphere $(r < R)$ will be **[BHU 2003]**

(1) $\frac{\rho R}{3\varepsilon_0}$ (2) $\frac{\rho r}{\varepsilon_0}$

(3) $\frac{\rho r}{3\varepsilon_0}$ (4) $\frac{3\rho R}{\varepsilon_0}$

177. Two plates are at potentials –10 *V* and +30 *V*. If the separation between the plates be 2 *cm*. The electric field between them is **[Pb. PET 2000]**

(1) 2000 *V*/*m* (2) 1000 *V*/*m*

(3) 500 *V*/*m* (4) 3000 *V*/*m*

178. The electric potential inside a conducting sphere **[RPMT 2002]**

(1) Increases from centre to surface

(2) Decreases from centre to surface

(3) Remains constant from centre to surface

(4) Is zero at every point inside

179. The wrong statement about electric lines of force is **[RPMT 2002]**

(1) These originate from positive charge and end on negative charge

(2) They do not intersect each other at a point

(3) They have the same form for a point charge and a sphere

(4) They have physical existence

180. A charge produces an electric field of 1 *N*/*C* at a point distant 0.1 *m* from it. The magnitude of charge is **[RPET 2002]**

(1) $1.11\times10^{-12}\,C$ (2) $9.11\times10^{-12}\,C$

(3) $7.11\times10^{-6}\,C$ (4) None of these

181. A charged particle is suspended in equilibrium in a uniform vertical electric field of intensity 20000 *V*/*m*. If mass of the particle is $9.6\times10^{-16}\,kg$, the charge on it and excess number of electrons on the particle are respectively $(g = 10\,m/s^2)$ **[Pb. PMT 2003]**

(1) $4.8\times10^{-19}\,C, 3$ (2) $5.8\times10^{-19}\,C, 4$

(3) $3.8\times10^{-19}\,C, 2$ (4) $2.8\times10^{-19}\,C, 1$

182. The potential at a distance *R*/2 from the centre of a conducting sphere of radius *R* will be **[RPMT 2003]**

(1) 0 (2) $\frac{Q}{8\pi\varepsilon_0 R}$

(3) $\frac{Q}{4\pi\varepsilon_0 R}$ (4) $\frac{Q}{2\pi\varepsilon_0 R}$

183. Four charges $+Q, -Q, +Q, -Q$ are placed at the corners of a square taken in order. At the centre of the square **[RPMT 2003]**

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

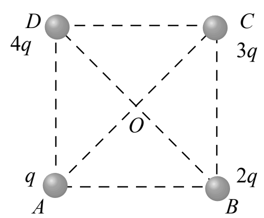
(3) $E \neq 0, V = 0$ (4) $E = 0, V \neq 0$

184. The radius of nucleus of silver (atomic number = 47) is $3.4\times10^{-14}\,m$. The electric potential on the surface of nucleus is $(e = 1.6\times10^{-19}\,C)$ **[Pb. PET 2003]**

(1) 1.99×10^6 *volt* (2) 2.9×10^6 *volt*

(3) 4.99×10^6 *volt* (4) 0.99×10^6 *volt*

185. Charges *q*, 2*q*, 3*q* and 4*q* are placed at the corners *A*, *B*, *C* and *D* of a square as shown in the following figure. The direction of electric field at the centre of the square is along **[MP PMT 2004]**



(1) AB (2) CB

(3) BD (4) AC

186. Point charge $q_1 = 2\mu C$ and $q_2 = -1\,\mu C$ are kept at points $x = 0$ and $x = 6$ respectively. Electrical potential will be zero at points

(1) $x = 2$ and $x = 9$ (2) $x = 1$ and $x = 5$

(3) $x = 4$ and $x = 12$ (4) $x = -2$ and $x = 2$

187. Equipotential surfaces associated with an electric field which is increasing in magnitude along the *x*-direction are **[AIIMS 2004]**

(1) Planes parallel to *yz*-plane

(2) Planes parallel to *xy*-plane

(3) Planes parallel to *xz*-plane

(4) Coaxial cylinders of increasing radii around the *x*-axis

188. A bullet of mass 2 *gm* is having a charge of $2\,\mu C$. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of $10\,m/s$ **[CBSE PMT 2004]**

(1) 5 *kV* (2) 50 *kV*

(3) 5 *V* (4) 50 *V*

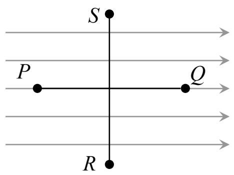
189. The points resembling equal potentials are **[Orissa PMT 2004]**

(1) *P* and *Q*

(2) *S* and *Q*

(3) *S* and *R*

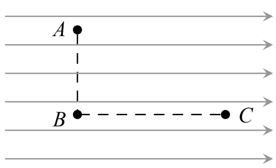
(4) *P* and *R*



190. Figure shows three points *A*, *B* and *C* in a region of uniform electric field $\vec{E}$. The line *AB* is perpendicular and *BC* is parallel to the field lines. Then which of the following holds good. Where V_A, V_B and V_C represent the electric potential at points *A*, *B* and *C* respectively **[CPMT 2004; MP PMT 2005]**

(1) $V_A = V_B = V_C$

(2) $V_A = V_B > V_C$



(3) $V_A = V_B < V_C$

(4) $V_A > V_B = V_C$

191. In a certain charge distribution, all points having zero potential can be joined by a circle *S*. Points inside *S* have positive potential and points outside *S* have negative potential. A positive charge, which is free to move, is placed inside *S* **[MP PMT 2004]** **[DPMT 2004]**

(1) It will remain in equilibrium

(2) It can move inside *S*, but it cannot cross *S*

(3) It must cross *S* at some time

(4) It may move, but will ultimately return to its starting point

192. Infinite charges of magnitude *q* each are lying at *x* =1, 2, 4, 8... *meter* on *X*-axis. The value of intensity of electric field at point *x* = 0 due to these charges will be **[J & K CET 2004]**

(1) $12 \times 10^9 q$ *N/C* (2) Zero

(3) $6 \times 10^9 q$ *N/C* (4) $4 \times 10^9 q$ *N/C*

193. A square of side '*a*' has charge *Q* at its centre and charge '*q*' at one of the corners. The work required to be done in moving the charge '*q*' from the corner to the diagonally opposite corner is **[UPSEAT 2004]**

(1) Zero (2) $\frac{Qq}{4\pi \epsilon_0 a}$

(3) $\frac{Qq\sqrt{2}}{4\pi \epsilon_0 a}$ (4) $\frac{Qq}{2\pi \epsilon_0 a}$

194. A pendulum bob of mass $30.7 \times 10^{-6}\,kg$ and carrying a charge $2 \times 10^{-8}\,C$ is at rest in a horizontal uniform electric field of 20000 *V*/*m*. The tension in the thread of the pendulum is $(g = 9.8\,m/s^2)$ **[UPSEAT 2004]**

(1) $3 \times 10^{-4}\,N$ (2) $4 \times 10^{-4}\,N$

(3) $5 \times 10^{-4}\,N$ (4) $6 \times 10^{-4}\,N$

195. An infinite line charge produce a field of $7.182 \times 10^8\,N/C$ at a distance of 2 *cm*. The linear charge density is **[MH CET 2004]**

(1) $7.27 \times 10^{-4}\,C/m$ (2) $7.98 \times 10^{-4}\,C/m$

(3) $7.11\times10^{-4}\ C/m$ (4) $7.04\times10^{-4}\ C/m$

196. An electron experiences a force equal to its weight when placed in an electric field. The intensity of the field will be **[MHCET 2004]**

(1) $1.7\times10^{-11}\ N/C$ (2) $5.0\times10^{-11}\ N/C$

(3) $5.5\times10^{-11}\ N/C$ (4) 56 *N/C*

197. The dielectric strength of air at NTP is $3\times10^{6}\ V/m$ then the maximum charge that can be given to a spherical conductor of radius 3 *m* is **[Pb. PMT 2001]**

(1) $3\times10^{-4}\ C$ (2) $3\times10^{-3}\ C$

(3) $3\times10^{-2}\ C$ (4) $3\times10^{-1}\ C$

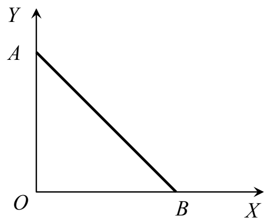
198. As per this diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point A [co-ordinates $(0, a)$] to another point *B* [co-ordinates (*a*, 0)] along the straight path AB is **[CBSE PMT 2005]**

(1) Zero

(2) $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$

(3) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\frac{a}{\sqrt{2}}$

(4) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$



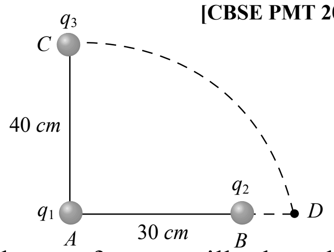
199. To charges q_1 and q_2 are placed 30 cm apart, shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to *D*. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where k is **[CBSE PMT 2005]**

(1) $8q_2$

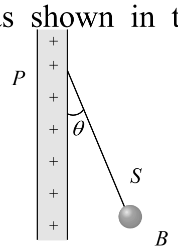
(2) $8q_1$

(3) $6q_2$

(4) $6q_1$



200. A charged ball *B* hangs from a silk thread *S*, which makes an angle θ with a large charged conducting sheet P, as shown in the figure.



The surface charge density σ of the sheet is proportional to **[AIEEE 2005]**

(1) $\sin\theta$

(2) $\tan\theta$

(3) $\cos\theta$

(4) $\cot\theta$

201. Two point charges $+8q$ and $-2q$ are located at $x = 0$ and $x = L$ respectively. The location of a point on the *x*-axis at which the net electric field due to these two point charges is zero is **[AIEEE 2005]**

(1) 8 *L* (2) 4 *L*

(3) 2 *L* (4) $\frac{L}{4}$

202. Two thin wire rings each having a radius *R* are placed at a distance *d* apart with their axes coinciding. The charges on the two rings are $+q$ and $-q$. The potential difference between the centres of the two rings is **[AIEEE 2005]**

(1) Zero (2) $\frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

(3) $QR/4\pi\varepsilon_0 d^2$ (4) $\frac{Q}{2\pi\varepsilon_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

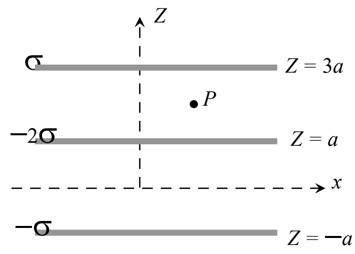
203. Three infinitely long charge sheets are placed as shown in figure. The electric field at point *P* is **[IIT-JEE (Screening) 2005]**

(1) $\frac{2\sigma}{\varepsilon_o}\hat{k}$

(2) $-\frac{2\sigma}{\varepsilon_o}\hat{k}$

(3) $\frac{4\sigma}{\varepsilon_o}\hat{k}$

(4) $-\frac{4\sigma}{\varepsilon_o}\hat{k}$



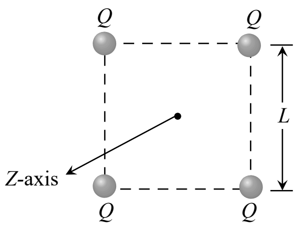
204. Two infinitely long parallel conducting plates having surface charge densities $+\sigma$ and $-\sigma$ respectively, are separated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacuum, then the electric field in the region between the plates is **[AIIMS 2005]**

(1) 0 *volts/ meter* (2) $\frac{\sigma}{2\varepsilon_o}$ *volts/ meter*

(3) $\frac{\sigma}{\varepsilon_o}$ *volts/ meter* (4) $\frac{2\sigma}{\varepsilon_o}$ *volts/ meter*

205. Four point +*ve* charges of same magnitude (Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to z axis. If a –*ve* point charge is placed at a distance z away from the above frame (z<<L) then

[AIIMS 2005]



(1) – *ve* charge oscillates along the z axis.

(2) It moves away from the frame

(3) It moves slowly towards the frame and stays in the plane of the frame

(4) It passes through the frame only once.

206. At a point 20 *cm* from the centre of a uniformly charged dielectric sphere of radius 10 *cm*, the electric field is 100 *V/m*. The electric field at 3 *cm* from the centre of the sphere will be

[BCECE 2005]

(1) 150 *V/m* (2) 125 *V/m*

(3) 120 *V/m* (4) Zero

207. Charges 4Q, q and Q and placed along x-axis at positions $x = 0, x = l/2$ and $x = l$, respectively. Find the value of q so that force on charge Q is zero **[DPMT 2005]**

(1) Q (2) $Q/2$

(3) $-Q/2$ (4) $-Q$

208. If an electron moves from rest from a point at which potential is 50 volt to another point at which potential is 70 volt, then its kinetic energy in the final state will be

[J & K CET 2005]

(1) 3.2×10^{-10} *J* (2) 3.2×10^{-18} *J*

(3) 1 *N* (4) 1 *dyne*

209. In the following diagram the work done in moving a point charge from point P to point A, B and C is respectively as W_A, W_B and W_C, then

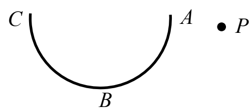
[J & K CET 2005]

(1) $W_A = W_B = W_C$

(2) $W_A = W_B = W_C = 0$

(3) $W_A > W_B > W_C$

(4) $W_A < W_B < W_C$



210. A hollow metallic sphere of radius R is given a charge Q. Then the potential at the centre is

[Orissa JEE 2005]

(1) Zero (2) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{R}$

(3) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{2Q}{R}$ (4) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{2R}$

Electric Dipole

1. An electric dipole when placed in a uniform electric field E will have minimum potential energy, if the positive direction of dipole moment makes the following angle with E

[CPMT 1981; MP PMT 1987]

(1) π (2) $\pi/2$

(3) Zero (4) $3\pi/2$

2. A given charge is situated at a certain distance from an electric dipole in the end-on position experiences a force F. If the distance of the charge is doubled, the force acting on the charge will be **[MNR 1986]**

(1) 2F (2) $F/2$

(3) $F/4$ (4) $F/8$

3. The electric potential at a point on the axis of an electric dipole depends on the distance r of the point from the dipole as **[CPMT 1982; UPSEAT 2001**

MP PMT 1996, 2002; MP PET 2001, 05]

(1) $\propto \frac{1}{r}$ (2) $\propto \frac{1}{r^2}$

(3) $\propto r$ (4) $\propto \frac{1}{r^3}$

4. 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 θ from the initial position. The potential energy of electric dipole in the final position is

[MP PET 1993]

(1) $pE\cos\theta$ (2) $pE\sin\theta$

(3) $pE(1-\cos\theta)$ (4) $-pE\cos\theta$

5. An electric dipole is kept in non-uniform electric field. It experiences
[AIIMS 2003; DCE 2001]

(1) A force and a torque (2) A force but not a torque

(3) A torque but not a force (4) Neither a force nor a torque

6. An electric dipole consisting of two opposite charges of $2\times10^{-6}C$ each separated by a distance of $3\,cm$ is placed in an electric field of 2×10^{5} N/C. The maximum torque on the dipole will be **[MP PMT 1987]**

(1) $12\times10^{-1}\,Nm$ (2) $12\times10^{-3}\,Nm$

(3) $24\times10^{-1}\,Nm$ (4) $24\times10^{-3}\,Nm$

7. An electric dipole of moment $\vec{p}$ is placed normal to the lines of force of electric intensity $\vec{E}$, then the work done in deflecting it through an angle of 180° is **[BVP 2003]**

(1) pE (2) $+2pE$

(3) $-2pE$ (4) Zero

8. The distance between the two charges $+q$ and $-q$ of a dipole is r. On the axial line at a distance d from the centre of dipole, the intensity is proportional to **[CPMT 1977]**

(1) $\frac{q}{d^2}$ (2) $\frac{qr}{d^2}$

(3) $\frac{q}{d^3}$ (4) $\frac{qr}{d^3}$

9. An electron and a proton are at a distance of $1\mathring{A}$. The moment of this dipole will be ($C\times m$)
[CPMT 1984]

(1) 1.6×10^{19} (2) 1.6×10^{-29}

(3) 3.2×10^{19} (4) 3.2×10^{29}

10. The electric field due to a dipole at a distance r on its axis is

[MP PMT 1993; RPET 2001; MP PET/PMT 2002; BCECE 2003]

(1) Directly proportional to r^3

(2) Inversely proportional to r^3

(3) Directly proportional to r^2

(4) Inversely proportional to r^2

11. Two charges $+3.2\times10^{-19}$ and $-3.2\times10^{-19}C$ placed at $2.4\mathring{A}$ apart form an electric dipole. It is placed in a uniform electric field of intensity 4×10^{5} $volt/m$. The electric dipole moment is

(1) 15.36×10^{-29} $coulomb\times m$

(2) 15.36×10^{-19} $coulomb\times m$

(3) 7.68×10^{-29} $coulomb\times m$

(4) 7.68×10^{-19} $coulomb\times m$

12. An electric dipole of moment p is placed at the origin along the x-axis. The electric field at a point P, whose position vector makes an angle θ with the x-axis, will make an angle ..... with the x-axis, where $\tan\alpha=\frac{1}{2}\tan\theta$ **[MP PMT 1994]**

(1) α (2) θ

(3) $\theta+\alpha$ (4) $\theta+2\alpha$

13. An electric dipole is placed along the $x-$axis at the origin O. A point P is at a distance of $20\,cm$ from this origin such that OP makes an angle $\frac{\pi}{3}$ with the x-axis. If the electric field at P makes an angle θ with the x-axis, the value of θ would be **[MP PMT 1997]**

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{3}+\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

(3) $\frac{2\pi}{3}$ (4) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

14. 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 **[MP PMT 1994]**

(1) ql (2) $2ql$

(3) $\sqrt{3}ql$ (4) $4ql$

15. The torque acting on a dipole of moment $\vec{P}$ in an electric field $\vec{E}$ is **[MP PMT 1994; CPMT 2001]**

(1) $\vec{P}\cdot\vec{E}$ (2) $\vec{P}\times\vec{E}$

(3) Zero (4) $\vec{E}\times\vec{P}$

16. The electric field at a point on equatorial line of a dipole and direction of the dipole moment **[MP PET 1995]**

(1) Will be parallel

(2) Will be in opposite direction

(3) Will be perpendicular

(4) Are not related

17. Two opposite and equal charges 4×10^{-8} *coulomb* when placed 2×10^{-2} *cm* away, form a dipole. If this dipole is placed in an external electric field 4×10^{8} *newton/ coulomb*, the value of maximum torque and the work done in rotating it through 180° will be **[MP PET 1996]**

(1) 64×10^{-4} *Nm* and 64×10^{-4} *J*

(2) 32×10^{-4} *Nm* and 32×10^{-4} *J*

(3) 64×10^{-4} *Nm* and 32×10^{-4} *J*

(4) 32×10^{-4} *Nm* and 64×10^{-4} *J*

18. If E_a be the electric field strength of a short dipole at a point on its axial line and E_e that on the equatorial line at the same distance, then **[MP PET 1999; J & K CET 2004]**

(1) $E_e = 2E_a$ (2) $E_a = 2E_e$

(3) $E_a = E_e$ (4) None of the above

19. An electric dipole is placed in an electric field generated by a point charge **[MP PMT 1999]**

(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

20. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then electric field at Q is proportional to **[CBSE PMT 1998; JIPMER 2001, 02]**

(1) p^{-1} and r^{-2} (2) p and r^{-2}

(3) p^2 and r^{-3} (4) p and r^{-3}

21. If the magnitude of intensity of electric field at a distance x on axial line and at a distance y on equatorial line on a given dipole are equal, then $x : y$ is **[EAMCET 1994]**

(1) $1:1$ (2) $1:\sqrt{2}$

(3) $1:2$ (4) $\sqrt[3]{2}:1$

22. An electric dipole in a uniform electric field experiences (When it is placed at an angle θ with the field) **[RPET 2000]**

(1) Force and torque both (2) Force but no torque

(3) Torque but no force (4) No force and no torque

23. The electric intensity due to a dipole of length 10 *cm* and having a charge of $500 \mu C$, at a point on the axis at a distance 20 *cm* from one of the charges in air, is **[CBSE PMT 2001]**

(1) 6.25×10^7 *N/C* (2) 9.28×10^7 *N/C*

(3) 13.1×11^{11} *N/C* (4) 20.5×10^7 *N/C*

24. Electric potential at an equatorial point of a small dipole with dipole moment P(r, distance from the dipole) is **[MP PMT 2001]**

(1) Zero (2) $\frac{P}{4\pi\varepsilon_0 r^2}$

(3) $\frac{P}{4\pi\varepsilon_0 r^3}$ (4) $\frac{2P}{4\pi\varepsilon_0 r^3}$

25. The distance between H^+ and Cl^- ions in *HCl* molecule is 1.28 Å. What will be the potential due to this dipole at a distance of 12 Å on the axis of dipole **[MP PMT 2002]**

(1) 0.13 *V* (2) 1.3 *V*

(3) 13 *V* (4) 130 *V*

26. The potential at a point due to an electric dipole will be maximum and minimum when the angles between the axis of the dipole and the line joining the point to the dipole are respectively **[MP PMT 2002]**

(1) 90^o and 180^o (2) 0^o and 90^o

(3) 90^o and 0^o (4) 0^o and 180^o

27. The value of electric potential at any point due to any electric dipole is **[MP PMT 2004]**

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

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

28. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a 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 **[CBSE PMT 2004]**

(1) $2q\cdot E$ and minimum (2) $q\cdot E$ and $p\cdot E$

(3) Zero and minimum (4) $q\cdot E$ and maximum

29. Intensity of an electric field E due to a dipole, depends on distance r as

(1) $E\propto\frac{1}{r^4}$ (2) $E\propto\frac{1}{r^3}$

(3) $E\propto\frac{1}{r^2}$ (4) $E\propto\frac{1}{r}$

30. The ratio of electric fields on the axis and at equator of an electric dipole will be **[RPMT 2002]**

(1) 1 : 1 (2) 2 : 1

(3) 4 : 1 (4) None of these

31. For a dipole $q=2\times10^{-6}\,C$ and $d=0.01\,m$. Calculate the maximum torque for this dipole if $E=5\times10^5\,N/C$ **[RPMT 2003]**

(1) $1\times10^{-3}\,Nm^{-1}$ (2) $10\times10^{-3}\,Nm^{-1}$

(3) $10\times10^{-3}\,Nm$ (4) $1\times10^2\,Nm^2$

32. A molecule with a dipole moment p is placed in an electric field of strength E. Initially the dipole is aligned parallel to the field. If the dipole is to be rotated to be anti-parallel to the field, the work required to be done by an external agency is **[UPSEAT 2004]**

(1) $-2pE$ (2) $-pE$

(3) pE (4) $2pE$

33. An electric dipole of moment $\vec{p}$ placed in a uniform electric field $\vec{E}$ has minimum potential energy when the angle between $\vec{p}$ and $\vec{E}$ is **[UPSEAT 2004]**

(1) Zero (2) $\frac{\pi}{2}$

(3) π (4) $\frac{3\pi}{2}$

34. A region surrounding a stationary electric dipoles has **[MP PET 1994]**

(1) Magnetic field only

(2) Electric field only

(3) Both electric and magnetic fields

(4) No electric and magnetic fields

35. Two electric dipoles of moment P and 64 P are placed in opposite direction on a line at a distance of 25 cm. The electric field will be zero at point between the dipoles whose distance from the dipole of moment P is **[MP PET 2003]**

(1) 5 cm (2) $\frac{25}{9}$ cm

[Pb. PMT 2004]

(3) 10 cm (4) $\frac{4}{13}$ cm

36. When an electric dipole $\vec{P}$ is placed in a uniform electric field $\vec{E}$ then at what angle between $\vec{P}$ and $\vec{E}$ the value of torque will be maximum **[MP PET 2002]**

(1) 90^o (2) 0^o

(3) 180^o (4) 45^o

37. Two charges $+3.2\times10^{-19}\,C$ and $-3.2\times10^{-9}\,C$ kept 2.4 Å apart forms a dipole. If it is kept in uniform electric field of intensity $4\times10^5\,volt/m$ then what will be its electrical energy in equilibrium **[MP PMT 2003]**

(1) $+3\times10^{-23}\,J$ (2) $-3\times10^{-23}\,J$

(3) $-6\times10^{-23}\,J$ (4) $-2\times10^{-23}\,J$

38. What is the angle between the electric dipole moment and the electric field strength due to it on the equatorial line **[AFMC 2005]**

(1) 0° (2) 90°

(3) 180° (4) None of these

39. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90° about its perpendicular axis, the electric field at the same point will be **[J & K CET 2005]**

(1) E (2) $E/4$

(3) $E/2$ (4) $2E$

Electric Flux and Gauss's Law

1. 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

[CPMT 1975; RPMT 2002; KCET 2004]

(1) $2\pi R^2 E$ (2) $\pi R^2 / E$

(3) $(\pi R^2 - \pi R)/ E$ (4) Zero

2. Electric field at a point varies as r^0 for

(1) An electric dipole

(2) A point charge

(3) A plane infinite sheet of charge

(4) A line charge of infinite length

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

[MP PMT 1994, 95; DCE 1999, 2001; AIIMS 2001]

(1) $\frac{q}{6\varepsilon_0}$ (2) $\frac{q}{\varepsilon_0 a^2}$

(3) $\frac{q}{4\pi\varepsilon_0 a^2}$ (4) $\frac{q}{\varepsilon_0}$

4. Total electric flux coming out of a unit positive charge put in air is **[MP PET 1995]**

(1) ε_0 (2) ε_0^{-1}

(3) $(4p\varepsilon_0)^{-1}$ (4) $4\pi\varepsilon_0$

5. For a given surface the Gauss's law is stated as $\oint E \cdot ds = 0$. From this we can conclude that

[MP PMT 1995]

(1) E is necessarily zero on the surface

(2) E is perpendicular to the surface at every point

(3) The total flux through the surface is zero

(4) The flux is only going out of the surface

6. A cube of side l is placed in a uniform field E, where $E = E\hat{i}$. The net electric flux through the cube is

[Haryana CEE 1996]

(1) Zero (2) $l^2 E$

(3) $4l^2 E$ (4) $6l^2 E$

7. Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

[MP PMT/PET 1998]

(1) $\frac{8e}{\varepsilon_0}$ (2) $\frac{16e}{\varepsilon_0}$

(3) $\frac{e}{\varepsilon_0}$ (4) Zero

8. A point charge $+q$ is placed at the centre of a cube of side L. The electric flux emerging from the cube is

[CBSE PMT 1996; BCECE 2003; AIEEE 2002]

(1) $\frac{q}{\varepsilon_0}$ (2) Zero

(3) $\frac{6qL^2}{\varepsilon_0}$ (4) $\frac{q}{6L^2\varepsilon_0}$

9. A charge q is placed at the centre of the open end of cylindrical vessel. The flux of the electric field through the surface of the vessel is

[MNR 1998]

(1) Zero (2) $\frac{q}{\varepsilon_0}$

(3) $\frac{q}{2\varepsilon_0}$ (4) $\frac{2q}{\varepsilon_0}$

10. It is not convenient to use a spherical Gaussian surface to find the electric field due to an electric dipole using Gauss's theorem because

(1) Gauss's law fails in this case

(2) This problem does not have spherical symmetry

(3) Coulomb's law is more fundamental than Gauss's law

(4) Spherical Gaussian surface will alter the dipole moment

11. According to Gauss' Theorem, electric field of an infinitely long straight wire is proportional to

[RPET 2000; DCE 2000]

(1) r (2) $\frac{1}{r^2}$

(3) $\frac{1}{r^3}$ (4) $\frac{1}{r}$

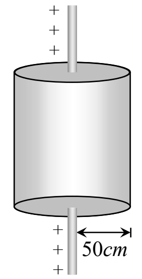
12. Electric charge is uniformly distributed along a long straight wire of radius 1*mm*. The charge per *cm* length of the wire is *Q coulomb*. Another cylindrical surface of radius 50 *cm* and length 1*m* symmetrically encloses the wire as shown in the figure. The total electric flux passing through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

(1) $\frac{Q}{\varepsilon_0}$

(2) $\frac{100Q}{\varepsilon_0}$

(3) $\frac{10Q}{(\pi\varepsilon_0)}$

(4) $\frac{100Q}{(\pi\varepsilon_0)}$

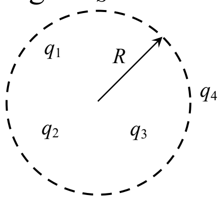


13. The S.I. unit of electric flux is

(1) *Weber* (2) *Newton per coulomb*

(3) *Volt* × *metre* (4) *Joule* per *coulomb*

14. q_1, q_2, q_3 and q_4 are point charges located at points as shown in the figure and S is a spherical Gaussian surface of radius *R*. Which of the following is true according to the Gauss's law **[AMU 2002]**



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

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

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

(4) None of the above

15. Gauss's law should be invalid if

(1) There were magnetic monopoles

(2) The inverse square law were not exactly true

(3) The velocity of light were not a universal constant

(4) None of these

16. The inward and outward electric flux for a closed surface in units of $N\text{-}m^2/C$ are respectively 8×10^3 and 4×10^3. Then the total charge inside the surface is [where $\varepsilon_0 =$ permittivity constant]

[KCET 2003; MP PMT 2002]

(1) 4×10^3 *C* (2) -4×10^3 *C*

(3) $\frac{(-4 \times 10^3)}{\varepsilon}$ *C* (4) $-4 \times 10^3 \varepsilon_0$ *C*

[MP PET 2001]

17. A charge *q* is placed at the centre of a cube. Then the flux passing through one face of cube will be

[RPET 2003; MP PET 2003; UPSEAT 2004]

(1) $\frac{q}{\varepsilon_0}$ (2) $\frac{q}{2\varepsilon_0}$

(3) $\frac{q}{4\varepsilon_0}$ (4) $\frac{q}{6\varepsilon_0}$

18. If a spherical conductor comes out from the closed surface of the sphere then total flux emitted from the surface will be

[KCET 2001]

[RPET 2003]

(1) $\frac{1}{\varepsilon_0} \times$ (the charge enclosed by surface)

(2) $\varepsilon_0 \times$ (charge enclosed by surface)

(3) $\frac{1}{4\pi\varepsilon_0} \times$ (charge enclosed by surface)

(4) 0

19. If the electric flux entering and leaving an enclosed surface respectively is ϕ_1 and ϕ_2 the electric charge inside the surface will be

(1) $(\phi_1 + \phi_2)\varepsilon_0$ (2) $(\phi_2 - \phi_1)\varepsilon_0$

(3) $(\phi_1 + \phi_2)/\varepsilon_0$ (4) $(\phi_2 - \phi_1)/\varepsilon_0$

20. A charge *q* is located at the centre of a cube. The electric flux through any face is

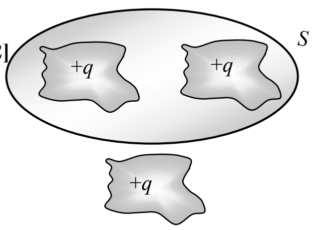
(1) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$ (2) $\frac{\pi q}{6(4\pi\varepsilon_0)}$

(3) $\frac{q}{6(4\pi\varepsilon_0)}$ (4) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$

21. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface *S* is

[AIIMS 2003]

[Orissa JEE 2002]

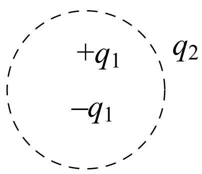


(1) $3q/\varepsilon_0$ (2) $2q/\varepsilon_0$

(3) q/ε_0 (4) Zero

22. 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

(1) q_2



(2) Only the positive charges

(3) All the charges

(4) $+q_1$ and $-q_1$

23. Gauss's law is true only if force due to a charge varies as

[MP PMT 2004]

(1) r^{-1} (2) r^{-2}

(3) r^{-3} (4) r^{-4}

24. An electric dipole is put in north-south direction in a sphere filled with water. Which statement is correct **[MP PET 1995]**

(1) Electric flux is coming towards sphere

(2) Electric flux is coming out of sphere

(3) Electric flux entering into sphere and leaving the sphere are same

(4) Water does not permit electric flux to enter into sphere

25. Two infinite plane parallel sheets separated by a distance d have equal and opposite uniform charge densities σ. Electric field at a point between the sheets is **[MP PET 1999]**

(1) Zero

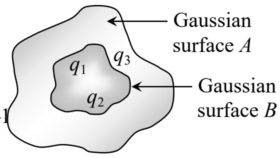
(2) $\frac{\sigma}{\varepsilon_0}$

(3) $\frac{\sigma}{2\varepsilon_0}$

(4) Depends upon the location of the point

26. The electric flux for Gaussian surface *A* that enclose the charged particles in free space is (given $q_1 = -14\ nC$, $q_2 = 78.85\ nC$, $q_3 = -56\ nC$)

[KCET 2005]



(1) $10^3\ Nm^2\ C^{-1}$

(2) $10^3\ CN^{-1}\ m^{-2}$

(3) $6.32 \times 10^3\ Nm^2\ C^{-1}$

(4) $6.32 \times 10^3\ CN^{-1}\ m^{-2}$

27. The electric 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 **[MP PMT 1993; AFMC 2000]**

(1) Directly proportional to r^2

(2) Directly proportional to r^3

(3) Inversely proportional to r

(4) Inversely proportional to r^2

28. A sphere of radius *R* has a uniform distribution of electric charge in its volume. At a distance *x* from its centre, for $x < R$, the electric field is directly proportional to

[MP PMT 1994; AIIMS 1997; BCECE 2005]

(1) $\frac{1}{x^2}$ (2) $\frac{1}{x}$

(3) x (4) x^2