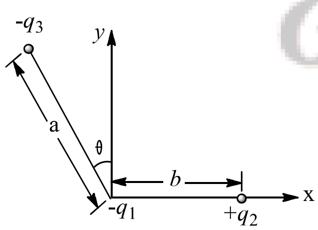
GPLUS EDUCATION

Date :
Time : **PHYSICS**
Marks :

ELECTRIC CHARGES AND FIELDS

Single Correct Answer Type

1. A polythene piece, rubbed with wool, is found to have negative charge of 4×10^{-7}C. the number of electrons transferred from wool to polythene is
a) 1.5×10^{12} b) 2.5×10^{12} c) 2.5×10^{13} d) 3.5×10^{13}
2. The intensity of electric field at a point between the plates of a charged capacitor
a) Is directly proportional to the distance between the plates
b) Is inversely proportional to the distance between the plates
c) Is inversely proportional to the square of the distance between the plates
d) Does not depend upon the distance between the plates
3. Four metal conductors having different shapes
I. A sphere
II. Cylinder
III. Pear
IV. Lightning conductor
are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is
a) 1 b) 2 c) 3 d) 4
4. Three charges $-q_1, +q_2$ and $-q_3$ are placed as shown in figure. The x component of the force on $-q_1$ is proportional to


a) $\frac{q_2}{b^2} - \frac{q_3}{b^2} \sin\theta$ b) $\frac{q_2}{b^2} - \frac{q_3}{b^2} \cos\theta$ c) $\frac{q_2}{b^2} + \frac{q_3}{b^2} \sin\theta$ d) $\frac{q_2}{b^2} + \frac{q_3}{b^2} \cos\theta$
5. According to Gauss' Theorem, electric field of an infinitely long straight wire is proportional to
a) r b) $1/r^2$ c) $1/r^3$ d) $1/r$
6. An electric dipole has a pair of equal and opposite point charges q and $-q$ separated by a distance $2x$. The axis of the dipole is defined as
a) Direction from positive charge to negative charge
b) Direction from negative charge to positive charge
c) Perpendicular to the line joining the two charges drawn at the centre and pointing upward direction
d) Perpendicular to the line joining the two charges drawn at the centre and pointing downward direction
7. The Gaussian surface for calculating the electric field due to a charge distribution is
a) Any surface near the charge distribution
b) Always a spherical surface
c) A symmetrical closed surface containing the charge distribution, at every point of which electric field has a single fixed value
d) None of the given options
8. Two charged spheres of radii 10 cm and 15 cm are connected by a thin wire. No charge will flow, if they have

a) The same charge on each
b) The same potential
c) The same energy
d) The same field on their surface

9. Three charges each of + 1μC are placed at the corners of an equilateral triangle. If the force between any two charges be F, then the net force on either charge will be
a) $\sqrt{2}\,F$
b) $F\sqrt{3}$
c) 2F
d) 3F

10. The work done in carrying a charge of $5\mu C$ from a point A to a point B in an electric field is $10mJ$. The potential difference $(V_B - V_A)$ is then
a) $+\,2kV$
b) $-2\ kV$
c) $+200\ V$
d) $-200\ V$

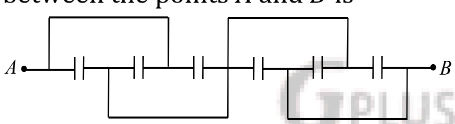
11. A parallel plate condenser has a uniform electric field $E(V/m)$ in the space between the plates. If the distance between the plates is $d(m)$ and area of each plate is $A(m^2)$ the energy (joules) stored in the condenser is
a) $\frac{1}{2}\varepsilon_0 E^2 Ad$
b) $E^2 Ad/\varepsilon_0$
c) $\frac{1}{2}\varepsilon_0 E^2$
d) $\varepsilon_0 EAd$

12. Two capacitors each of $1\mu F$ capacitance are connected in parallel and are then charged by 200 $volts\ d.c.$ supply. The total energy of their charges (in joules) is
a) 0.01
b) 0.02
c) 0.04
d) 0.06

13. Identify the wrong statement in the following. Coulomb's law correctly described the electric force that
a) binds the electrons of an atom to its nucleus
b) binds the protons and neutrons in the nucleus of an atom
c) binds atoms together to form molecules
d) Binds atoms and molecules to from solids

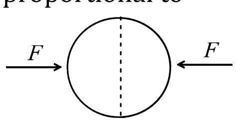
14. When one electron is taken towards the other electron, then the electric potential energy of the system
a) Decreases
b) Increases
c) Remains unchanged
d) Becomes zero

15. All capacitors used in the diagram are identical and each is of capacitance C. Then the effective capacitance between the points A and B is



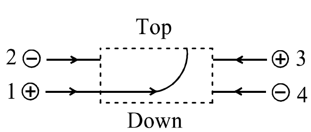
a) $1.5C$
b) $6C$
c) C
d) $3C$

16. A uniformly charged thin spherical shell of radius R carries uniform surface charge density of σ per unit area. It is made of two hemispherical shells, held together by pressing them with force F (see figure). F is proportional to



a) $\frac{1}{\varepsilon_0}\sigma^2 R^2$
b) $\frac{1}{\varepsilon_0}\sigma^2 R$
c) $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R}$
d) $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R^2}$

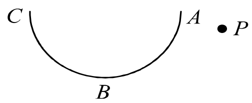
17. The figure shows the path of a positively charged particle 1 through a rectangular region of uniform electric field as shown in the figure. What is the direction of electric field and the direction of particles 2, 3 and 4



a) Top; down, top, down
b) Top; down, down, top
c) Down; top, top, down
d) Down; top, down, down

18. The capacitance of a metallic sphere will be $1\mu F$, if its radius is nearly
a) $9km$
b) $10m$
c) $1.11\ m$
d) $1.11\ cm$

19. 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



a) $W_A = W_B = W_C$ b) $W_A = W_B = W_C = 0$ c) $W_A > W_B > W_C$ d) $W_A < W_B < W_C$

20. The electric field at a point on equatorial line of a dipole and direction of the dipole moment
a) Will be parallel
b) Will be in opposite direction
c) Will be perpendicular
d) Are not related

21. A solid sphere of radius $R_1$and volume charge density $\rho = \frac{\rho_0}{r}$ is enclosed by a hollow sphere of radius R_2 with negative surface charge densityσ, such that the total charge in the system is zero, ρ_0 is a positive constant and r is the distance from the centre of sphere. The ratio $\frac{R_2}{R_2}$ is
a) $\frac{\sigma}{\rho_0}$ b) $\sqrt{2\sigma}/\rho_0$ c) $\sqrt{\rho_0}/2\sigma$ d) $\frac{\rho_0}{\sigma}$

22. The voltage of clouds is 4×10^6 $volt$ with respect to ground. In a lightening strike lasting 100 $m\ sec$, a charge of 4 coulombs is delivered to the ground. The power of lightening strike is
a) 160 MW b) 80 MW c) 20 MW d) 500 KW

23. Two point charge $-q$ and $+q/2$ are situated at the origin and at the point $(a, 0,0)$ respectively. The point along the X-axis where the electric field vanishes is
a) $x = \frac{a}{\sqrt{2}}$ b) $x = \sqrt{2}a$ c) $x = \frac{\sqrt{2}a}{\sqrt{2}-1}$ d) $x = \frac{\sqrt{2}a}{\sqrt{2}+1}$

24. A $6\mu F$ capacitor is charged from 10 $volts$ to 20 $volts$. Increase in energy will be
a) $18 \times 10^{-4}\ J$ b) $9 \times 10^{-4}\ J$ c) $4.5 \times 10^{-4}\ J$ d) $9 \times 10^{-6}\ J$

25. A ring of radius r carries a charge Q uniformly distributed over its length. A charge q is placed at its centre will experience a force equal to
a) $\frac{qQ}{4\pi\varepsilon_0 r^2}$ b) $\frac{qQ}{8\pi\varepsilon_0 r^3}$ c) Zero d) None of these

26. Value of potential at a point due to a point charge is
a) Inversely proportional to square of the distance
b) Directly proportional to square of the distance
c) Inversely proportional to the distance
d) Directly proportional to the distance

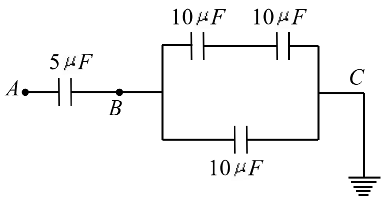
27. The distance between a proton and electron both having a charge 1.6×10^{-19} $coulomb$, of a hydrogen atom is $10^{-10}$$metre$. The value of intensity of electric field produced on electron due to proton will be
a) $2.304 \times 10^{-10} N/C$ b) 14.4 V/m c) 16V/m d) $1.44 \times 10^{11} N/C$

28. A capacitor of capacity C has charge Q and stored energy is W. If the charge is increased to $2Q$, the stored energy will be
a) $2W$ b) $W/2$ c) $4W$ d) $W/4$

29. The equivalent capacitance of three capacitors of capacitance C_1, C_2 and C_3 are connected in parallel is 12 units and product $C_1.C_2.C_3 = 48$ unit. When the capacitors C_1 and C_2 are connected in parallel, the equivalent capacitance is 6 units. Then the capacitances are
a) 2, 3, 7 b) 1, 5, 2, 5, 8 c) 1, 5, 6 d) 4, 2, 6

30. 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
a) 22.8 cm/s b) 228 cm/s c) 16.8 m/s d) 168 m/s

31. In the given circuit if point C is connected to the earth and a potential of $+2000\ V$ is given to the point A, the potential at B is



a) 1500 V b) 1000 V c) 500 V d) 400 V

32. When two identical capacitors are in series have $3\mu F$ capacitance and when parallel $12\mu F$. What is the capacitance of each

a) $6\mu\ F$ b) $3\mu\ F$ c) $12\mu\ F$ d) $9\mu\ F$

33. 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

a) 6 m b) 12 m c) 36 m d) 144 m

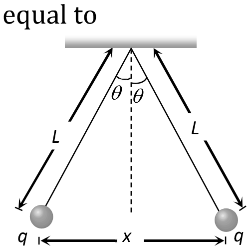
34. Let $P(r) = \frac{Q}{\pi R^4} r$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point $'p'$ inside the sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is

a) 0 b) $\frac{Q}{4\pi \in_0 r_1^2}$ c) $\frac{Qr_1^2}{4\pi \in_0 R^4}$ d) $\frac{Qr_1^2}{3\pi \in_0 R^4}$

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

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

36. In the given figure two tiny conducting balls of identical mass m and identical charge q hang from non-conducting threads of equal length L. Assume that θ is so small that $\tan\theta \approx \sin\theta$, then for equilibrium x is equal to

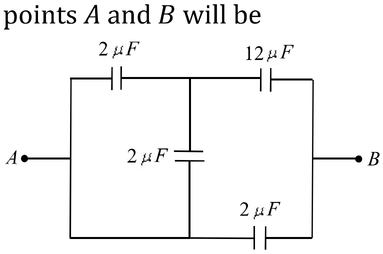


a) $\left(\frac{q^2 L}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$ b) $\left(\frac{qL^2}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$ c) $\left(\frac{q^2 L^2}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$ d) $\left(\frac{q^2 L}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

37. Charge q_2 of mass m revolves around a stationary charge q_1 in a circular orbit of radius r. The orbital periodic time of q_2 would be

a) $\left[\frac{4\pi^3 mr^2}{kq_1 q_2}\right]^{1/2}$ b) $\left[\frac{kq_1 q_2}{4\pi^2 mr^2}\right]^{1/2}$ c) $\left[\frac{4\pi^2 mr^4}{kq_1 q_2}\right]^{1/2}$ d) $\left[\frac{4\pi^2 mr^2}{kq_1 q_2}\right]^{1/2}$

38. Four capacitors are connected in a circuit as shown in the figure. The effective capacitance in μF between points A and B will be



a) $\frac{28}{9}$ b) 4 c) 5 d) 18

39. Identify the WRONG statement

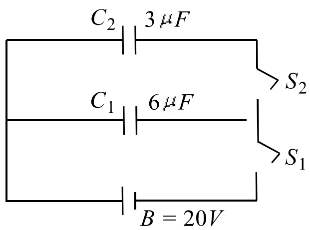
a) The electrical potential energy of a system of two protons shall increase if the separation between the two is decreased

b) The electrical potential energy of a proton electron system will increase if the separation between the two is decreased

c) The electrical potential energy of a proton electron system will increase if the separation between the two is increased

d) The electrical potential energy of a system of two electrons shall increase if the separation between the two is decreased

40. In the circuit shown here $C_1 = 6\mu F, C_2 = 3\mu F$ and battery $B = 20V$. The switch S_1 is first closed. It is then opened and afterwards S_2 is closed. What is the charge finally on C_2



a) $120\mu C$ b) $80\mu C$ c) $40\mu C$ d) $20\mu C$

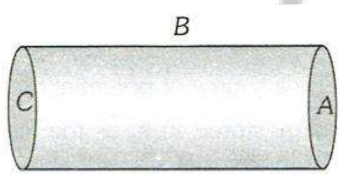
41. Two parallel infinite line charges $+\lambda$ and $-\lambda$ are placed with a separation distance R in free space. The net electric field exactly mid-way between the two line charges is

a) Zero b) $\frac{2\lambda}{\pi\varepsilon_0 R}$ c) $\frac{\lambda}{\pi\varepsilon_0 R}$ d) $\frac{\lambda}{2\pi\varepsilon_0 R}$

42. An α −particle of mass $6.4 \times 10^{-27} kg$ and charge $3.2 \times 10^{-19} C$ is situated in a uniform electric field of $1.6 \times 10^5 Vm^{-1}$. The velocity of the particle at the end of $2 \times 10^{-2} m$ path when it starts from rest is

a) $2\sqrt{3} \times 10^5 ms^{-1}$ b) $8 \times 10^5 ms^{-1}$ c) $16 \times 10^5 ms^{-1}$ d) $4\sqrt{2} \times 10^5 ms^{-1}$

43. A hollow cylinder has a charge q coulomb within it. If ϕ is the electric flux in units of $volt - meter$ associated with the curved surface B, the flux linked with the plane surface A in units of $volt - meter$ will be



a) $\frac{1}{2}\left(\frac{q}{\epsilon_0} - \phi\right)$ b) $\frac{q}{2\epsilon_0}$ c) $\frac{\phi}{3}$ d) $\frac{q}{\epsilon_0} - \phi$

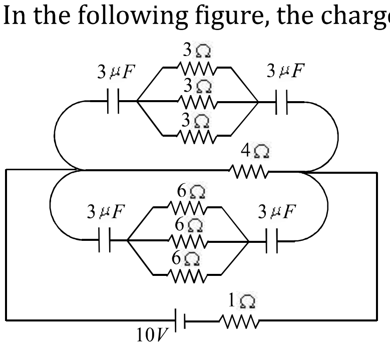
44. The dimensional formula of electric intensity is

a) $[MLT^{-2} A^{-1}]$ b) $[MLT^{-3} A^{-1}]$ c) $[ML^2T^{-3} A^{-1}]$ d) $[ML^2T^{-3} A^{-2}]$

45. A parallel plate capacitor having a plate separation of 2 mm is charged by connecting it to a 300 V supply. The energy density is

a) 0.01 J/m^3 b) 0.1 J/m^3 c) 1.0 J/m^3 d) 10 J/m^3

46. In the following figure, the charge on each condenser in the steady state will be

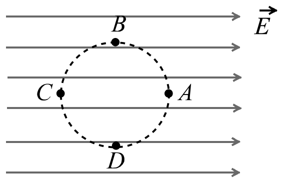


a) 3 μC b) 6 μC c) 9 μC d) 12 μC

47. 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 1cm

a) 10 V b) 250 V c) 1000 V d) 2500 V

48. The electric field in a region surrounding the origin is uniform and along the x-axis. A small circle is drawn with the centre at the origin cutting the axes at points A, B, C, D having co-ordinates $(a, 0), (0, a), (-a, 0), (0, -a)$; respectively as shown in figure then potential in minimum at the point



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

49. 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

a) 1 : 8 b) $-8: 1$ c) 1 : 2 d) $-2: 1$

50. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is

a) Zero b) E c) $\frac{E}{2}$ d) $\frac{E}{3}$

51. If a slab of insulating material $4 \times 10^{-3} m$ thick is introduced between the plates of a parallel plate capacitor, the separation between plates has to be increased by $3.5 \times 10^{-3} m$ to restore the capacity to original value. The dielectric constant of the material will be

a) 6 b) 8 c) 10 d) 12

52. To form a composite $16\mu F$, $1000V$ capacitor from a supply of identical capacitors marked $8\mu F$, $250V$, we require a minimum number of capacitors

a) 40 b) 32 c) 8 d) 2

53. The unit of intensity of electric field is

a) $Newton/Coulomb$ b) $Joule/Coulomb$ c) $Volt - metre$ d) $Newton/metre$

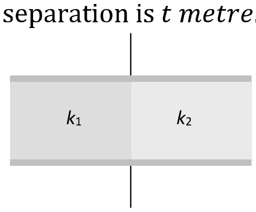
54. Under the action of a given coulombic force the acceleration of an electron is $2.5 \times 10^{22} \mathrm{m/s^2}$. Then the magnitude of acceleration of a proton under the action of same force is nearly

a) $1.6 \times 10^{-19} \mathrm{m/s^2}$ b) $9.1 \times 10^{31} \mathrm{m/s^2}$ c) $1.5 \times 10^{19} \mathrm{m/s^2}$ d) $1.6 \times 10^{27} \mathrm{m/s^2}$

55. An object A has a charge of -2μ C and the object B has a charge of $+6\ \mu\ C$. Which statement is true?

a) $F_{AB} = -3F_{BA}$ b) $F_{AB} = -F_{BA}$ c) $3F_{AB} = -F_{BA}$ d) $F_{AB} = 4F_{BA}$

56. A parallel plate condenser is filled with two dielectrics as shown. Area of each plate is $A\ metre^2$ and the separation is $t\ metre$. The dielectric constants are k_1 and k_2 respectively. Its capacitance in farad will be



a) $\frac{\varepsilon_0 A}{t}(k_1 + k_2)$ b) $\frac{\varepsilon_0 A}{t} \cdot \frac{k_1 + k_2}{2}$ c) $\frac{2\varepsilon_0 A}{t}(k_1 + k_2)$ d) $\frac{\varepsilon_0 A}{t} \cdot \frac{k_1 - k_2}{2}$

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

a) A force and a torque b) A force but not a torque

c) A torque but not a torque d) Neither a force nor a torque

58. Two small conducting sphere of equal radius have charges $+10\ \mu$C and -20μC 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

a) 1 : 2 b) -8 : 1 c) 1 : 8 d) -2 : 1

59. The potential on the hollow sphere of radius 1 m is 100 volt. The potential at $1/4$ m from the centre of sphere is

a) 1000 $volt$ b) 500 $volt$ c) 250 $volt$ d) 0 $volt$

60. Two opposite and equal charges 4×10^{-8} $coulomb$ when placed $2 \times 10^{-2} cm$ 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 in through 180^{o} will be

a) $64 \times 10^{-4} Nm$ and 64×10^{-4} J b) $32 \times 10^{-4} Nm$ and 32×10^{-4} J

c) $64 \times 10^{-4} Nm$ and 32×10^{-4} J d) $32 \times 10^{-4} Nm$ and 64×10^{-4} J

61. The distance between two point charges is increased by 10%. The force of interaction between them

a) Increased by 10% b) decreased by 10% c) decreased by 17% d) decreased by 21%

62. What about Gauss theorem is not incorrect

a) It can be derived by using Coulomb's Law

b) It is valid for conservative field obeys inverse square root law

c) Gauss theorem is not applicable in gravitation

d) (A) & (B) both

63. Eight drops of mercury of equal radii possessing equal charges combine to form a big drop. Then the capacitance of bigger drop compared to each individual small drop is

a) 8 times b) 4 times c) 2 times d) 32 times

64. A $2\mu F$ capacitor is charged to 100 $volt$ and then its plates are connected by a conducting wire. The heat produced is

a) 1 J b) 0.1 J c) 0.01 J d) 0.001 J

65. There is 10 units of charge at the centre of a circle of radius $10m$. The work done in moving 1 unit of charge around the circle once is

a) Zero b) 10 units c) 100 units d) 1 unit

66. What is called electrical energy tank

a) Resistor b) Inductance c) Capacitor d) Motor

67. Charges $+2q, +q$ and $+q$ are placed at the corners A, B and C of an equilateral triangle ABC. If E is the electric field at the circumcentre O of the triangle, due to the charge $+q$, then the magnitude and direction of the resultant electric field at O is

a) E along AO b) $2E$ along AO c) E along BO d) E along CO

68. The electric field near a conducting surface having a uniform surface charge density σ is given by

a) $\frac{\sigma}{\varepsilon_0}$ and is parallel to the surface b) $\frac{2\sigma}{\varepsilon_0}$ and is parallel to the surface

c) $\frac{\sigma}{\varepsilon_0}$ and is normal to the surface d) $\frac{2\sigma}{\varepsilon_0}$ and is normal to the surface

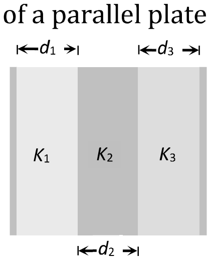
69. In a capacitor of capacitance 20μ F, the distance between the plates is $2mm$. If a dielectric of width 1 mm and dielectric constant 2 is inserted between the plates, then the new capacitance is

a) 2μ F b) 15.5μ F c) 26.6μ F d) 32μ F

70. There exists an electric field of 1N/C along y-direction. The flux passing through the square of 1m placed in xy plane inside the electric field is

a) 1.0 N/m^2 b) $10.0 Nm^2/C$ c) $2.0 Nm^2/C$ d) Zero

71. The expression for the capacity of the capacitor formed by compound dielectric placed between the plates of a parallel plate capacitor as shown in figure, will be (area of plate $= A$)



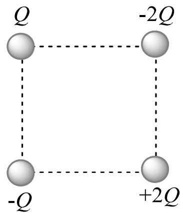
a) $\dfrac{\varepsilon_0 A}{\left(\frac{d_1}{K_1}+\frac{d_2}{K_2}+\frac{d_3}{K_3}\right)}$

b) $\dfrac{\varepsilon_0 A}{\left(\frac{d_1+d_2+d_3}{K_1+K_2+K_3}\right)}$

c) $\dfrac{\varepsilon_0 A(K_1K_2K_3)}{d_1d_2d_3}$

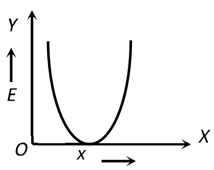
d) $\varepsilon_0\left(\dfrac{AK_1}{d_1}+\dfrac{AK_2}{d_2}+\dfrac{AK_3}{d_3}\right)$

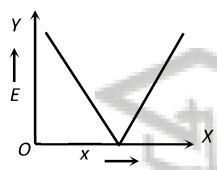
72. Four charges are placed on corners of a square as shown in figure having side of 5 cm. If Q is one microcoulomb, then electric field intensity at centre will be

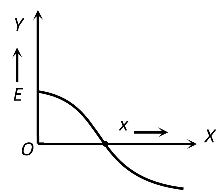


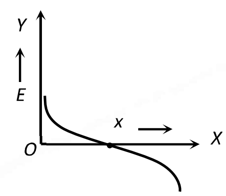
a) $1.02 \times 10^7 N/C$ upwards
b) $2.04 \times 10^7 N/C$ downwards
c) $2.04 \times 10^7 N/C$ upwards
d) $1.02 \times 10^7 N/C$ downwards

73. Two identical point charges are placed at a separation of d. P is a point on the line joining the charges, at a distance x from any one charge. The field at P is E, E is plotted against x for values of x from close to zero to slightly less than d. Which of the following represents the resulting curve

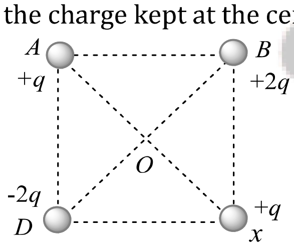
a) 

b) 

c) 

d) 

74. Four charges arranged the at the corners of a square $ABCD$, as shown in the adjoining figure. The force on the charge kept at the centre O is



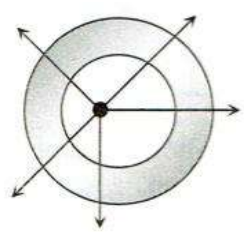
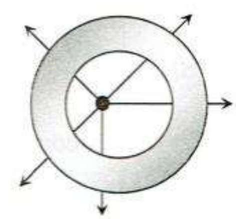
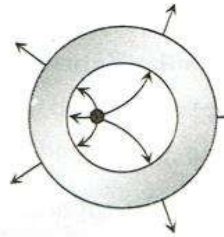
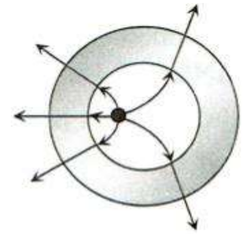
a) Zero
b) Along the diagonal AC
c) Along the diagonal BD
d) Perpendicular to side AB

75. Four metal conductors having different shapes
1. A sphere 2. Cylindrical
3. Pear 4. Lightning conductor
Are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is
a) 1 b) 2 c) 3 d) 4

76. A capacitor of capacitance value $1\mu\, F$ is charged to 30 V and the battery is then disconnected. If it is connected across a $2\mu\, F$ capacitor, the energy lost by the system is
a) 300 μJ b) 450 μJ c) 225 μJ d) 150 μJ

77. 64 small drops of mercury, each of radius r and charge q coalesce to form a big drop. The ratio of the surface density of charge of each small drop with that of the big drop is
a) 1 : 64 b) 64 : 1 c) 4 : 1 d) 1 : 4

78. A metallic shell has a point charge $'q'$ kept inside its cavity. Which one of the following diagrams correctly represents the electric lines of forces

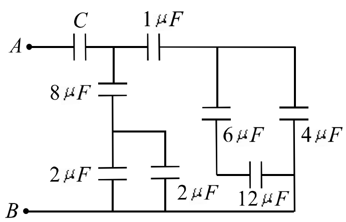
a)  b)  c)  d) 

79. If the circumference of a sphere is 2m, then capacitance of sphere in water would be
a) 2700 pF b) 2760 pF c) 2780 pF d) 2800 pF

80. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will
a) Be doubled b) Increase four times c) Be reduced to half d) Remain the same

81. The electric dipole moment of an electron and a proton 4.3 nm apart is
a) $6.88 \times 10^{-28} cm$ b) $2.56 \times 10^{-29} c^2/m$ c) $3.72 \times 10^{-14} c/m$ d) $11 \times 10^{-46} c^2/m$

82. In the following circuit, the resultant capacitance between A and B is $1\mu F$. Then value of C is



a) $\frac{32}{11}\mu F$ b) $\frac{11}{32}\mu F$ c) $\frac{23}{32}\mu F$ d) $\frac{32}{23}\mu F$

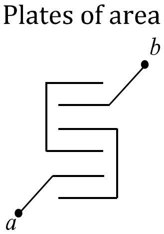
83. Charges 5μC and 10μC are placed 1 m apart. Work done to bring these charges at a distance 0.5 m from each other is
a) 9×10^4 J b) 18×10^4 J c) 45×10^{-2} J d) 9×10^{-1} J

84. A capacitor of capacitance $6\mu F$ is charged upto 100 $volt$. The energy stored in the capacitor is
a) 0.6 $Joule$ b) 0.06 $Joule$ c) 0.03 $Joule$ d) 0.3 $Joule$

85. Two point charges $-q$ and $+q$ are located at points $(0,0-a)$ and $(0,0a)$, respectively. The potential at a point $(0,0,z)$ where $z > $ a is
a) $\frac{qa}{4\pi\varepsilon_0 z^2}$ b) $\frac{q}{4\pi\varepsilon_0 a}$ c) $\frac{2qa}{4\pi\varepsilon_0(z^2-a^2)}$ d) $\frac{2qa}{4\pi\varepsilon_0(z^2+a^2)}$

86. A hollow sphere of charge does not produce an electric field at any
a) Interior point b) Outer point c) Beyond 2m d) Beyond 10m

87. Plates of area A are arranged as shown. The distance between each plate is d, the net capacitance is



a) $\frac{\varepsilon_0 A}{d}$ b) $\frac{7\varepsilon_0 A}{d}$ c) $\frac{6\varepsilon_0 A}{d}$ d) $\frac{5\varepsilon_0 A}{d}$

88. Two point charges $(+Q)$ and $(-2Q)$ are fixed on the X-axis at positions a and $2a$ from origin respectively. At what positions on the axis, the resultant electric field is zero
a) Only $x = \sqrt{2}a$ b) Only $x = -\sqrt{2}a$ c) Both $x = \pm\sqrt{2}a$ d) $x = \frac{3a}{2}$ only

89. A non-conducting ring of radius $0.5m$ carries a total charge of $1.11 \times 10^{-10}C$ distributed non-uniformly on its circumference producing an electric field $\vec{E}$ everywhere in space. The value of the line integral $\int_{l=\infty}^{l=0} -\vec{E}.\vec{dl}$ ($l = 0$ being centre of the ring) in volt is
a) +2 b) −1 c) −2 d) Zero

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

a) 20 N/C b) 500 N/C c) 5 N/C d) 250 N/C

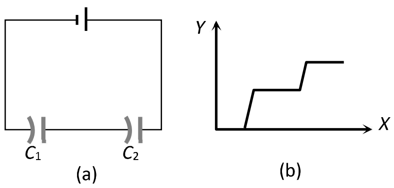
91. Work done by an external agent in separating the parallel plate capacitor is

a) CV b) $\frac{1}{2}C^2V$ c) $\frac{1}{2}CV^2$ d) None of these

92. 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

a) 8.8×10^{14} m/sec^2 b) 6.2×10^{13} m/sec^2 c) $5.4 \times 10^{12} m/sec^2$ d) Zero

93. Figure (a) shows two capacitors connected in series and joined to a battery. The graph in figure (b) shows the variation in potential as one moves from left to right on the branch containing the capacitors, if



a) $C_1 > C_2$ b) $C_1 = C_2$

c) $C_1 < C_2$ d) The information is not sufficient to decide the relation between $C1$ and C_2

94. If the electric flux entering and leaving an enclosed surface respectively are ϕ_1 and ϕ_2, the electric charge inside the surface will be

a) $(\phi_2 - \phi_1)\varepsilon_0$ b) $\frac{\phi_1 + \phi_2}{\varepsilon_0}$ c) $\frac{\phi_1 - \phi_2}{\varepsilon_0}$ d) $\varepsilon_0(\phi_1 - \phi_2)$

95. Two identify 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

a) 0 $volts/meter$ b) $\frac{\sigma}{2\varepsilon_0}$ $volts/meter$ c) $\frac{\sigma}{\varepsilon_0}$ $volts/meter$ d) $\frac{2\sigma}{\varepsilon_0}$ $volts/meter$

96. 1000 small water drops each of radius r and charge q coalesce together to form one spherical drop. The potential of the big drop is larger than that of the smaller drop by a factor of

a) 1000 b) 100 c) 10 d) 1

97. Two capacitors of $3pF$ and $6pF$ are connected in series and a potential difference of 5000 V is applied across the combination. They are then disconnected and reconnected in parallel. The potential between the plates is

a) $2250V$ b) $2222V$ c) $2.25 \times 10^6 V$ d) $1.1 \times 10^6 V$

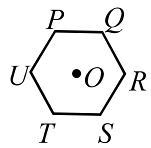
98. Two equal point charges are fixed at $x = -a$ and $x = +a$ on the x-axis. Another point charge Q is placed at the origin. The change in the electrical potential energy of Q, when it is displaced by a small distance x along the x-axis, is approximately proportional to

a) x b) x^2 c) x^3 d) $1/x$

99. The capacity and the energy stored in a parallel plate condenser with air between its plates are respectively C_0 and W_0. If the air is replaced by glass (dielectric constant = 5) between the plates, the capacity of the plates and the energy stored in it will respectively be

a) $5C_0, 5W_0$ b) $5C_0, \frac{W_0}{5}$ c) $\frac{C_0}{5}, 5W_0$ d) $\frac{C_0}{5}, \frac{W_0}{5}$

100. Six charges, three positive and three negative of equal magnitude are to be placed at the vertices of a regular hexagon such that the electric field at O is double the electric field when only one positive charge of same magnitude is placed at R. Which of the following arrangements of charges is possible for P, Q, R, S, T and U respectively?



a) $+,-,+,-,-,+$ b) $+,-,+,-,+,-$ c) $+,+,-,+,-,-$ d) $-,+,+,-,+,-$

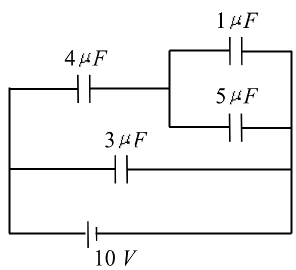
101. Two identical conductors of copper and aluminium are placed in an identical electric fields. The magnitude of induced charge in the aluminium will be
a) Zero b) Greater than in copper
c) Equal to that in copper d) Less than in copper

102. 64 drops each having the capacity C and potential V are combined to form a big drop. If the charge on the small drop is q, then the charge on the big drop will be
a) $2q$ b) $4q$ c) $16q$ d) $64q$

103. A capacitor $4\ \mu F$ charged to $50\ V$ is connected to another capacitor of $2\mu F$ charged to $100\ V$ with plates of like charges connected together. The total energy before and after connection in multiples of $(10^{-2}\ J)$ is
a) 1.5 and 1.33 b) 1.33 and 1.5 c) 3.0 and 2.67 d) 2.67 and 3.0

104. 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
a) π b) $\pi/2$ c) Zero d) $3\pi/2$

105. The charge on $4\ \mu F$ capacitor in the given circuit is …. in μC

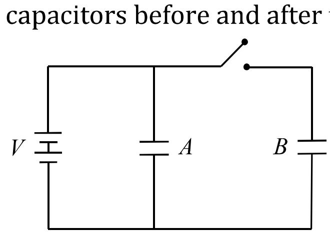


a) 12 b) 24 c) 36 d) 32

106. The electric field at a point due to an electric dipole, on an axis inclined at an angle $\theta (< 90°)$to the dipole axis, is perpendicular to the dipole axis, if the angle θ is
a) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ b) $\tan^{-1}(\sqrt{2})$ c) $\tan^{-1}\left(\frac{1}{2}\right)$ d) $\tan^{-1}(2)$

107. Minimum number of capacitors of $2\mu F$ capacitance each required to obtain a capacitor of $5\mu F$ will be
a) Three b) Four c) Five d) Six

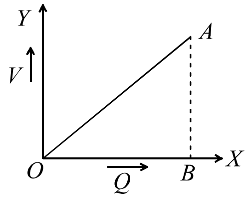
108. Figure given below shows two identical parallel plate capacitors connected to a battery with switch S closed. The switch is now opened and the free space between the plate of capacitors is filled with a dielectric of dielectric constant 3. What will be the ratio of total electrostatic energy stored in both capacitors before and after the introduction of the dielectric



a) 3 : 1 b) 5 : 1 c) 3 : 5 d) 5 : 3

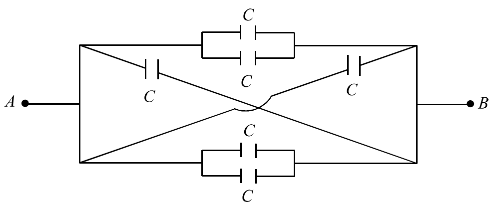
109. A condenser having a capacity of $6\mu F$ is charged to $100\ V$ and is then joined to an uncharged condenser of $14\mu F$ and then removed. The ratio of the charges on $6\mu F$ and $14\mu F$ and the potential of $6\mu F$ will be
a) $\frac{6}{14}$ and 50 $volt$ b) $\frac{14}{6}$ and 30 $volt$ c) $\frac{6}{14}$ and 30 $volt$ d) $\frac{14}{6}$ and 0 $volt$

110. Charge Q on a capacitor varies with voltage V as shown in the figure, where Q is taken along the X-axis and V along the Y-axis. The area of triangle OAB represents



a) Capacitance
b) Capacitive reactance
c) Magnetic field between the plates
d) Energy stored in the capacitor

111. Six capacitors each of capacitance of $2\mu F$ are connected as shown in the figure. The effective capacitance between A and B is



a) $12\mu F$
b) $8/3\mu F$
c) $3\mu F$
d) $6\mu F$

112. What is not true for equipotential surface for uniform electric field
a) Equipotential surface is flat
b) Equipotential surface is spherical
c) Electric lines are perpendicular to equipotential surface
d) Work done is zero

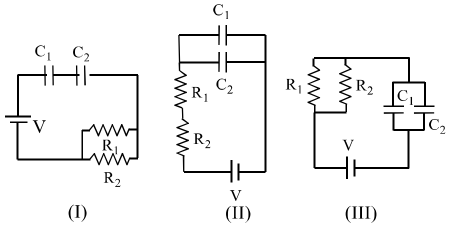
113. Electric charges of $+10\mu C, +5\mu C, -3\mu C$ and $+ 8\mu C$ are placed at the corners of a square of side $\sqrt{2}m$. the potential at the centre of the square is
a) $1.8\ V$
b) $1.8 \times 10^6\ V$
c) $1.8 \times 10^5\ V$
d) $1.8 \times 10^4\ V$

114. A series combination of three capacitors of capacities $1\mu\ F, 2\mu\ F$ and $8\mu\ F$ is connected to a battery of e.m.f. 13 $volt$. The potential difference across the plates of $2\ \mu\ F$ capacitor will be
a) $1V$
b) $8V$
c) $4V$
d) $\frac{13}{3}V$

115. The ratio of momenta of an electron and an α –particle which are accelerated from rest by a potential difference of 100 $volt$ is
a) 1
b) $\sqrt{\frac{2m_e}{m_\alpha}}$
c) $\sqrt{\frac{m_e}{m_\alpha}}$
d) $\sqrt{\frac{m_e}{2m_\alpha}}$

116. 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
a) 0.13 V
b) 1.3 V
c) 13 V
d) 130 V

117. Given,
$R_1 = 1\Omega \quad C_1 = 2\mu F$
$R_2 = 2\Omega \quad C_2 = 4\mu F$

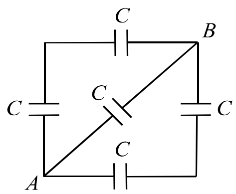


The time constant (in $\mu\ s$) for the circuits, I, II, III, are respectively
a) 18, 18/9, 4
b) 18,4,8/9
c) 4,8/9,18
d) 8/9,18,4

118. An air capacitor of capacity $C = 10\mu F$ is connected to a constant voltage battery of 12 V. Now the space between the plates is filled with a liquid of dielectric constant 5. The charge that flows now from battery to the capacitor is

a) $120\mu C$ b) $699\mu C$ c) $480\mu C$ d) $24\mu C$

119. In the figure shown, the effective capacitance between the points A and B, if each has capacitance C, is



a) $2C$ b) $\frac{C}{5}$ c) $5C$ d) $\frac{C}{2}$

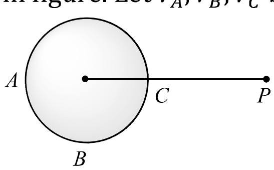
120. Two large vertical and parallel metal plates having a separation of 1 cm are connected to a DC voltage source of potential difference X. A proton is released at rest midway between the two plates. It is found to move at 45^o to the vertical JUST after release. Then X is nearly

a) $1 \times 10^{-5} V$ b) $1 \times 10^{-7} V$ c) $1 \times 10^{-9} V$ d) $1 \times 10^{-10} V$

121. An electron enters in an electric field with its velocity in the direction of the electric lines of force. Then

a) The path of the electron will be a circle b) The path of the electron will be a parabola
c) The velocity of the electron will decrease d) The velocity of the electron will increase

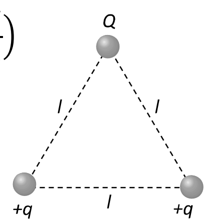
122. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure. Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then



a) $V_C > V_B$ b) $V_B > V_C$ c) $V_A > V_B$ d) $V_A = V_C$

123. 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

a) $\left(-\frac{q}{2}\right)$ b) $(-q)$ c) $(+q)$ d) Zero



124. Two point charges 100 μC and 5 μC are placed at points A and B respectively with $AB = 40\ cm$. The work done by external force in displacing the charge 5 μC from B to C, where $BC = 30 cm$, angle $ABC = \frac{\pi}{2}$ and $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2/C^2$

a) $9\ J$
b) $\frac{81}{20} J$
c) $\frac{9}{25} J$
d) $-\frac{9}{4} J$

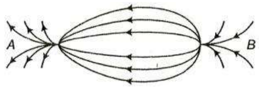
125. A neutral water molecule (H_2O) in its vapour state has an electric dipole moment of 6×10^{-30} Cm. If the molecule is placed in an electric field of 1.5×10^4 NC^{-1}, the maximum torque that the field can exert on it is nearly

a) 4.5×10^{-26} N-m b) 4×10^{-34} N-m c) 9×10^{-26} N-m d) 6×10^{-26} N-m

126. Two identical conducting spheres carrying different charges attract each other with a force F when placed in air medium at a distance d apart. The spheres are brought into contact and then taken to their original positions. Now the two spheres repel each other with a force whose magnitude is equal to that of the initial attractive force. The ratio between initial charges on the spheres is

a) $-(3+\sqrt{8})$ only b) $-3+\sqrt{8}$ only
c) $-3(3+\sqrt{8})$ or $(-3+\sqrt{8})$ d) $+\sqrt{3}$

127. The spatial distribution of the electric field due to charges (A, B) is shown in figure. Which one of the following statements is correct?



a) A is + ve and B − ve, $|A| > |B|$ b) A is − ve and B + ve, $|A| = |B|$
c) Both are +ve but $A > B$ d) Both are −ve but $A > B$

128. Two equal charges are separated by a distance d. A third charge placed on a perpendicular bisector at x distance will experience maximum coulomb force when

a) $x = \frac{d}{\sqrt{2}}$ b) $x = \frac{d}{2}$ c) $x = \frac{d}{2\sqrt{2}}$ d) $x = \frac{d}{2\sqrt{3}}$

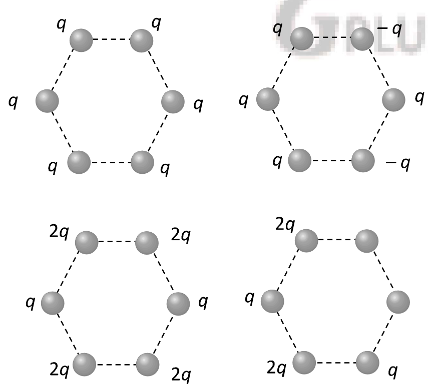
129. Four point charges $-Q, -q, 2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is

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

130. 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

a) Remains equal to T b) Less than T c) Greater than T d) Infinite

131. Figures below show regular hexagons, which charges at the vertices. In which of the following cases the electric field at the centre is not zero



(3) (4)

a) 1 b) 2 c) 3 d) 4

132. Kinetic energy of an electron accelerated in a potential difference of 100 V is

a) $1.6 \times 10^{-17}\,J$ b) $1.6 \times 10^{21}\,J$ c) $1.6 \times 10^{-29}\,J$ d) $1.6 \times 10^{-34}\,J$

133. A parallel plate capacitor of capacity C_0 is charged to a potential V_0
(i) The energy stored in the capacitor when the battery is disconnected and the separation is doubled E_1
(ii) The energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is doubled is E_2. Then E_1/E_2 value is

a) 4 b) 3/2 c) 2 d) 1/2

134. Two conducting spheres of radii R_1 and R_2 having charges Q_1 and Q_2 respectively are connected to each other. There is

a) No change in the energy of the system b) An increase in the energy of the system

c) Always a decrease in the energy of the system
d) A decrease in the energy of the system unless $Q_1R_2 = Q_2R_1$

135. 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 $\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \frac{N-m^2}{coulomb^2}\right]$

a) 2.5 $micro - coulomb$ b) 2.0 $micro - coulomb$ c) 1.0 $micro - coulomb$ d) 0.5 $micro - coulomb$

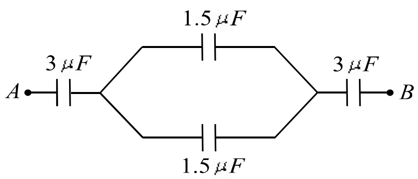
136. A 10 μF capacitor is charged to a potential difference of 1000 V. The terminals of the charged capacitor are disconnected from the power supply and connected to the terminals of an uncharged 6μF capacitor. What is the final potential difference across each capacitor

a) 167 V b) 100 V c) 625 V d) 250 V

137. A charge q is placed at the centre of the line joining two equal point charges each equal to$Q$. The system of three charges will be in equilibrium if $q$is equal to

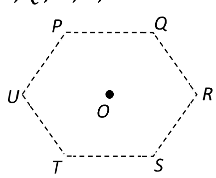
a) $+Q/4$ b) $-Q/2$ c) $+Q/2$ d) $-Q/4$

138. The capacitance between the points A and B in the given circuit will be



a) 1 μ F b) 2 μ F c) 3 μ F d) 4 μ F

139. Six charges, three positive and three negative of equal magnitude are to be placed at the vertices of a regular hexagon such that the electric field at O is double the electric field when only one positive charge of same magnitude is placed at R. Which of the following arrangements of charges is possible for P, Q, R, S, T and U respectively



a) $+,-,+,-,-,+$ b) $+,-,+,-,+,-$ c) $+,+,-,+,-,-$ d) $-,+,+,-,+,-$

140. A solid conducting sphere of radius R_1 is surrounded by another concentric hollow conducting sphere of radius R_2. The capacitance of this assembly is proportional to

a) $\frac{R_2 - R_1}{R_1R_2}$ b) $\frac{R_2 + R_1}{R_1R_2}$ c) $\frac{R_1R_2}{R_1 + R_2}$ d) $\frac{R_1R_2}{R_2 - R_1}$

141. The S.I. unit of electric flux is

a) $Weber$ b) $Newton\ per\ coulomb$ c) $Volt \times metre$ d) $Joule$ per $coulomb$

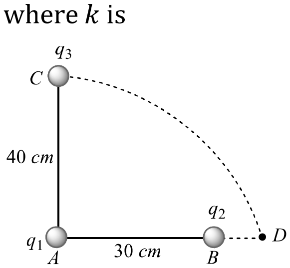
142. Electric potential is given by

$V = 6x - 8xy^2 - 8y + 6yz - 4z^2$

Then electric force acting on 2C point charge placed on origin will be

a) 2N b) 6N c) 8N d) 20N

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



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

144. Two capacitors connected in parallel having the capacities C_1 and C_2 are given $'q'$ charge, which is distributed among them. The ratio of the charge on C_1 and C_2 will be
a) $\frac{C_1}{C_2}$ b) $\frac{C_2}{C_1}$ c) C_1C_2 d) $\frac{1}{C_1C_2}$

145. An uniform electric field E exists along positive x-axis. The work done in moving a charge 0.5 C through a distance 2 m along a direction making an angle 60^o with x-axis is 10 J. Then the magnitude of electric field is
a) $5\ Vm^{-1}$ b) $2\ Vm^{-1}$ c) $\sqrt{5}Vm^{-1}$ d) $20\ Vm^{-1}$

146. Three capacitances of capacity $10\mu F$, $5\mu F$ and $5\mu F$ are connected in parallel. The total capacity will be
a) $10\mu F$ b) $5\mu F$ c) $20\mu F$ d) None of the above

147. The radius of a metallic sphere if its capacitance is $1/9F$, is
a) $10^6\ m$ b) $10^7\ m$ c) $10^9\ m$ d) $10^8\ m$

148. The potential at a point x (measured in μm) due to some charges situated on the x-axis is given by $V(x) = 20/(x^2 - 4)\ Volts$. The electric field E at $x = 4\mu m$ is given by
a) $5/3\ Volt/\mu m$ and in the $-ve\ x$ direction
b) $5/3\ Volt/\mu m$ and in the $+ve\ x$ direction
c) $10/9\ Volt/\mu m$ and in the $-ve\ x$ direction
d) $10/9\ Volt/\mu m$ and in the $+ve\ x$ direction

149. Charge motion within the Gaussian surface gives changing physical quantity
a) Electric field
b) Electric flux
c) Charge
d) Gaussian surface area

150. A point charge of 40 stat coulomb is placed 2 cm in front of an earthed metallic plane plate of large size. Then the force of attraction on the point charge is
a) 100 $dynes$ b) 160 $dynes$ c) 1600 $dynes$ d) 400 $dynes$

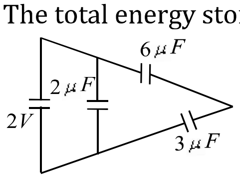
151. n identical condensers are joined in parallel and are charged to potential V. Now they are separated and joined in series. Then the total energy and potential difference of the combination will be
a) Energy and potential difference remain same
b) Energy remains same and potential difference is nV
c) Energy increases n times and potential difference is nV
d) Energy increases n times and potential difference remains same

152. A $4\mu F$ condenser is connected in parallel to another condenser of $8\mu F$. Both the condensers are then connected in series with a $12\mu F$ condenser and charged to 20 $volts$. The charge on the plate of $4\mu F$ condenser is
a) $3.3\mu C$ b) $40\mu C$ c) $80\mu C$ d) $240\mu C$

153. An uncharged capacitor is connected to a battery. On charging the capacitor
a) All the energy supplied is stored in the capacitor
b) Half the energy supplied is stored in the capacitor
c) The energy stored depends upon the capacity of the capacitor only
d) The energy stored depends upon the time for which the capacitor is charged

154. The condensers of capacity C_1 and C_2 are connected in parallel, then the equivalent capacitance is
a) $C_1 + C_2$ b) $\frac{C_1C_2}{C_1 + C_2}$ c) $\frac{C_1}{C_2}$ d) $\frac{C_2}{C_1}$

155. The total energy stored in the condenser system shown in the figure will be



a) $8\ \mu J$ b) $16\ \mu J$ c) $2\ \mu J$ d) $4\ \mu J$

156. 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

a) $Q_2 = \frac{Q}{R}, Q_1 = Q - \frac{Q}{R}$ b) $Q_2 = \frac{Q}{4}, Q_1 = Q - \frac{2Q}{3}$ c) $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{4}$ d) $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

157. A charge q is placed at the corner of a cube of side$a$. The electric flux through the cube is

a) $\frac{q}{\varepsilon_0}$ b) $\frac{q}{3\varepsilon_0}$ c) $\frac{q}{6\varepsilon_0}$ d) $\frac{q}{8\varepsilon_0}$

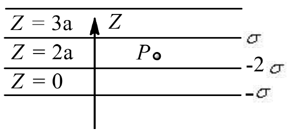
158. A parallel plate capacitor has a plate separation of 0.01 mm and use a dielectric (whose dielectric strength is 19 KV/mm) as an insulator. The maximum potential difference that can be applied to the terminals of the capacitor is

a) 190 V b) 290 V c) 95 V d) 350 V

159. If E_a be the electric field strength of a short dipole at a point on its axial line and E_e that on equatorial line at the same distance, then

a) $E_e = 2E_a$ b) $E_a = 2E_e$ c) $E_a = E_e$ d) None of these

160. Three infinitely charged sheets are kept parallel to $x - y$ plane having charge densities as shown in figure. Then the value of electric field at point P is



a) $-\frac{2\sigma}{\varepsilon_0}\hat{k}$ b) $\frac{2\sigma}{\varepsilon_0}\hat{k}$ c) $-\frac{4\sigma}{\varepsilon_0}\hat{k}$ d) $\frac{4\sigma}{\varepsilon_0}\hat{k}$

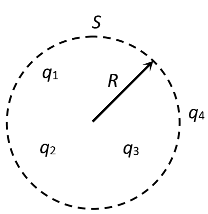
161. Three condensers each of capacitance $2F$ are put in series. The resultant capacitance is

a) $6F$ b) $\frac{3}{2}F$ c) $\frac{2}{3}F$ d) $5F$

162. A hollow conducting spherical shell of radius R is charged with Q coulomb. The amount of work done for moving any charge q from the centre to the surface of the shell will be

a) $\frac{qQ}{4\pi\varepsilon_0 R}$ b) Zero c) $\frac{Qq}{\pi\varepsilon_0 R}$ d) $\frac{Qq}{2\pi\varepsilon_0 R}$

163. 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



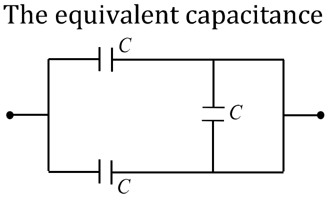
a) $\oint_s (\vec{E}_1 + \vec{E}_2 + \vec{E}_3).d\vec{A} = \frac{q_1 + q_2 + q_3}{2\varepsilon_0}$

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

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

d) None of the above

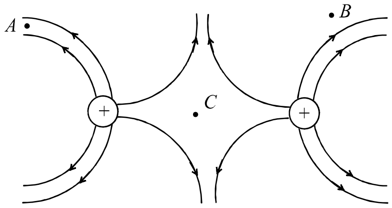
164. The equivalent capacitance of the combination shown in figure below is



a) $2C$ b) C c) $\frac{1}{2}C$ d) None of these

165. The figure below shows the electric field lines due to two positive charges. The magnitudes E_A, E_B and E_C

of the electric fields at points A, B and C respectively are related as



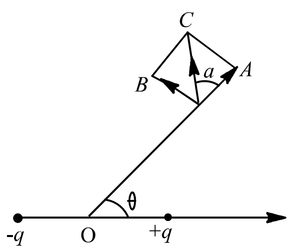
a) $E_A > E_B > E_C$ b) $E_B > E_A > E_C$ c) $E_A = E_B > E_C$ d) $E_A > E_B = E_C$

166. Top of the stratosphere has an electric field E (in units of V/m) nearly equal to
a) 0 b) 10 c) 100 d) 1000

167. Ten capacitor are joined in parallel and charged with a battery up to a potential V. They are then disconnected from battery and joined again in series then the potential of this combination will be
a) V b) $10V$ c) $5V$ d) $2V$

168. Two identical charged spherical drops each of capacitance C merge to form a single drop. The resultant capacitance is
a) Equal to $2C$ b) Greater than $2C$
c) Less than $2C$ but greater than C d) Less than C

169. 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 $\tan\alpha = \frac{1}{2}\tan\theta$.



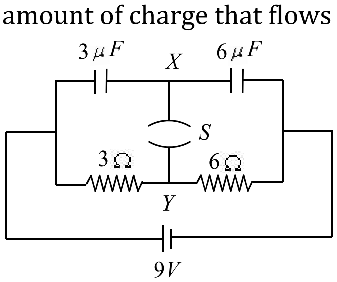
a) α b) θ c) $\theta + \alpha$ d) $2\theta + \alpha$

170. The displacement of a charge Q in the electric field $\vec{E} = e_1\hat{\imath} + e_2\hat{\jmath} + e_3\hat{k}$ is $\vec{r} = a\hat{\imath} + b\hat{\jmath}$. The work done is
a) $Q(ae_1 + be_2)$ b) $Q\sqrt{(ae_1)^2 + (be_2)^2}$
c) $Q(e_1 + e_2)\sqrt{a^2 + b^2}$ d) $Q\left(\sqrt{e_1^2 + e_2^2}\right)(a + b)$

171. Consider a parallel plate capacitor with plates 20 cm by 20 cm and separated by 2 mm. The dielectric constant of the material between the plates is 5. The plates are connected to a voltage sources of 500 V. The energy density of the field between the plates will be close to
a) 2.65 J/m^3 b) 1.95 J/m^3 c) 1.38 J/m^3 d) 0.69 J/m^3

172. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre .If the system is in equilibrium, the value of q is
a) $-\frac{Q}{4}(1 + 2\sqrt{2})$ b) $\frac{Q}{4}(1 + 2\sqrt{2})$ c) $-\frac{Q}{2}(1 + 2\sqrt{2})$ d) $\frac{Q}{2}(1 + 2\sqrt{2})$

173. A circuit is connected as shown in the figure with the switch S open. When the switch is closed, the total amount of charge that flows from Y to X is

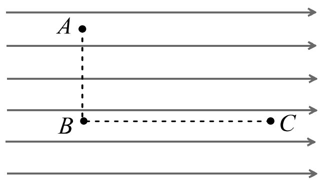


a) 0 b) 54 μC c) 27 μC d) 81 μC

174. The electric field between the plates of a parallel plate capacitor when connected to a certain battery is E_0. If the space between the plates of the capacitor is filled by introducing a material of dielectric constant K without disturbing the battery connections, the field between the plates shall be

a) KE_0 b) E_0 c) $\frac{E_0}{K}$ d) None of the above

175. 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



a) $V_A = V_B = V_C$ b) $V_A = V_B > V_C$ c) $V_A = V_B < V_C$ d) $V_A > V_B = V_C$

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

a) Electric field and potential both are zero
b) Electric field is zero but potential is not zero
c) Electric field is not zero but potential is zero
d) Neither electric field nor potential is zero

177. A charge Q.is divided in two parts $Q - q$.What is value of q for maximum force between them?

a) $\frac{3Q}{4}$ b) $\frac{Q}{3}$ c) Q d) $\frac{Q}{2}$

178. 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 and equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio of t_2/t_1 is nearly equal to

a) 1 b) $(m_p/m_e)^{1/2}$ c) $(m_e/m_p)^{1/2}$ d) 1836

179. The capacitance C of a capacitor is

a) Independent of the charge and potential of the capacitor
b) Dependent on the charge and independent of potential
c) Independent of the geometrical configuration of the capacitor
d) Independent of the dielectric medium between the two conducting surfaces of the capacitor

180. Between the plates of a parallel plate condenser, a plate of thickness t_1 and dielectric constant k_1 is placed. In the rest of the space, there is another plate of thickness t_2 and dielectric constant k_2. The potential difference across the condenser will be

a) $\frac{Q}{A\varepsilon_0}\left(\frac{t_1}{k_1} + \frac{t_2}{k_2}\right)$ b) $\frac{\varepsilon_0 Q}{A}\left(\frac{t_1}{k_1} + \frac{t_2}{k_2}\right)$ c) $\frac{Q}{A\varepsilon_0}\left(\frac{k_1}{t_1} + \frac{k_2}{t_2}\right)$ d) $\frac{\varepsilon_0 Q}{A}(k_1 t_1 + k_2 t_2)$

181. A dipole of electric dipole moment p is placed in a uniform electric field of strength E. If θ is the angle between positive directions of p and E, then the potential energy of the electric dipole is largest when θ is

a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) π d) Zero

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

a) $2.3 \times 10^{-8} N$ b) $4.6 \times 10^{-8} N$ c) $1.5 \times 10^{-8} N$ d) None of these

183. Under the influence of the coulomb field of charge$+Q$, a charge $-q$ is moving around it in an elliptical orbit .Find out the correct statements(s).

a) The angular momentum of the charge $-q$ is constant
b) The linear momentum of the charge$-q$ is constant
c) The angular velocity of the charge$-q$ is constant
d) The linear speed of the charge$-q$ is constant

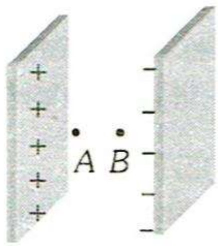
184. Charge on α-particle is

a) $4.8 \times 10^{-19}C$ b) $1.6 \times 10^{-19}C$ c) $3.2 \times 10^{-19}C$ d) $6.4 \times 10^{-19}C$

185. 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)

a) $\frac{F}{2}$ b) F c) $2F$ d) $4F$

186. Two protons A and B are placed in space between plates of a parallel plate capacitor charged upto $V\ volts$ (see fig.)
Force on protons are F_A and F_B then



a) $F_A > F_B$ b) $F_A < F_B$ c) $F_A = F_B$ d) Nothing can be said

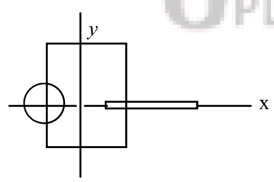
187. If the magnitude of intensity of electric field at a distance x on axial line and at a distance y on equatorial line on a given dipole are equal, then x: y is

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

188. Two charges each equal to $\eta q(\eta^{-1} < \sqrt{3})$ are placed at corners of an equilateral triangle of side a. The electric field at the third corner is E_3 then (where $E_0 = q/4\pi\varepsilon_0 a^2$)

a) $E_3 = E_0$ b) $E_3 < E_0$ c) $E_3 > E_0$ d) $E_3 \geq E_0$

189. A disc of radius $\frac{a}{4}$ having a uniformly distributed charge 6C is placed in the $x-y$ plane with its centre at $\left(\frac{-a}{2}, 0,0\right)$. A rod of length a carrying a uniformly distributed charge 8 C is placed on the x-axis form $x = \frac{a}{4}$ to $x = \frac{5a}{4}$. Two point charges -7C and 3C are placed at $\left(\frac{a}{4}, \frac{-a}{4}, 0\right)$ and $\left(\frac{-3a}{4}, \frac{3a}{4}, 0\right)$ respectively. Consider a cubical surface formed by six surfaces $x = \pm\frac{a}{2}, y = \pm\frac{a}{2}, z = \pm\frac{a}{2}$. The electric flux through this cubical surface is



a) $\frac{-2C}{\varepsilon_0}$ b) $\frac{2C}{\varepsilon_0}$ c) $\frac{10C}{\varepsilon_0}$ d) $\frac{12C}{\varepsilon_0}$

190. Infinite charges of magnitude q each are lying at $x = 1,2,4,8 \ldots meter$ on X-axis. The value of intensity of electric field at point $x = 0$ due to these charges will be

a) $12 \times 10^9 q\ N/C$ b) Zero c) $6 \times 10^9 q\ N/C$ d) $4 \times 10^9 q\ N/C$

191. A spherical shell of radius R has a charge$+q$ units. The electric field due to the shell at a point

a) Inside is zero and varies as r^{-1} outside it
b) Inside the constant and varies as r^{-2} outside it
c) Inside is zero and varies as r^{-2} outside it
d) Inside is constant and varies as r^{-1} outside it

192. An electron moving with the speed $5 \times 10^6\ m$ per sec is shooted parallel to the electric field of intensity $1 \times 10^3 N/C$. 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 $e = 9 \times 10^{-31}\ Kg$. charge $= 1.6 \times 10^{-19}C$)

a) $7\ m$ b) $0.7\ mm$ c) $7\ cm$ d) $0.7\ cm$

193. 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

a) Directly proportional to r^2
b) Directly proportional to r^3
c) Inversely proportional to r
d) Inversely proportional to r^2

194. If the distance between parallel plates of a capacitor is halved and dielectric constant is doubled then the capacitance

a) Decreases two times b) Increases two times c) Increases four times d) Remains the same

195. Two spheres A and B of radius $4cm$ and 6 cm 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

a) $20\mu C$ from A to B b) $16\mu C$ from A to B c) $32\mu C$ from B to A d) $32\mu C$ from A to B

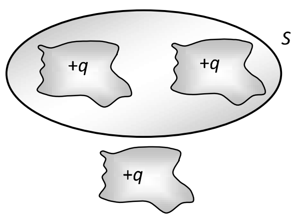
196. Three concentric metallic spherical shells of radii R, $2R$, $3R$ given charges Q_1, Q_2, Q_3 respectively. It is found that the surface charge densities on the outer surfaces of the shells are equal. Then, the ratio of the charges given to the shells, $Q_1 : Q_2 : Q_3$ is

a) 1:2:3 b) 1:3:5 c) 1:4:9 d) 1:8:18

197. Two identical charged spheres suspended from a common point by two massless strings of length l are initially a distance $d(d << l)$ apart because of their mutual repulsion. The charge begins to leak from both the spheres at a constant rate. As a result charges approach each other with a velocity v .Then as a function of distance x between them

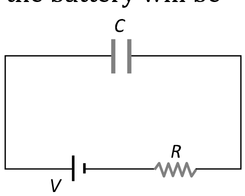
a) $v \propto x^{-1}$ b) $v \propto x^{1/2}$ c) $v \propto x$ d) $v \propto x^{-1/2}$

198. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface S is



a) $3q/\varepsilon_0$ b) $2q/\varepsilon_0$ c) q/ε_0 d) Zero

199. As in figure shown, if a capacitor C is charged by connecting it with resistance R, then energy is given by the battery will be



a) $\frac{1}{2}CV^2$ b) More than $\frac{1}{2}CV^2$ c) Less than $\frac{1}{2}CV^2$ d) zero

200. 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 $ergs$)

a) 87.5 b) 112.5 c) 150 d) 250

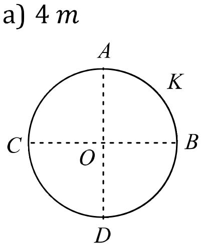
201. Two charges of equal magnitudes and at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is

a) $F/8$ b) $F/4$ c) $4F$ d) $F/16$

202. A neutral water molecule (H_2O) in it's vapor state has an electric dipole moment of magnitude $6.4 \times 10^{-30}\ C-m$. How far apart are the molecules centres of positive and negative charge

a) $4\ m$ b) $4\ mm$ c) $4\ \mu m$ d) $4\ pm$

203.



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

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

204. An electric line of force in the xy plane is given by equaton $x^2 + y^2 = 1$. A particle with unit positive charge, initially at rest at the point $x = 1, y = 0$ in the xy plane

a) Not move at all
b) Will move along straight line
c) Will move along the circular line of force
d) Information is insufficient to draw any conclusion

205. 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 $(g = 9.8 m/s^2)$

a) $3 \times 10^{-4} N$ b) $4 \times 10^{-4} N$ c) $5 \times 10^{-4} N$ d) $6 \times 10^{-4} N$

206. One of the following is not a property of field lines

a) Field lines are continuous curves without any breaks
b) Two field lines cannot cross each other
c) Field lines start at positive charge and end at negative charges
d) They form closed loop

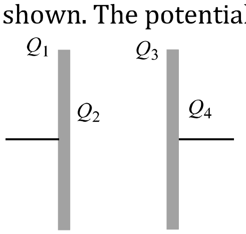
207. A parallel plate condenser with a dielectric of dielectric constant K between the plates has a capacity C and is charged to a potential V $volts$. The dielectric stab is slowly removed from between the plates and then reinserted. The net work done by the system in this process is

a) $\frac{1}{2}(K-1)CV^2$ b) $CV^2(K-1)/K$ c) $(K-1)CV^2$ d) Zero

208. 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

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

209. In an isolated parallel plate capacitor of capacitance C, the four surface have charges Q_1, Q_2, Q_3 and Q_4 as shown. The potential difference between the plates is



a) $\frac{Q_1 + Q_2 + Q_3 + Q_4}{2C}$ b) $\frac{Q_2 + Q_3}{2C}$ c) $\frac{Q_2 - Q_3}{2C}$ d) $\frac{Q_1 + Q_4}{2C}$

210. Two conducting spheres of radii 5 cm and 10 cm are given a charge of $15\mu C$ each. After the two spheres are joined by a conducting wire, the charge on the smaller sphere is

a) $5\mu C$ b) $10\mu C$ c) $15\mu C$ d) $20\mu C$

211. Three charges 1 μC, 1μC and 2 μC are kept at vertices of A, B and C of an equilateral triangle ABC of 10cm side respectively. The resultant force on the charge at C is

a) 0.9 N b) 1.8 N c) 2.72 N d) 3.12 N

212. A comb run through one's dry hair attracts small bits of paper. This is due to

a) Comb is good conductor
b) Paper is good conductor
c) The atoms in the paper get polarised by the charged comb
d) The comb possesses magnetic properties

213. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90° about its perpendicular axis, the electric field at the same point will be

a) E
b) $\frac{E}{4}$

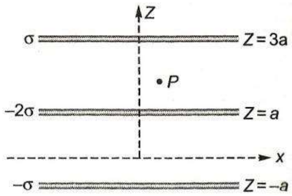
c) $\frac{E}{2}$

d) 2E

214. Two copper balls, each weighting 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)

a) $2.0 \times 10^{10} N$ b) $2.0 \times 10^4 N$ c) $2.0 \times 10^8 N$ d) $2.0 \times 10^6 N$

215. Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



a) $\frac{2\sigma}{\varepsilon_0}\hat{\boldsymbol{k}}$ b) $-\frac{2\sigma}{\varepsilon_0}\hat{\boldsymbol{k}}$ c) $\frac{4\sigma}{\varepsilon_0}\hat{\boldsymbol{k}}$ d) $-\frac{4\sigma}{\varepsilon_0}\hat{\boldsymbol{k}}$

216. Gauss's law of electrostatics would be invalid if

a) There were magnetic monopoles

b) The speed of light was not a universal constant

c) The inverse square law was not exactly true

d) The electrical charge was not quantized

217. A hollow metallic sphere of radius 10 cm is given a charge of 3.2×10^{-9} C.The electric intensity at a point 4 cm from the centre is

a) 9×10^{-9} NC^{-1} b) 288 NC^{-1} c) 2.88 NC^{-1} d) Zero

218. Conduction electrons are almost uniformly distributed within a conducting plate. When placed in an electrostatic field $\vec{E}$, the electric field within the plate

a) Is zero

b) Depends upon E

c) Depends upon $\vec{E}$

d) Depends upon the atomic number of the conducting element

219. Two identical balls having like charges and placed at a certain distance apart repel each other with a certain force. They are brought in contact and then moved apart to a distance equal to half their initial separation. The force of repulsion between them increases 4.5 times in comparison with the initial value. The ratio of the initial charges of the balls is

a) 2 b) 3 c) 4 d) 6

220. In nature, the electric charge of any system is always equal to

a) Half integral multiple of the least amount of charge

b) Zero

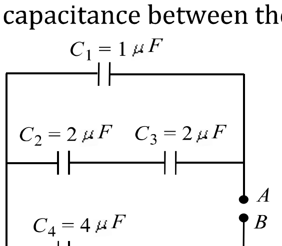
c) Square of the least amount of charge

d) Integral multiple of the least amount of charge

221. The number of electrons to be put on a spherical conductor of radius $0.1m$ to produce an electric field of $0.036N/C$ just above its surface is

a) 2.7×10^5 b) 2.6×10^5 c) 2.5×10^5 d) 2.4×10^5

222. Four capacitors are connected in a circuit as shown in the following figure. Calculate the effective capacitance between the points A and B



a) $\frac{4}{3}\mu F$ b) $\frac{24}{5}\mu F$ c) $9\mu F$ d) $5\mu F$

223. To increase the charge on the plate of a capacitor means to

a) Decrease the potential difference between the plates
b) Decrease the capacitance of the capacitor
c) Increase the capacitance of the capacitor
d) Increase the potential difference between the plates

224. Let V be the electric potential at a given point. Then the electric field E_x along x-direction at that point is given by

a) $\int_0^\infty V\,dx$ b) $\frac{dV}{dx}$ c) $-\frac{dV}{dx}$ d) $-V\frac{dV}{dx}$

225. 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

a) $1/2$ b) 2 c) $1/\sqrt{2}$ d) $\sqrt{2}$

226. The electric flux through a closed surface area S enclosing charge Q is ϕ. If the surface area is doubled, then the flux is

a) 2ϕ b) $\phi/2$ c) $\phi/4$ d) ϕ

227. A solid spherical conductor of radius R has a spherical cavity of radius $a(a < R)$ at its centre. A charge $+Q$ is kept at the center. The charge at the inner surface, outer and at a position $r(a < r < R)$ are respectively

a) $+Q, -Q, 0$ b) $-Q, +Q, 0$ c) $0, -Q, 0$ d) $+Q, 0, 0$

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

a) The system can never be in equilibrium
b) The system will be in equilibrium if the charges rotate about the centre of the triangle
c) The system will be in equilibrium if the charges have different magnitudes and different signs
d) The system will be in equilibrium if the charges have the same magnitudes but different signs

229. An electron is moving around the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force $\vec{F}$ between the two is $\left(\text{where } K = \frac{1}{4\pi\varepsilon_0}\right)$

a) $-K\frac{e^2}{r^3}\hat{r}$ b) $K\frac{e^2}{r^3}\vec{r}$ c) $-K\frac{e^2}{r^3}\vec{r}$ d) $K\frac{e^2}{r^3}\hat{r}$

230. 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

a) $5\,cm$
b) $\frac{25}{9}\,cm$
c) $10\,cm$
d) $\frac{4}{13}\,cm$

231. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then the $\frac{Q}{q}$ eQuals

a) $-2\sqrt{2}$ b) -1 c) 1 d) $-\frac{1}{\sqrt{2}}$

232. The electric intensity outside a charged sphere of radius R at a distance $r(r > R)$ is

a) $\frac{\sigma R^2}{\varepsilon_0 r^2}$ b) $\frac{\sigma r^2}{\varepsilon_0 R^2}$ c) $\frac{\sigma r}{\varepsilon_0 R}$ d) $\frac{\sigma R}{\varepsilon_0 r}$

233. If the linear charge density of a cylinder is $4\mu\text{Cm}^{-1}$ then electric field intensity at point 3.6 cm from axis is

a) $4 \times 10^5\ \text{NC}^{-1}$ b) $2 \times 10^6\text{NC}^{-1}$ c) $8 \times 10^7\ \text{NC}^{-1}$ d) $12 \times 10^7\text{NC}^{-1}$

234. The torque acting on a dipole of a moment $\vec{P}$ in an electric field $\vec{E}$ is

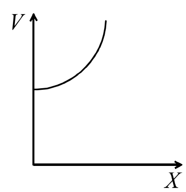
a) $\vec{P}.\vec{E}$ b) $\vec{P} \times \vec{E}$ c) Zero d) $\vec{E} \times \vec{P}$

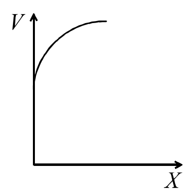
235. An electric dipole is placed along the x −axis at the origin O. A point P is at a distance of $20cm$ from this

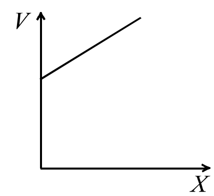
origin such that OP makes an angle $\frac{\pi}{3}$ with the x −axis. If the electric field at P makes an angle θ with the x −axis, the value of θ would be

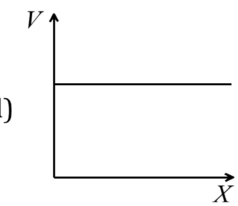
a) $\frac{\pi}{3}$ b) $\frac{\pi}{3}+\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ c) $\frac{2\pi}{3}$ d) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

236. Between the plates of a parallel plate capacitor a dielectric plate is introduced just to fill the space between the plates. The capacitor is charged and later disconnected from the battery. The dielectric plate is slowly drawn out of the capacitor parallel to the plates. The plot of the potential difference across the plates and the length of the dielectric plate drawn out is

a)


b)


c)


d)


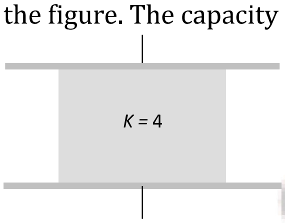
237. The energy stored in the condenser is

a) QV b) $\frac{1}{2}QV$ c) $\frac{1}{2}C$ d) $\frac{1}{2}\frac{Q}{C}$

238. If the charge on a capacitor is increased by 2 coulomb, the energy stored in it increase by 21%. The original charge on the capacitor is

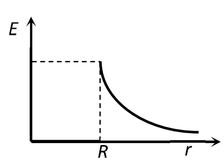
a) 10 C b) 20 C c) 30 C d) 40 C

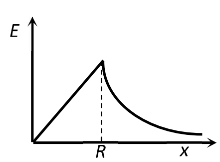
239. Consider a parallel plate capacitor of $10\mu F$ $(micro-farad)$ with air filled in the gap between the plates. Now one half of the space between the plates is filled with a dielectric of dielectric constant 4, as shown in the figure. The capacity of the capacitor changes to

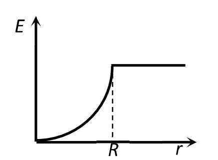


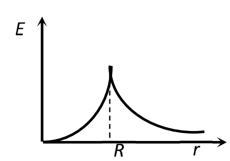
a) 25 μF b) 20 μF c) 40 μF d) 5 μF

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

a)


b)


c)


d)


241. Two charges $+6\ \mu C$ and $+15\ \mu C$ are placed along the x −axis at $x=0$ and $x=2$m respectively A negative charge is placed between them such that the resultant force on it is zero. The negative charge is placed at

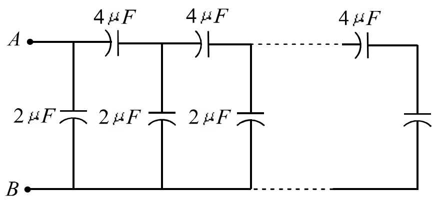
a) $x=0.775m$ b) $x=1.2m$

c) $x=0.5m$ d) Position depends on the amount of charge

242. Let three be a spherically symmetric charge distribution with charge density varying as $\rho(r)=\rho_0\left(\frac{5}{4}-\frac{r}{R}\right)$ upto $r=R$, and $\rho(r)=0$ for $r>R$, where r is the distance from the origin. The electric field at a distance $r(r<R)$ from the origin is given by

a) $\frac{4\pi\rho_0 r}{3\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$ b) $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$ c) $\frac{4\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4}-\frac{r}{R}\right)$ d) $\frac{\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4}-\frac{r}{R}\right)$

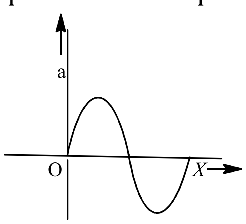
243. A finite ladder is constructed by connecting several sections, of $2\mu F$, $4\mu F$ capacitor combinations as shown in the figure. It is terminated by a capacitor of capacitance C. What value should be chosen for C such that the equivalent capacitance of the ladder between the points A and B becomes independent of the number of sections in between

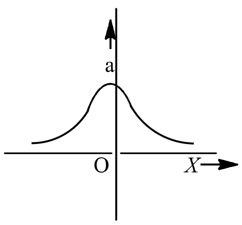


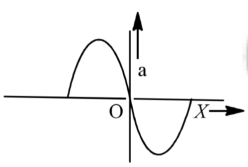
a) $4\mu F$ b) $2\mu F$ c) $18\mu F$ d) $6\mu F$

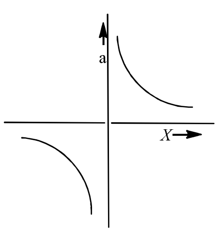
244. A point charge +q is placed at the midpoint of a cube of side$a$. The electric flux emerging from the cube is
a) Zero b) $\frac{3qa^2}{\varepsilon_0}$ c) $\frac{q}{\varepsilon_0}$ d) $\frac{\varepsilon_0}{4qa^2}$

245. Two identical positive charges are fixed on the y-axis at equal distances from the origin O. A negatively charged particle starts on the x-axis, at a large distance from$O$, moves along the x-axis, passes through O and moves far away from O. Its acceleration a is taken as positive along its direction of motion. The best graph between the particle's acceleration and its x-coordinate is represented by

a) 

b) 

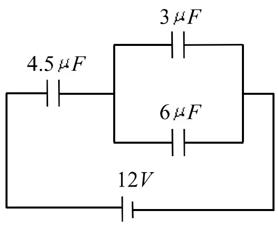
c) 

d) 

246. Two identical charged spheres are suspended by strings of equal lengths. The strings make an angle of 30° with each other. When suspended in a liquid of density 0.8 gcm^{-3}, then angle remains the same. If density of the material of the sphere is 16g cm^{-3}, the dielectric constant of the liquid is
a) 4 b) 3 c) 2 d) 1

247. Pick out the false statement from the following
a) The direction of eddy current is given by Fleming's right hand rule
b) A choke coil is a pure inductor used for controlling current in an a.c circuit
c) The energy stored in a conductor of capacitance C having a charge q is $\frac{1}{2}\frac{q^2}{C}$
d) The magnetic energy stored in a coil of self-inductance L carrying current is $\frac{1}{2}LI^2$

248. In the circuit shown in the figure, the potential difference across the $4.5\mu F$ capacitor is



a) $\frac{8}{3} volts$ b) 4 $volts$ c) 6 $volts$ d) 8 $volts$

249. 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

a) East b) South c) West d) North

250. A parallel plate condenser with oil between the plates (dielectric constant of oil $K = 2$) has a capacitance C. If the oil is removed, then capacitance of the capacitor becomes

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

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

a) Uniformly in the metal object
b) Uniformly on the surface of the object
c) Such that potential energy of the system is minimised
d) Such that the total heat loss is minimised

252. 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)

a) Zero b) $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{L^2}$ c) $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{L^2}$ d) $\frac{1}{12\pi\varepsilon_0}\frac{q^2}{L^2}$

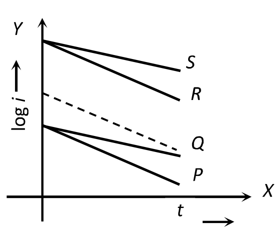
253. When a slab of dielectric material is introduced between the parallel plates of a capacitor which remains connected to a battery, then charge on plates relative to earlier charge

a) Is less
b) Is same
c) Is more
d) May be less or more depending on the nature of the material introduced

254. A sphere of radius 1 cm has potential of 8000 V, then energy density near its surface will be

a) $64 \times 10^5\ J/m^3$ b) $8 \times 10^3\ J/m^3$ c) $32\ J/m^3$ d) $2.83\ J/m^3$

255. In an RC circuit while charging, the graph of $\ln i$ versus time is as shown by the dotted line in the diagram figure, where i is the current. When the value of the resistance is doubled, which of the solid curve best represents the variation of $\ln i$ versus time



a) P b) Q c) R d) S

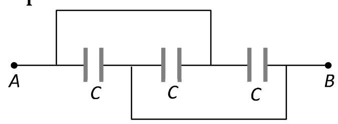
256. Consider a thin spherical shell of radius R consisting of uniform surface charge densityσ. The electric field at a point of distance x from its centre and outside the shell is

a) inversely proportional to σ
b) directly proportional tox^2
c) directly proportional to σ
d) inversely proportional tox^2

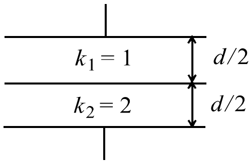
257. What will be the capacity of a parallel-plate capacitor when the half of parallel space between the plates is filled by a material of dielectric constant ε_r? Assume that the capacity of the capacitor in air is C

a) $\frac{2\varepsilon_r C}{1+\varepsilon_r}$ b) $\frac{C(\varepsilon_r+1)}{2}$ c) $\frac{C\varepsilon_r}{1+\varepsilon_r}$ d) $\varepsilon_r C$

258. Four charges $+Q, -Q, +Q, -Q$ are placed at the corners of a square taken in order. At the centre of the square
a) $E = 0, V = 0$
b) $E = 0, V \neq 0$
c) $E \neq 0, V = 0$
d) $E \neq 0, V \neq 0$
259. Three equal capacitors, each with capacitance C are connected as shown in figure. Then the equivalent capacitance between A and B is

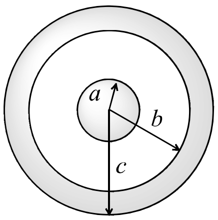


a) C b) $3C$ c) $\frac{C}{3}$ d) $\frac{3C}{2}$
260. A long, hollow conducting cylinder is kept coaxially inside another long, hollow conducting cylinder of larger radius. Both the cylinders are initially electrically neutral.
a) A potential difference appears between the two cylinders when a charge density is given to the inner cylinder
b) A potential difference appears between the two cylinders when a charge density is given to the outer cylinder
c) No potential difference appears between the two cylinders when a uniform line charge is kept along the axis of the cylinders
d) No potential difference appears between the two cylinders when same charge density is given to both the cylinders
261. 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
a) $\frac{1}{4\pi\varepsilon_0}\frac{Qq}{l}$ b) $\frac{1}{4\pi\varepsilon_0}\frac{Qq}{l^2}$ c) $\frac{1}{4\pi\varepsilon_0}Qql$ d) Zero
262. Two insulated charged conducting spheres of radii $20cm$ and $15cm$ respectively and having an equal charge of $10C$ are connected by a copper wire and then they are separated. Then
a) Both the spheres will have the same charge of 10 C
b) Surface charge density on the $20cm$ sphere will be greater than that on the $15cm$ sphere
c) Surface charge density on the $15cm$ sphere will be greater than that on the $20cm$ sphere
d) Surface charge density on the two spheres will be equal
263. 64 drops of mercury each charged to a potential of $10V$. They are combined to form one bigger drop. The potential of this drop will be (Assume all the drops to be spherical)
a) 160 V b) 80 V c) 10 V d) 640 V
264. Electric potential at an equatorial point of a small dipole with dipole moment P (r, distance from the dipole) is
a) Zero b) $\frac{P}{4\pi\varepsilon_0 r^2}$ c) $\frac{P}{4\pi\varepsilon_0 r^3}$ d) $\frac{2P}{4\pi\varepsilon_0 r^3}$
265. When the distance between the charged particles is halved, the force between them becomes
a) One-fourth b) Half c) Double d) Four times
266. A point charge is kept at the centre of a metallic insulated spherical shell. Then
a) Electric field out side the sphere is zero b) Electric field inside the sphere is zero
c) Net induced charge on the sphere is zero d) Electric potential inside the sphere is zero
267. Two parallel plate of area A are separated by two different dielectrics as shown in figure. The net capacitance is



a) $\frac{4\varepsilon_0 A}{3d}$ b) $\frac{3\varepsilon_0 A}{4d}$ c) $\frac{2\varepsilon_0 A}{d}$ d) $\frac{\varepsilon_0 A}{d}$

268. 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



a) $-\frac{2Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$ b) $-\frac{Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$ c) $0, \frac{Q}{4\pi c^2}$ d) None of the above

269. The capacity of a parallel plate condenser is $15\mu F$, when the distance between its plates is 6 cm. If the distance between the plates is reduced to 2 cm, then the capacity of this parallel plate condenser will be

a) $15\mu F$ b) $30\mu F$ c) $45\mu F$ d) $60\mu F$

270. 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

a) The divergence of leaves will not be affected b) The leaves will diverge further
c) The leaves will collapse d) The leaves will melt

271. 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 cub will be

a) $\frac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$ b) $\frac{-8\sqrt{2}q^2}{\pi\varepsilon_0 b}$ c) $\frac{-4\sqrt{2}q^2}{\pi\varepsilon_0 b}$ d) $\frac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$

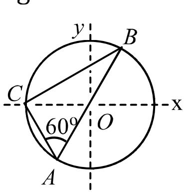
272. Dipole is placed parallel to the electric field. If Q is the work done in rotating the dipole by 60°, then work done in rotating it by 180° is

a) $2W$ b) $3W$ c) $4W$ d) $W/2$

273. A parallel plate capacitor of plate area A and plate separation d is charged to potential V and then the battery is disconnected. A slab of dielectric constant k is then inserted between the plates of the capacitors so as to fill the space between the plates. If Q, E and W denote respectively, the magnitude of charge on each plate, the electric field between the plates (after the slab is inserted) and work done on the system in question in the process of inserting the slab, then state incorrect relation from the following

a) $Q = \frac{\varepsilon_0 AV}{d}$ b) $W = \frac{\varepsilon_0 AV^2}{2kd}$ c) $E = \frac{V}{kd}$ d) $W = \frac{\varepsilon_0 AV^2}{2d}\left(1 - \frac{1}{k}\right)$

274. Consider a system of three charges $\frac{q}{3}, \frac{q}{3}$ and $-\frac{2q}{3}$ placed at point A, B and C, respectively, as shown in the figure. Take O to be the centre of the circle of radius R and angle CAB=60°.



a) The electric field at point O is $\frac{q}{8\pi\varepsilon_0 R^2}$ directed along the negative x-axis

b) The potential energy of the system is zero

c) The magnitude of the force between the charges at C and B is

$\frac{q^2}{54\pi\varepsilon_0 R^2}$

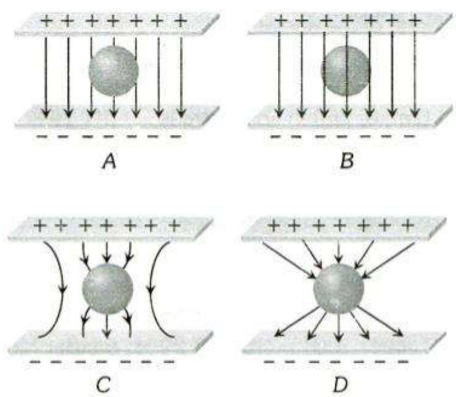
The potential at point O is

d) $\frac{q}{12\pi\varepsilon_0 R}$

275. The ratio of charge to potential of a body is known as

a) Capacitance b) Conductance c) Inductance d) Resistance

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



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

277. Two identical charged spheres suspended from a common point by two massless stings of length l are initially a distance $d(d << l)$ apart because of their mutual repulsion. The charge begins to leak from both the spheres at a constant rate. As a result the charges approach each other with a velocity v. Then as a function of distance x between them

a) $v \propto x^{-1/2}$ b) $v \propto x^{-1}$ c) $v \propto x^{1/2}$ d) $v \propto x$

278. The direction of electric field intensity $(\vec{E})$ at a point on the equatorial line of an electric dipole of dipole moment $(\vec{p})$ is

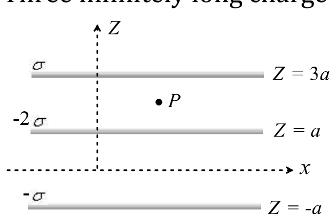
a) Along the equatorial line towards the dipole

b) Along equatorial line away from the dipole

c) Perpendicular to the equatorial line and opposite to $(\vec{p})$

d) Perpendicular to the equatorial line and parallel to $(\vec{p})$

279. Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



a) $\frac{2\sigma}{\varepsilon_0}\hat{k}$ b) $-\frac{2\sigma}{\varepsilon_0}\hat{k}$ c) $\frac{4\sigma}{\varepsilon_0}\hat{k}$ d) $-\frac{4\sigma}{\varepsilon_0}\hat{k}$

280. If E is the electric field intensity of an electrostatic field, then the electrostatic energy density is proportional to

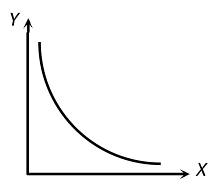
a) E b) E^2 c) $1/E^2$ d) E^3

281. Two identical conducting balls A and B have positive charges q_1 and q_2 respectively. But $q_1 \neq q_2$. The balls are brought together so that they touch each other and kept in their original positions. The force between them is

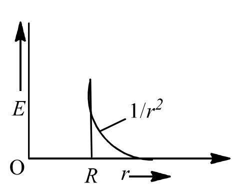
a) Less than that before the balls touched b) Greater than that before the balls touched

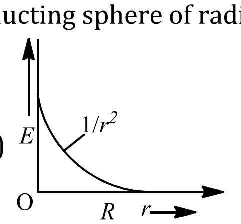
c) Same as that before the balls touched d) Zero

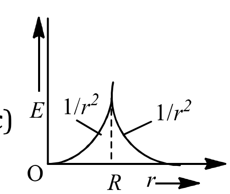
282. The electric field between the two spheres of a charged spherical condenser
    a) Is zero
    b) Is constant
    c) Increases with distance from the Centre
    d) Decreases with distance from the Centre
283. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then
    a) Negative and distributed uniformly over the surface of the sphere
    b) Negative and appears only at the point on the sphere closest to the point charge
    c) Negative and distributed non-uniformly over the entire surface of the sphere
    d) Zero
284. Two points P and Q are maintained at the potential of 10 V and $-4V$, respectively. The work done in moving 100 electrons from P to Q is
    a) $-9.60 \times 10^{-17}\,J$
    b) $9.60 \times 10^{-17}\,J$
    c) $-2.24 \times 10^{-16}\,J$
    d) $2.24 \times 10^{-16}\,J$
285. A comb run through one's dry hair attracts small bits of paper. This is due to
    a) Comb is a good conductor
    b) Paper is a good conductor
    c) The atoms in the paper get polarised by the charged comb
    d) The comb possesses magnetic properties
286. If a conducting medium is placed between two charges, then the electric force between them will become.
    a) Zero
    b) Infinity
    c) 1 N
    d) 1 dyne
287. Electric potential of earth is taken to be zero because earth is a good
    a) Insulator
    b) Conductor
    c) Semiconductor
    d) Dielectric
288. What physical quantities may X and Y reprsent? (Y represents the first mentioned quantity)

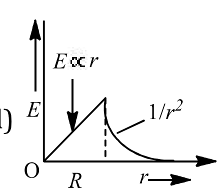


    a) Pressure v/s temperature of a given gas (constant volume)
    b) Kinetic energy v/s velocity of a particle
    c) Capacitance v/s charge to give a constant potential
    d) Potential v/s capacitance to give a constant charge
289. Three capacitors of capacity C_1, C_2, C_3 are connected in series. Their total capacity will be
    a) $C_1 + C_2 + C_3$
    b) $1/(C_1 + C_2 + C_3)$
    c) $(C_1^{-1} + C_2^{-1} + C_3^{-1})^{-1}$
    d) None of these
290. Which of the following plots represents the variation of the electric field with distance from the centre of a uniformly charged non-conducting sphere of radius R?

a) 

b) 

c) 

d) 

291. 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
    a) 150 V/m
    b) 125 V/m
    c) 120 V/m
    d) Zero
292. What happens when some charge is placed on a soap bubble?
    a) Its radius decreases
    b) Its radius increases
    c) The bubble collapses
    d) None of these
293. Two identical capacitors, have the same capacitance C. One of them is charged to potential V_1 and the other to V_2. The negative ends of the capacitors are connected together. When the positive ends are also connected, the decrease in energy of the combined system is

a) $\frac{1}{4}C(V_1^2 - V_2^2)$ b) $\frac{1}{4}C(V_1^2 + V_2^2)$ c) $\frac{1}{4}C(V_1 - V_2)^2$ d) $\frac{1}{4}C(V_1 + V_2)^2$

294. A sample of HCl gas is placed in an electric field of $3 \times 10^4 NC^{-1}$. The dipole moment of each HCl molecule is 6×10^{-30}Cm. The maximum torque that can act on a molecule is

a) $2 \times 10^{-34} C^2 mN^{-1}$ b) 2×10^{-34}Nm c) 18×10^{-26}Nm d) $0.5 \times 10^{34} C^{-2} Nm^{-1}$

295. Two charged spheres of radii R_1 and R_2 having equal surface charge density. The ratio of their potential is

a) R_1/R_2 b) R_2/R_1 c) $(R_1/R_2)^2$ d) $(R_2/R_1)^2$

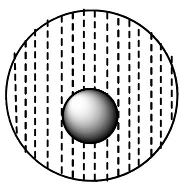
296. Three capacitors each of capacity $4\mu\ F$ are to be connected in such a way that the effective capacitance is $6\mu\ F$. This can be done by

a) Connecting them in parallel
b) Connecting two in series and one in parallel
c) Connecting two in parallel and one in series
d) Connecting all of them in series

297. An insulated sphere of radius R has charge density ρ. The electric field at a distance r from the centre of the sphere ($r < R$)

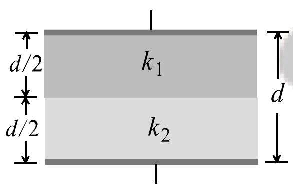
a) $\frac{\rho r}{3\varepsilon_0}$ b) $\frac{\rho R}{3\varepsilon_0}$ c) $\frac{\rho r}{\varepsilon_0}$ d) $\frac{\rho R}{\varepsilon_0}$

298. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inside the emptied space is



a) Zero everywhere
b) Non-zero and uniform
c) Non-uniform
d) Zero only at its centre

299. Two dielectric slabs of constant K_1 and K_2 have been filled in between the plates of a capacitor as shown below. What will be the capacitance of the capacitor



a) $\frac{2\varepsilon_0 A}{d}(K_1 + K_2)$ b) $\frac{2\varepsilon_0 A}{d}\left(\frac{K_1 + K_2}{K_1 \times K_2}\right)$ c) $\frac{2\varepsilon_0 A}{2}\left(\frac{K_1 \times K_2}{K_1 + K_2}\right)$ d) $\frac{2\varepsilon_0 A}{d}\left(\frac{K_1 \times K_2}{K_1 + K_2}\right)$

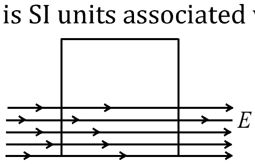
300. Two thin wire rings each having radius R are placed at a distance d apart with their axes coinciding. The charges on the two rings are $+q$ and $-q$. The potential difference between the centres of the two rings is

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

301. If charge q is placed at the centre of the line joining two equal charges Q, the system of these charges will be the same distance would be

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

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



a) Zero b) EL^2 c) $EL^2/(2\varepsilon_0)$ d) $EL^2/2$

303. 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

a) $\frac{q^2}{8\pi\varepsilon_0 a}$ b) $\frac{6q^2}{8\pi\varepsilon_0 a}$ c) $-\frac{7q^2}{8\pi\varepsilon_0 a}$ d) $\frac{9q^2}{8\pi\varepsilon_0 a}$

304. A point charge q produces an electric field of magnitude 2NC^{-1} at a point distance 0.25 m from it. What is the value of charge?
a) 1.39×10^{-11} C b) 1.39×10^{11} C c) 13.9×10^{-11} C d) 13.9×10^{11} C

305. The electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10 cm surrounding the total charge is 20 Vm. The flux over a concentric sphere of radius 20 cm will be
a) 20Vm b) 25Vm c) 40Vm d) 200Vm

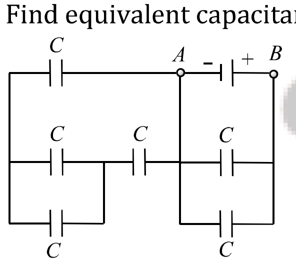
306. A series combination of n_1 capacitors each of value C_1, is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has, The value of C_2, in terms of C_1, is then
a) $\frac{16C_1}{n_1 n_2}$ b) $\frac{2C_1}{n_1 n_2}$ c) $16\frac{n_2}{n_1}C_1$ d) $2\frac{n_2}{n_1}C_1$

307. The electrostatic potential energy between proton and electron separated by a distance 1Å is
a) $13.6eV$ b) $27.2eV$ c) $14.4eV$ d) $1.44eV$

308. The insulation property of air breaks down at $E = 3 \times 10^6\ volt/metre$. The maximum charge that can be given to a square of diameter $5m$ is approximately
(in coulombs)
a) 2×10^{-2} b) 2×10^{-3} c) 2×10^{-4} d) 2×10^{-5}

309. Two point charges placed at 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
a) r b) r/k c) $r/\sqrt{k}$ d) $r\sqrt{k}$

310. Find equivalent capacitance between A and B



a) $6C$ b) $5C$ c) $3C$ d) $2C$

311. 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 $\tan\theta = \frac{1}{2}\tan\theta$
a) α b) θ c) $\theta + \alpha$ d) $\theta + 2\alpha$

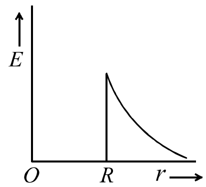
312. Consider two points 1 and 2 in a region outside a charged sphere. Two points are not very far away from the sphere. If E and V represent the electric field vector and the electric potential, which of the following is not possible
a) $|\vec{E}_1| = |\vec{E}_2|, V_1 = V_2$ b) $\vec{E}_1 \neq \vec{E}_2, V_1 \neq V_2$ c) $\vec{E}_1 \neq \vec{E}_2, V_1 = V_2$ d) $|\vec{E}_1| = |\vec{E}_2|, V_1 \neq V_2$

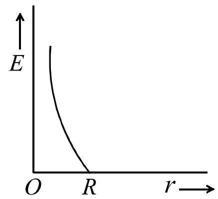
313. Point charges $+4q, -q$ and $+4q$ are kept on the x –axis at points $x = 0, x = a$ and $x = 2a$ respectively, then
a) Only q is in stable equilibrium
b) None of the charges are in equilibrium
c) All the charges are in unstable equilibrium
d) All the charges are in stable equilibrium

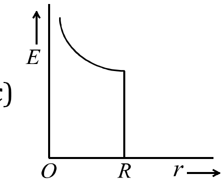
314. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness $\left(\frac{3}{4}\right)d$, where d is the separation of the plates. The ratio of the capacitance C (in the presence of the dielectric) to the capacitance C_0 (in the absence of the dielectric) is

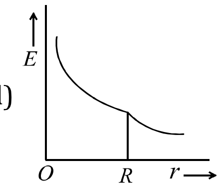
a) $\frac{3K}{K+4}$ b) $\frac{3}{4}K$ c) $\frac{4K}{K+3}$ d) $\frac{4}{3}K$

315. A metallic shell of radius R has a charge $-Q$ on it. A point charge $+Q$ is placed at the centre of the shell. Which of the graphs shown below may correctly represent the variation of the electric field E with distance r from the centre of the shell

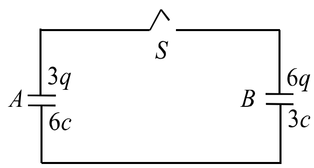
a) 

b) 

c) 

d) 

316. In given circuit when switch S has been closed then charge on capacitor A & B respectively



a) $3\,q, 6\,q$ b) $6\,q, 3\,q$ c) $4.5\,q, 4.5\,q$ d) $5\,q, 4\,q$

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

a) 10 V/m upward b) 10 V/m downward c) 0.1 V/m downward d) 0.1 V/m upward

318. The radius of solid metallic non-conducting sphere is 60 cm and charge on the sphere is 500μC. The electric field at a distance 10cm from centre of sphere is

a) $2 \times 10^6 \text{NC}^{-1}$ b) $2 \times 10^8 \text{NC}^{-1}$ c) $5 \times 10^6 \text{NC}^{-1}$ d) $5 \times 10^8 \text{NC}^{-1}$

319. Two spherical conductors each of capacity C are charged to potentials V and $-V$. These are then connected by means of a fine wire. The loss of energy will be

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

320. A square of side $'a'$ has charge Q at its centre and charge $'q'$ at one of the corners. The work required in moving the charge $'q'$ from one corner to the diagonally opposite corner is

a) Zero b) $\frac{Qq}{4\pi \in_0 a}$ c) $\frac{Qq\sqrt{2}}{4\pi \in_0 a}$ d) $\frac{Qq}{2\pi \in_0 a}$

321. An electric dipole of length 1 cm is placed with the axis making an angle of 30° to an electric field of strength10^4NC^{-1}. If it experiences a torque of $10\sqrt{2}$Nm, the potential energy of the dipole is

a) 0.245J b) 2.45×10^{-4}J c) 0.0245 J d) 24.5×10^{-4}J

322. An electric field is spread uniformly in Y-axis. Consider a point A as origin point. The co-ordinates of point B are equal to $(0, 2)m$. The co-ordinates of point C are $(2,0)m$. At points A, B and C, electric potentials are V_A, V_B and V_C respectively. From the following options, which is correct

a) $V_A = V_C < V_B$ b) $V_A = V_B = V_C$ c) $V_A = V_B > V_C$ d) $V_A = V_C > V_B$

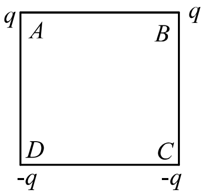
323. Two charged spherical conductors of radii R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres σ_1/σ_2 is

a) $\frac{R_1}{R_2}$ b) $\frac{R_2}{R_1}$ c) $\sqrt{\left(\frac{R_1}{R_2}\right)}$ d) $\frac{R_1^2}{R_2^2}$

324. The electric potential due to a small electric dipole at a large distance r from the centre of the dipole is proportional to

a) r b) $1/r$ c) $\frac{1}{r^5}$ d) $1/r^2$

325. Charges are placed on the vertices of a square as shown. Let **E** be the electric field and V the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then

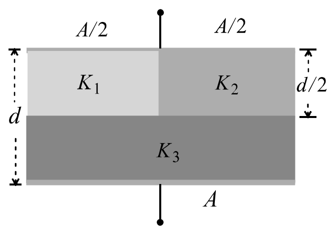


a) **E** remains unchanged, V changes
b) Both **E** and V change
c) **E** and V remain unchanged
d) **E** changes, V remains unchanged

326. When a charge of 3 $coulomb$ 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 $1cm$ is
a) 10 $volts$
b) 90 $volts$
c) 1000 $volts$
d) 3000 $volts$

327. Three capacitors of capacitance $3\mu F$, $10\mu F$ and $15\mu F$ are connected in series to a voltage source of $100V$. The charge on $15\mu F$ is
a) 50 μC
b) 100 μC
c) 200 μC
d) 280 μC

328. A parallel plate capacitor of area A, plate separation d and capacitance C is filled with three different dielectric materials having dielectric constants k_1, k_2 and k_3 as shown. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by



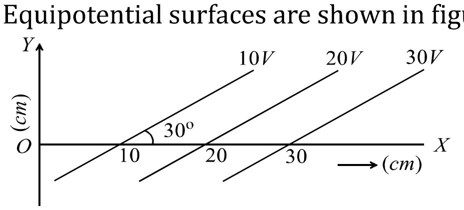
A = Area of plates

a) $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{2k_3}$
b) $\frac{1}{k} = \frac{1}{k_1 + k_2} + \frac{1}{2k_3}$
c) $k = \frac{k_1 k_2}{k_1 + k_2} + 2k_3$
d) $k = k_1 + k_2 + 2k_3$

329. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to its weight is given by
a) mge
b) $\frac{mg}{e}$
c) $\frac{e}{mg}$
d) $\frac{e^2}{m^2}g$

330. Three point charges $+q$, $-2q$ and $+q$ are placed at points $(x = 0, y = a, z = 0)$, $(x = 0, y = 0, z = 0)$ and $(x = a, y = 0, z = 0)$ respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are
a) $\sqrt{2}qa$ along $+y$ direction
b) $\sqrt{2}qa$ along the line joining points $(x = 0, y = 0, z = 0)$ and $(x = a, y = a, z = 0)$
c) qa along the line joining points $(x = 0, y = 0, z = 0)$ and $(x = a, y = a, z = 0)$
d) $\sqrt{2}qa$ along $+x$ direction

331. Equipotential surfaces are shown in figure. Then the electric field strength will be



a) 100 Vm^{-1} along X-axis
b) 100 Vm^{-1} along Y-axis
c) 200 Vm^{-1} at an angle 120° with X-axis
d) 50 Vm^{-1} at an angle 120° with X-axis

332. Two metal pieces having a potential difference of $800V$ are $0.02m$ apart horizontally. A particle of mass $1.96 \times 10^{-15} kg$ is suspended in equilibrium between the plates. If e is the elementary charge, then charge on the particle is
a) e
b) $3e$
c) $6e$
d) $8e$

333. Three particles, each having a charge of $10\mu C$ are placed at the corners of an equilateral of side $10cm$, the

corners of an equilateral triangle of side 10 cm. The electrostatic potential energy of the system is (Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2/C^2$)

a) Zero b) Infinite c) 27 J d) 100 J

334. A given charge situated at a certain distance from an electric dipole in the end on opposition, experiences a force F. If the distance of charge is doubled, the force acting on the charge will be

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

335. A simple pendulum has a length l and the mass of the bob is m. The bob is given a charge q coulomb. The pendulum is suspended between the vertical plates of a charged parallel plate capacitor. If E is the electric field strength between the plates, the time period of the pendulum is given by

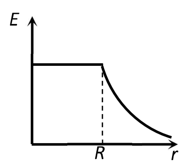
a) $2\pi \sqrt{\frac{1}{g}}$

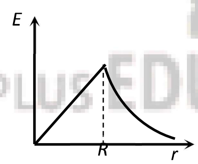
b) $2\pi \sqrt{\frac{l}{\sqrt{g + \frac{qE}{m}}}}$

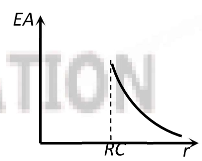
c) $2\pi \sqrt{\frac{l}{\sqrt{g - \frac{qE}{m}}}}$

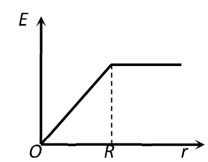
d) $2\pi \sqrt{\frac{l}{\sqrt{g^2 + \left(\frac{qE}{m}\right)^2}}}$

336. The electric field due to a uniformly charged sphere of radius R as a function of the distance from its centre is represented graphically by

a) 

b) 

c) 

d) 

337. The charge on 500 cc of water due to protons will be

a) $6.0 \times 10^{27} C$ b) $2.67 \times 10^7 C$ c) $6 \times 10^{23} C$ d) $1.67 \times 10^{23} C$

338. Electric field of an isolated metallic sphere at any interior point is

a) Zero b) One

c) Proportional to field d) None of these

339. 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

a) q/b^2 b) $q/2b^2$ c) $32q/b^2$ d) Zero

340. Two equal negative charge $-q$ are fixed at the fixed points $(0, a)$ and $(0, -a)$ on the Y-axis. A positive charge Q is released from rest at the point $(2a, 0)$ on the X-axis. The charge Q will

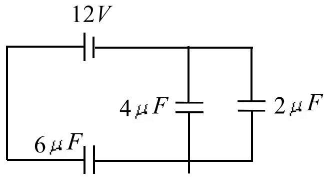
a) Execute simple harmonic motion about the origin

b) Move to the origin and remain at rest

c) Move to infinity

d) Execute oscillatory but not simple harmonic motion

341. The charge deposited on $4\mu F$ capacitor in the circuit is



a) $6 \times 10^{-6}C$ b) $12 \times 10^{-6}C$ c) $24 \times 10^{-6}C$ d) $36 \times 10^{-6}C$

342. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then Q/q equals

a) $-2\sqrt{2}$ b) -1 c) 1 d) $-\frac{1}{\sqrt{2}}$

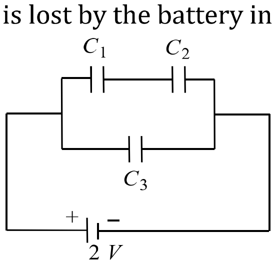
343. A conducting sphere of radius R, and carrying a charge q is joined to a conducting sphere of radius $2R$, and carrying a charge $-2q$. The charge flowing between them will be

a) $\frac{q}{3}$ b) $\frac{2q}{3}$ c) q d) $\frac{4q}{3}$

344. The bob of simple pendulum is hanging vertically down from a fixed identical bob by means of string of length l. If both bobs are charged with a charge with a charge q each, time period of the pendulum is (ignore the radii of the bobs)

a) $2\pi\sqrt{\frac{l}{g+\left(\frac{q^2}{l^2m}\right)}}$ b) $2\pi\sqrt{\frac{l}{g-\left(\frac{q^2}{l^2m}\right)}}$ c) $2\pi\sqrt{\frac{l}{g}}$ d) $2\pi\sqrt{\frac{l}{g-\left(\frac{q2}{l}\right)}}$

345. Two capacitors $C_1 = 2\mu\, F$ and $C_2 = 6\mu\, F$ in series, are connected in parallel to a third capacitor $C_3 = 4\mu\, F$. This arrangement is then connected to a battery of $\text{e.m.f.} = 2V$, as shown in the figure. How much energy is lost by the battery in charging the capacitors



a) $22 \times 10^{-6}\, J$ b) $11 \times 10^{-6}\, J$ c) $\left(\frac{32}{3}\right) \times 10^{-6}\, J$ d) $\left(\frac{16}{3}\right) \times 10^{-6}\, J$

346. 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

a) Zero b) $5\, \mu\, Cm^{-2}$ c) $20\, \mu\, Cm^{-2}$ d) $8\, \mu\, Cm^{-2}$

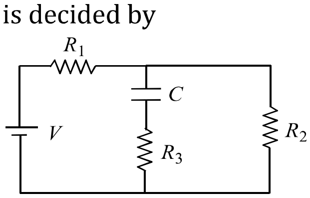
347. Three capacitors of capacitances $3\mu F$, $9\mu F$ and $18\mu F$ are connected once in series and another time in parallel. The ratio of equivalent capacitance in the two cases $\left(\frac{C_s}{C_p}\right)$ will be

a) 1 : 15 b) 15 : 1 c) 1 : 1 d) 1 : 3

348. 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

a) 90° b) 0° c) 180° d) 45°

349. In the circuit here, the steady state voltage across capacitor C is a fraction of the battery e.m.f. The fraction is decided by



a) R_1 only b) R_1 and R_2 only c) R_1 and R_3 only d) R_1, R_2 and R_3

350. An electron enters between two horizontal plates separated by $2mm$ and having a potential difference of

1000V. The force on electron is

a) $8 \times 10^{-12} N$ b) $8 \times 10^{-14} N$ c) $8 \times 10^{9} N$ d) $8 \times 10^{14} N$

351. Two spheres of radii a and b respectively are charged and joined by a wire. The ratio of electric field of the spheres is

a) a/b b) b/a c) a^2/b^2 d) b^2/a^2

352. 64 identical spheres of charge q and capacitance C each are combined to form a large sphere. The charge and capacitance of the large sphere is

a) $64q, C$ b) $16q, 4C$ c) $64q, 4C$ d) $16q, 64C$

353. A capacitor of capacity C_1 is charged upto V volt and then connected to an uncharged capacitor of capacity C_2. Then final potential difference across each will be

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

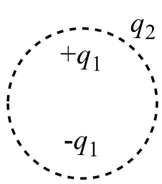
354. When air is replaced by a dielectric medium of constant k, the maximum force of attraction between two charges separated by a distance

a) Decreases k times b) Remains unchanged c) Increases k times d) Increases k^{-1} times

355. A $10 \mu F$ capacitor and a $20 \mu F$ capacitor are connected in series across a 200 V supply line. The charged capacitors are then disconnected from the line and reconnected with their positive plates together and negative plates together and no external voltage is applied. What is the potential difference across each capacitor

a) $\frac{400}{9} V$ b) $\frac{800}{9} V$ c) 400 V d) 200 V

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



a) q_2 b) Only the positive charges

c) All the charges d) $+q_1$ and $-q_1$

357. n identical droplets are charged to V volt each. If they coalesce to form a single drop, then its potential will be

a) $n^{2/3} V$ b) $n^{1/3} V$ c) nV d) V/n

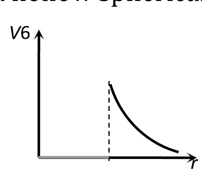
358. If the electric field given by $(5\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + 9\hat{\mathbf{k}})$, the electric flux through a surface of area 20 unit lying in the Y-Z plane will be

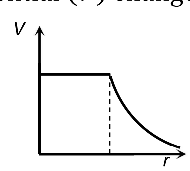
a) 100 unit b) 80unit c) 180 unit d) 20 unit

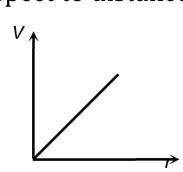
359. An electron having charge $'e'$ and mass $'m'$ is moving in a uniform electric field E. Its acceleration will be

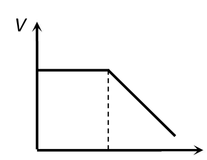
a) $\frac{e^2}{m}$ b) $\frac{E^2 e}{m}$ c) $\frac{eE}{m}$ d) $\frac{mE}{e}$

360. In a hollow spherical shell potential (V) changes with respect to distance (r) from centre

a) 

b) 

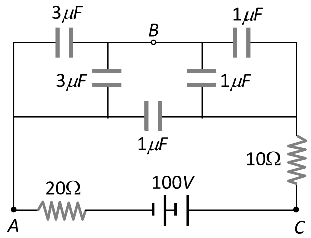
c) 

d) 

361. A and B are two identical spherical charged bodies which repel each other with force F, kept at a finite distance. A third uncharged sphere of same size is brought in contact with sphere B and removed. It is then kept at midpoint of A and B. Find the magnitude of force on C.

a) $F/2$ b) $F/8$ c) F d) Zero

362. In the figure below, what is the potential difference between the points A and B and between B and C respectively in steady state



a) $V_{AB} = V_{BC} = 100\ V$
b) $V_{AB} = 75\ V, V_{BC} = 25\ V$
c) $V_{AB} = 25\ V, V_{BC} = 75\ V$
d) $V_{AB} = V_{BC} = 50\ V$

363. Two small spheres each carrying a charge q are placed r metre apart. If one of the sphere is taken around the other one in a circular path of radius r, the work done will be equal to

a) Force between them $\times r$
b) Force between them $\times 2\pi r$
c) Force between them $/2\pi r$
d) Zero

364. The earth has Volume $'V'$ and surface area $'A'$ then capacitance would be

a) $4\pi \in_0 \frac{A}{V}$
b) $4\pi \in_0 \frac{V}{A}$
c) $12\pi \in_0 \frac{V}{A}$
d) $12\pi \in_0 \frac{A}{V}$

365. 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

a) $\frac{Eq^2m}{2t^2}$
b) $\frac{2E^2t^2}{mq}$
c) $\frac{E^2q^2t^2}{2m}$
d) $\frac{Eqm}{t}$

366. 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

a) F
b) $3F/4$
c) $F/2$
d) $F/4$

367. The diameter of each plate of an air capacitor is $4cm$. To make the capacity of this plate capacitor equal to that of $20cm$ diameter sphere, the distance between the plates will be

a) $4 \times 10^{-3}m$
b) $1 \times 10^{-3}m$
c) $1cm$
d) $1 \times 10^{-3}cm$

368. Two unlike charges of the same magnitude Q are placed at a distance d. The intensity of the electric field at the middle point in the line joining the two charges.

a) Zero
b) $\frac{3Q}{4\pi\varepsilon_0 d^2}$
c) $\frac{6Q}{2\pi\varepsilon_0 d^2}$
d) $\frac{4Q}{4\pi\varepsilon_0 d^2}$

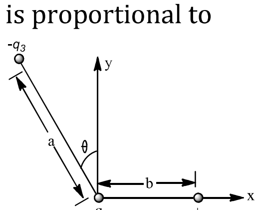
369. Two charges of 4 μC each are placed at the corners A and B of an equilateral triangle of side length 0.2 m in air. The electric potential at C is $\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \frac{N-m^2}{C^2}\right]$

a) $9 \times 10^4\ V$
b) $18 \times 10^4\ V$
c) $36 \times 10^4\ V$
d) $36 \times 10^{-4}\ V$

370. What is angle between electric field and equipotential surface?

a) 90°always
b) 0° always
c) 0° to 90°
d) 0° to 180°

371. Three charges $-q_1 + q_2$ and $-q_3$ are placed as shown in the figure. The x −component of the force on $-q_1$ is proportional to



a) $\frac{q_2}{b^2} - \frac{q_3}{a^2}\cos\theta$
b) $\frac{q_2}{b^2} + \frac{q_3}{a^2}\sin\theta$
c) $\frac{q_2}{b^2} + \frac{q_3}{a^2}\cos\theta$
d) $\frac{q_2}{b^2} - \frac{q_3}{a^2}\sin\theta$

372. Gauss law of gravitation is

a) $\oint \vec{g}.\overrightarrow{ds} = m$ b) $\oint \vec{g}.\overrightarrow{ds} = Gm$ c) $\oint \vec{g}.\overrightarrow{ds} = -4\,G\pi m$ d) All the above

373. There are two metallic spheres of same radii but one is solid and the other is hollow, then
a) Solid sphere can be given more charge b) Hollow sphere can be given more charge
c) They can be charged equally (maximum) d) None of the above

374. There is an electric field E in X-direction. If the work done on moving a charge 0.2 C through a distance of $2m$ along a line making an angle 60° with the X-axis is 4.0, what is the value of E
a) $\sqrt{3}N/C$ b) $4N/C$ c) $5\ N/C$ d) None of these

375. What is the area of the plates of a $3F$ parallel plate capacitor, if the separation between the plates is $5mm$
a) $1.694 \times 10^9 m^2$ b) $4.529 \times 10^9 m^2$ c) $9.281 \times 10^9 m^2$ d) $12.981 \times 10^9 m^2$

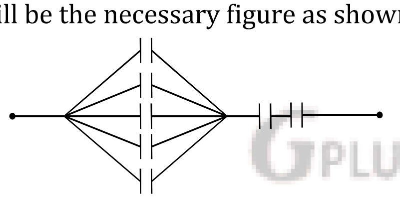
376. Two positive point charges of 12 and 5 microcoulombs, are placed 10cm apart in air. The work needed to bring them 4cm closer is
a) $2.4\ J$ b) $3.6\ J$ c) $4.8\ J$ d) $6.0\ J$

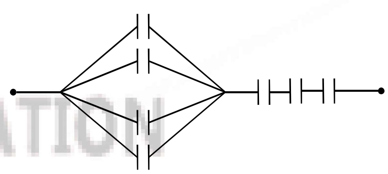
377. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90^0 about its perpendicular axis, the electric field at the same point will be
a) E b) $\frac{E}{4}$ c) $\frac{E}{2}$ d) $2E$

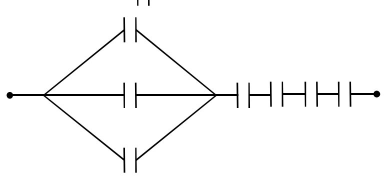
378. A capacitor is used to store 24 $watt$ hour of energy at 1200 $volt$. What should be the capacitance of the capacitor
a) $120\ mF$ b) $120\ \mu F$ c) $24\ \mu F$ d) $24\ mF$

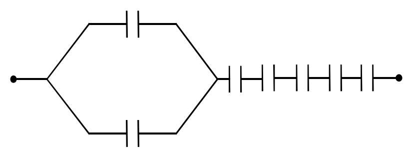
379. Total electric flux coming out of a unit positive charge put in air is
a) ε_0 b) ε_0^{-1} c) $(4p\varepsilon_0)^{-1}$ d) $4\pi\varepsilon_0$

380. Seven capacitors each of capacity $2\mu F$ are to be so connected to have a equivalent capacity $\frac{10}{11}\mu F$. Which will be the necessary figure as shown

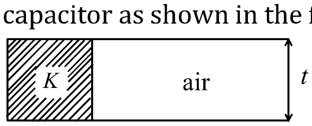
a) 

b) 

c) 

d) 

381. A parallel plate capacitor with air as the dielectric has a capacitance C. A slab of dielectric constant K and having the same thickness as the separation between the plates is introduced so as to fill one-fourth of the capacitor as shown in the figure The new capacitance will be



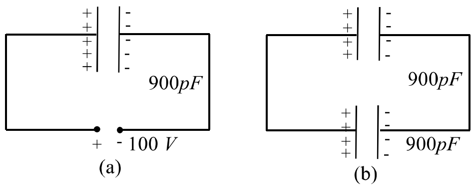
a) $(K+3)\frac{C}{4}$ b) $(K+2)\frac{C}{4}$ c) $(K+1)\frac{C}{4}$ d) $\frac{KC}{4}$

382. The charge on two identical metallic balls are $+40\mu$ and -10μC respectively and they are separated at 2.0 m. How much and nature of force will act between them?
a) 2.9 N, repulsive b) 1.9 N, attractive c) 1.2 N, repulsive d) 0.9 N, attractive

383. Equipotential surfaces associated with an electric field which is increasing in magnitude along the x-direction are
a) Planes parallel to yz-plane b) Planes parallel to xy-plane
c) Planes parallel to xz-plane d) Coaxial cylinders of increasing radii around the x-axis

384. The energy stored in the capacitor as shown in the figure (a) is $4.5 \times 10^{-6}J$. If the battery is replaced by

another capacitor of 900 pF as shown in figure (b), then the total energy of system is



a) $4.5 \times 10^{-6}\, J$ b) $2.25 \times 10^{-6}\, J$ c) Zero d) $9 \times 10^{-6}\, J$

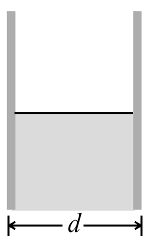
385. The electric field at the centroid of an equilateral triangle carrying an equal charge q at each of the vertices is

a) Zero b) $\frac{\sqrt{2kq}}{r^2}$ c) $\frac{kq}{\sqrt{2r^2}}$ d) $\frac{3kq}{r^2}$

386. A solid metallic sphere has a charge $+3Q$. Concentric with this sphere is a conducting spherical shell having charge-Q. The radius of the sphere is a and that of the spherical shell is b $(b > a)$. What is the electric field at a distance $R(a < R < b)$ from the centre?

a) $\frac{4Q}{2\pi\varepsilon_0 R^2}$ b) $\frac{3Q}{4\pi\varepsilon_0 R^2}$ c) $\frac{3Q}{2\pi\varepsilon_0 R^2}$ d) $\frac{Q}{2\pi\varepsilon_0 R}$

387. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be



a) 400% b) 66.6% c) 33.3% d) 200%

388. Two identical capacitors are joined in parallel, charged to a potential V and then separated and then connected in series $i.e.$ the positive plate of one is connected to negative of the other

a) The charges on the free plates connected together are destroyed
b) The charges on the free plates are enhanced
c) The energy stored in the system increases
d) The potential difference in the free plates becomes $2V$

389. 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

a) Gauss's law fails in this case
b) This problem does not have spherical symmetry
c) Coulomb's law is more fundamental than Gauss's law
d) Spherical Gaussian surface will alter the dipole moment

390. Consider a thin spherical shell of radius R consisting of uniform surface charge density σ. The electric field at a point of distance x from its centre and outside the shell is

a) Inversely proportional to σ b) Directly proportional to x^2
c) Directly proportional to R d) Inversely proportional to x^2

391. 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

a) 8 along negative $C -$ axis b) 8 along positive $X -$ axis
c) 16 along negative $X -$ axis d) 16 along positive $Z -$ axis

392. Two capacitor of capacitance $2\mu F$ and $3\mu F$ are joined in series. Outer plate first capacitor is at 1000 $volt$ and outer plate of second capacitor is earthed (grounded). Now the potential on inner plate of each capacitor will be

a) 700 $Volt$ b) 200 $Volt$ c) 600 $Volt$ d) 400 $Volt$

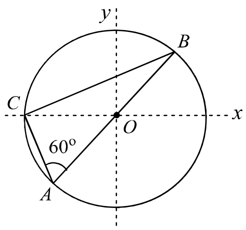
393. What is the magnitude of a point charge due to which the electric field 30cm away has the magnitude 2$newton/coulomb$ $1/4\pi\varepsilon_0 = 9 \times 10^9 Nm^2/C^2$]

a) $2 \times 10^{-11} coulomb$ b) $3 \times 10^{-11} coulomb$ c) $5 \times 10^{-11} coulomb$ d) $9 \times 10^{-11} coulomb$

394. A cube of side l is placed in a uniform field $\boldsymbol{E}$, where $\boldsymbol{E} = E\hat{\boldsymbol{i}}$. The net electric flux through the cube is

a) Zero b) l^2E c) $4l^2E$ d) $6l^2E$

395. Consider a system of three charges $\frac{q}{3}, \frac{q}{3}$ and $-\frac{2q}{3}$ placed at points A, B and C, respectively, as shown in the figure. Take O to be the centre of the circle of radius R and angle CAB $= 60^o$



a) The electric field at point O is $\frac{q}{8\pi\varepsilon_0 R^2}$ directed along the negative x –axis

b) The Potential energy of the system is zero

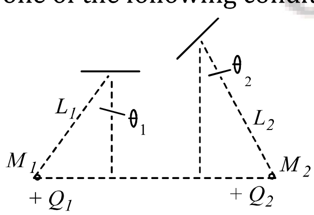
c) The magnitude of the force between the charges at C and B is $\frac{q^2}{54\pi\varepsilon_0 R^2}$

d) The potential at point O is $\frac{q}{12\pi\varepsilon_0 R}$

396. Two capacitors of capacitance $3\mu\ F$ and $6\mu\ F$ are charged to a potential of 12 V each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be

a) 6 $volt$ b) 4 $volt$ c) 3 $volt$ d) Zero

397. Two small spheres of masses M_1 and M_2 are suspended by weightless insulating threads of lengths $L_1$and L_2. The spheres carry charges Q_1 and Q_2 respectively. The spheres are suspended such that they are in level with one another and the threads are inclined to the vertical at angles of θ_1 and $\theta_2$as shown. Which one of the following conditions is essential, if $\theta_1 = \theta_2$?



a) $M_1 \neq M_2$, but $Q_1 = Q_2$ b) $M_1 = M_2$

c) $Q_1 = Q_2$ d) $L_1 = L_1$

398. For a dipole $q = 2 \times 10^{-6} C$ and $d = 0.01\ m$. Calculate the maximum torque for this dipole if $E = 5 \times 10^5\ N/C$

a) $1 \times 10^{-3} Nm^{-1}$ b) $10 \times 10^{-3} Nm^{-1}$ c) $10 \times 10^{-3} Nm$ d) $1 \times 10^2 Nm^2$

399. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is

a) $\epsilon_0\ E^2 Ad$ b) $\frac{1}{2} \epsilon_0\ E^2 Ad$ c) $\frac{1}{2} \epsilon_0\ E^2/A.d$ d) $\epsilon_0\ E^2/Ad$

400. The capacity of a parallel plate capacitor increases with the

a) Decreases of its area b) Increase of its distance

c) Increase of its area d) None of the above

401. What is not true for equipotential surface for uniform electric field?

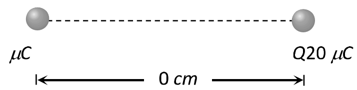
a) Equipotential surface is flat

b) Equipotential surface is spherical

c) Electric lines are perpendicular to equipotential surface

d) Work done is zero

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



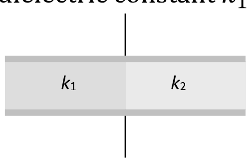
a) 20 cm
b) 10 cm
c) 33 cm
d) None of these

403. Two point charges repel each other with a force of 100 N. One of the charges is increased by 10% and other is reduced by 10%. The new force of repulsion at the same distance would be
a) 100 N b) 121 N c) 99 N d) None of these

404. 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
a) $V\sqrt{e/m}$ b) $\sqrt{eV/m}$ c) $\sqrt{2eV/m}$ d) $2eV/m$

405. An electron initially at rest falls a distance of 1.5cm in a uniform electric field of magnitude $2 \times 10^4 N/C$. The time taken by the electron to fall this distance is
a) $1.3 \times 10^2 s$ b) $2.1 \times 10^{-12} s$ c) $1.6 \times 10^{-10} s$ d) $2.9 \times 10^{-9} s$

406. A parallel plate capacitor with air as medium between the plates has a capacitance of $10\mu F$. The area of capacitor of divided into two equal halves and filled with two media as shown in the figure having dielectric constant $k_1 = 2$ and $k_2 = 4$. The capacitance of the system will now be



a) $10\mu F$ b) $20\mu F$ c) $30\mu F$ d) $40\mu F$

407. There is an air filled $1pF$ parallel plate capacitor. When the plate separation is doubled and the space is filled with wax, the capacitance increases to $2pF$. The dielectric constant of wax is
a) 2 b) 4 c) 6 d) 8

408. The dimension of $(1/2)\ \varepsilon_0 E^2$ (ε_0 : permittivity of free space; E: electric field) is
a) MLT^{-1} b) ML^2T^{-2} c) $ML^{-1}T^{-2}$ d) ML^2T^{-1}

409. $0.2F$ capacitor is charged to 600 V by a battery. On removing the battery, it is connected with another parallel plate condenser of $1F$. The potential decreases to
a) 100 $volts$ b) 120 $volts$ c) 300 $volts$ d) 600 $volts$

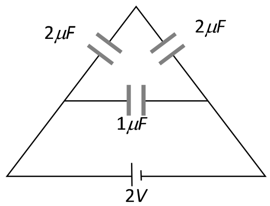
410. One metallic sphere A is given positive charge whereas another identical sphere B of exactly same mass as of A is given equal amount of negative charge. Then
a) Mass of A and mass of B still remain equal b) Mass of A increases
c) Mass of B decreases d) Mass of B increases

411. Work done in carrying a charge around an equipotential surface will
a) Increase b) Decrease c) Zero d) Infinity

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

413. A point charge$q$ produces an electric field of magnitude 2 NC^{-1} at a point distance 0.25 m from it. What is the value of charge?
a) 1.39×10^{-11} C b) 1.39×10^{11} C c) 13.9×10^{-11} C d) 13.9×10^{11} C

414. The charge on any one of the $2\mu\ F$ capacitors and $1\mu\ F$ capacitor will be given respectively (in $\mu\ C$) as



a) 1,2 b) 2,1 c) 1,1 d) 2,2

415. The plates of a parallel plate condenser are pulled apart with a velocity v. If at any instant their mutual distance of separation is d, then the magnitude of the time of rate of change of capacity depends on d as follows
a) $1/d$ b) $1/d^2$ c) d^2 d) d

416. An electric dipole is put in north-south direction in a sphere filled with water. Which statement is correct
a) Electric flux is coming towards sphere
b) Electric flux is coming out of sphere
c) Electric flux entering into sphere and leaving the sphere are same
d) Water does not permit electric flux to enter into sphere

417. 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
a) $7.27 \times 10^{-4}\ C/m$ b) $7.98 \times 10^{-4}\ C/m$ c) $7.11 \times 10^{-4}\ C/m$ d) $7.04 \times 10^{-4}\ C/m$

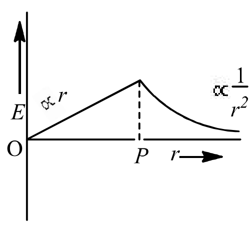
418. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then electric field at Q is proportional to
a) p^{-1} and r^{-2} b) p and r^{-2} c) p^2 and r^{-3} d) p and r^{-3}

419. A capacitor of capacitance C is charged to potential V. The flux of the electric field through a closed surface enclosing the capacitor is
a) $\frac{CV}{\epsilon_0}$ b) $\frac{2CV}{\epsilon_0}$ c) $\frac{CV}{2\ \epsilon_0}$ d) Zero

420. An air filled parallel plate capacitor the capacity C. If distance between plates is doubled and it is immersed in a liquid then capacity becomes twice. Dielectric constant of the liquid is
a) 1 b) 2 c) 3 d) 4

421. An electron enters in high potential region V_2 from lower potential region V_1 then its velocity
a) Will increase
b) Will change in direction but not in magnitude
c) No change in direction of field
d) No change in direction perpendicular to field

422. The figure shows electric field E at a distance r in any direction from the origin$O$. The electric field E is due to



a) A charged hollow metallic sphere of radius OP with centre at O
b) A charged solid metallic sphere of radius OP with centre at$O$
c) A uniformly charged non-conducting sphere of radius $OP$with centre at O
d) A uniformly charged non-conducting hollow sphere of radius $OP$with centre at O

423. Force acting upon a charged particle kept between the plates of a charged condenser is F. If one plate of the condenser is removed, then the force acting on the same particle will become
a) 0 b) $F/2$ c) F d) $2F$

424. Two point charges of $20\mu C$ and $80\mu C$ are $10cm$ apart. Where will the electric field strength be zero on the line joining the charges form $20\mu C$ charge

a) 0.1 m b) 0.04 m c) 0.033 m d) 0.33 m

425. The ratio of electric field and potential (E/V) at midpoint of electric dipole, for which separation is l

a) $\frac{1}{l}$ b) l c) $\frac{2}{l}$ d) None of these

426. An electric dipole of the dipole moment **p** is placed in a uniform electric field **E**. The maximum torque experienced by the dipole is

a) pE b) $\frac{P}{E}$ c) $\frac{E}{P}$ d) **p.E**

427. The potential at a point x(measured in μm) due to some charges situated on the x-axis is given by $V(x) = 20/(x^2 - 4)$ volt

The electric field E at x=4 μm is given by

a) $\frac{5}{3}$Vμ^{-1}m^{-1} and in the $-$ ve x direction

b) $\frac{5}{3}$Vμ^{-1}m^{-1} and in the $+$ ve x direction

c) $\frac{10}{9}$Vμ^{-1}m^{-1} and in the $-$ ve x direction

d) $\frac{10}{9}$Vμ^{-1}m^{-1} and in the $+$ ve x direction

428. The electric field and the potential of an electric dipole vary with distance r as

a) $\frac{1}{r}$ and $\frac{1}{r^2}$ b) $\frac{1}{r^2}$ and $\frac{1}{r}$ c) $\frac{1}{r^2}$ and $\frac{1}{r^3}$ d) $\frac{1}{r^3}$ and $\frac{1}{r^2}$

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

a) Electric potential at the surface of the cube is zero

b) Electric potential within the cube is zero

c) Electric field is normal to the surface of the cube

d) Electric field varies within the cube

430. Which of the following statement is correct?

a) Electric field is zero on the surface of current carrying wire.

b) Electric field is non-zero on the axis of hollow current carrying wire

c) Surface integral of magnetic field for any closed surface is equal to μ_0 times of total algebraic sum of current which are crossing through the closed surface

d) None of the above

431. A capacitor is charged by using a battery which is then disconnected. A dielectric slab is then slipped between the plates, which results in

a) Reduction of charge on the plates and increase of potential difference across the plates

b) Increase in the potential difference across the plate, reduction in stored energy, but no change in the charge on the plates

c) Decrease in the potential difference across the plates, reduction in the stored energy, but no change in the charge on the plates

d) None of the above

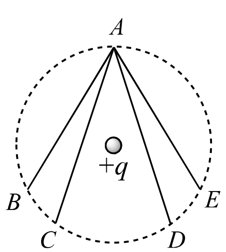
432. n identical capacitors each of capacitance C when connected in parallel give the effective capacitance 90 μF and when connected in series give 2.5 μF. Then the values of n and C respectively are

a) 6 and 15 μF b) 5 and 18 μF c) 15 and 6 μF d) 18 and 5 μF

433. Two pint 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

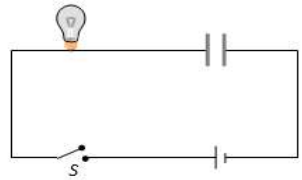
a) 2L b) L/4 c) 8L d) 4L

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



a) Is least along the path AB b) Is least along the path AD
c) Is zero along all the parts AB, AC, AD and AE d) Is least along AE

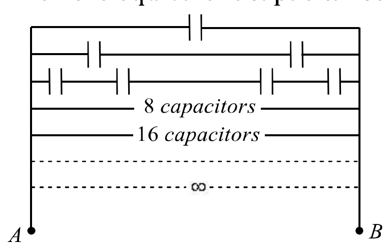
435. A light bulb, a capacitor and a battery are connected together as shown here, with switch S initially open. When the switch S is closed, which one of the following is true



a) The bulb will light up for an instant when the capacitor starts charging
b) The bulb will light up when the capacitor is fully charged
c) The bulb will not light up at all
d) The bulb will light up and go off at regular intervals

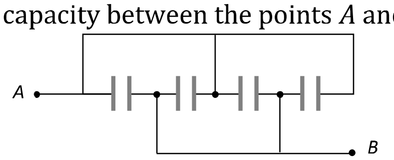
436. A capacitor of capacity C is connected with a battery of potential V in parallel. The distance between its plates is reduced to half at once, assuming that the charge remains the same. Then to charge the capacitance upto the potential V again, the energy given by the battery will be
a) $CV^2/4$ b) $CV^2/2$ c) $3CV^2/4$ d) CV^2

437. An infinite number of identical capacitors each of capacitance $1\mu F$ are connected as in adjoining figure. Then the equivalent capacitance between A and B is



a) $1\mu F$ b) $2\mu F$ c) $\frac{1}{2}\mu F$ d) ∞

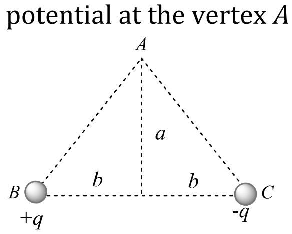
438. Four condensers are joined are shown in the adjoining figure. The capacity of each is $8\mu F$. The equivalent capacity between the points A and B will be



a) $32\mu F$ b) $2\mu F$ c) $8\mu F$ d) $16\mu F$

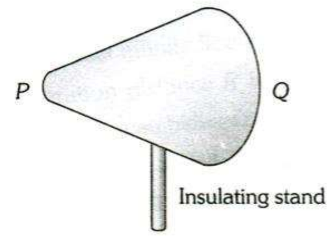
439. An electric dipole of moment $\vec{p}$ is placed normal to the lines of force of electric intensity $\vec{E}$, then the work done in deflecting it through an angle of 180^{o} is
a) pE
b) $+2pE$
c) $-2pE$
d) Zero

440. 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



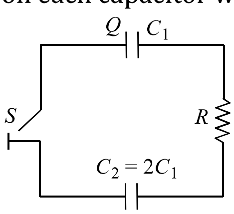
a) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{2q}{\sqrt{a^2+b^2}}$ b) Zero c) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{\sqrt{a^2+b^2}}$ d) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{(-q)}{\sqrt{a^2+b^2}}$

441. Figure shows a charged conductor resting on an insulating stand. If at the point P the charge density is σ, the potential is V and the electric field strength is E, what are the values of these quantities at point Q

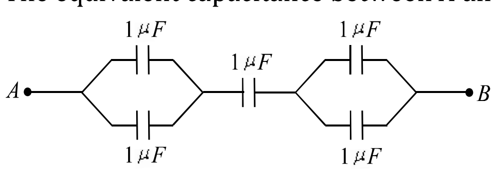


Charge Density	Potential	Electric intensity
a) $> \sigma$	$> V$	$> E$
b) $> \sigma$	V	$> E$
c) $< \sigma$	V	E
d) $< \sigma$	V	$< E$

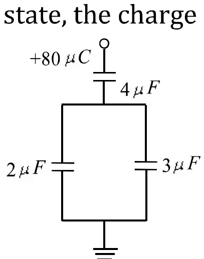
442. When a body is earth connected, electrons from the earth flow into the body. This means the body is
   a) Charged negatively b) An insulator
   c) Uncharged d) Charged positively
443. The capacity of parallel plate condenser depends on
   a) The type of metal used b) The thickness of plates
   c) The potential applied across the plates d) The separation between the plates
444. Two capacitors C_1 and $C_2 = 2C_1$ are connected in a circuit with a switch between them as shown in the figure. Initially the switch is open and C_1 holds charge Q. The switch is closed. At steady state, the charge on each capacitor will be



   a) $Q, 2Q$ b) $Q/3, 2Q/3$ c) $3Q/2, 3Q$ d) $2Q/3, 4Q/3$
445. The equivalent capacitance between A and B is



   a) $2\ \mu F$ b) $3\ \mu F$ c) $5\ \mu F$ d) $0.5\ \mu F$
446. 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
   a) $-20 \times 10^{-5} \mu C$ b) $-5 \times 10^{-5} \mu C$ c) $5 \times 10^{-5} \mu C$ d) $20 \times 10^{-5} \mu C$
447. In the given circuit, a charge of $+80\ \mu C$ is given to the upper plate of the $4\ \mu F$ capacitor. Then in the steady state, the charge on the upper plate of the $3\ \mu F$ capacitor is

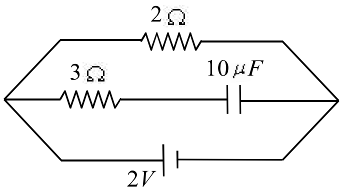


   a) $+32\ \mu C$ b) $+40\ \mu C$ c) $+48\ \mu C$ d) $+80\ \mu C$
448. An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Then
   (i) The torque on the dipole is $\vec{p} \times \vec{E}$

(ii) The potential energy of the system is $\vec{p}.\vec{E}$
(iii) The resultant force on the dipole is zero

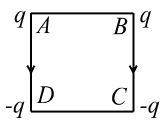
a) (i), (ii) and (iii) are correct
b) (i) and (iii) are correct and (ii) is wrong
c) Only (i) is correct
d) (i) and (ii) are correct (iii) is wrong

449. The charge on a capacitor of capacitance $10\mu F$ connected as shown in the figure is



a) $20\mu C$
b) $15\mu C$
c) $10\mu C$
d) Zero

450. Charges are placed on the vertices of a square as shown. Let E be the electric field and V the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then

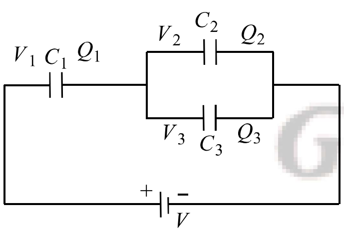


a) $\vec{E}$ remains unchanged, V changes
b) Both $\vec{E}$ and V change
c) $\vec{E}$ and V remains unchanged
d) $\vec{E}$ changes, V remains unchanged

451. Gauss's law is true only if force due to a charge varies as

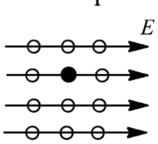
a) r^{-1}
b) r^{-2}
c) r^{-3}
d) r^{-4}

452. In an adjoining figure are shown three capacitors C_1, C_2 and C_3 joined to a battery. The correct condition will be (Symbols have their usual meanings)



a) $Q_1 = Q_2 = Q_3$ and $V_1 = V_2 = V_3 = V$
b) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2 + V_3$
c) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2$
d) $Q_2 = Q_3$ and $V_2 = V_3$

453. There is a uniform electric field of intensity E which is as shown. How many labeled points have the same electric potential as the fully shaded point?



a) 2
b) 3
c) 8
d) 11

454. Which of the following is the correct statement of Gauss law for electrostatics in a region of charge distribution in free space?

a) $\oint \mathrm{E.ds} = 0$
b) $\oint E.ds = \frac{\rho}{\varepsilon_0}$
c) $\oint E.ds = \rho$
d) $\oint E.ds = \varepsilon_0\rho$

455. When a lamp is connected in series with capacitor, then

a) Lamp will not glow
b) Lamp will burst out
c) Lamp will glow normally
d) None of these

456. Identify the false statement

a) Inside a charged or neutral conductor electrostatic field is zero
b) The electrostatic field at the surface of the charged conductor must be tangential to the surface at any point

c) There is no net charge at any point inside the conductor
d) Electric field at the surface of a charged conductor is proportional to the surface charge density

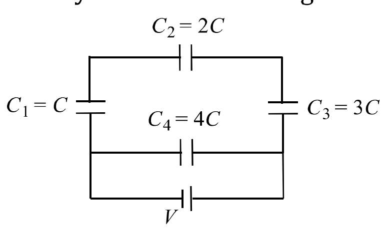
457. A force of 2.25 N acts on a charge of 15×10^{-4}C. Calculate the intensity of electric field at that point
a) 1500 NC^{-1} b) 150 NC^{-1} c) 15000 NC^{-1} d) None of these

458. Between the plates of a parallel plate condenser there is $1mm$ thick paper of dielectric constant 4. It is charged at 100 $volt$. The electric field in $volt/metre$ between the plates of the capacitor is
a) 100 b) 100000 c) 25000 d) 4000000

459. The magnitude of electric field at distance r from an infinitely thin rod having a linear charge density λ is(use Gauss's law)
a) $E = \frac{\lambda}{2\pi\varepsilon_0 r}$ b) $E = \frac{2\lambda}{\pi\varepsilon_0 r}$ c) $E = \frac{\lambda}{4\pi\varepsilon_0 r}$ d) $E = \frac{4\lambda}{\pi\varepsilon_0 r}$

460. 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
a) $pE \cos\theta$ b) $pE \sin\theta$ c) $pE(1 - \cos\theta)$ d) $-pE \cos\theta$

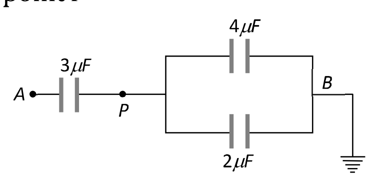
461. A network of four capacitors of capacity equal to $C_1 = C, C_2 = 2C, C_3 = 3C$ and $C_4 = 4C$ are conducted in a battery as shown in the figure. The ratio of the charges on C_2 and C_4 is



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

462. A ball with charge $-50\ e$ is placed at the centre of a hollow spherical shell which has a net charge of $-50\ e$. What is the charge on the shell's outer surface
a) $-50e$ b) Zero c) $-100e$ d) $+100e$

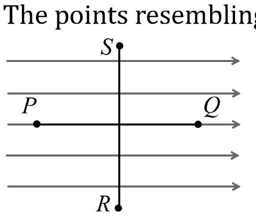
463. In the figure a potential of $+\ 1200\ V$ is given to point A and point B is earthed, what is the potential at the point P



a) 100 V b) 200 V c) 400 V d) 600 V

464. A spherical drop of mercury having a potential of 2.5 V is obtained as a result of merging 125 droplets. The potential of constituent droplets would be
a) 1.0 V b) 0.5 V c) 0.2 V d) 0.1 V

465. The points resembling equal potentials are

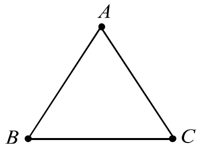


a) P and Q b) S and Q c) S and R d) P and R

466. 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
a) 24 cm from $+\ 9e$
b) 12 cm from $+\ 9e$

c) 24 cm from $+e$
d) 12 cm from $+e$

467. Three identical charges, each of $2\mu C$ are placed at the vertices of a triangle ABC as shown in the figure



If $AB + AC = 12\ cm$ and $AB.AC = 32\ cm^2$, the potential energy of the charge at A is

a) 1.53 J b) 5.31 J c) 3.15 J d) 1.35 J

468. 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

a) $4.5 \times 10^6\ N/C$ directed towards $+5\mu C$
b) $4.5 \times 10^6\ N/C$ directed towards $+10\mu C$
c) $13.5 \times 10^6\ N/C$ directed towards $+5\mu C$
d) $13.5 \times 10^6\ N/C$ directed towards $+10\mu C$

469. There are two charges $+1\ \mu C$ and $+5\ \mu C$ respectively. The ratio of the forces acting on them will be

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

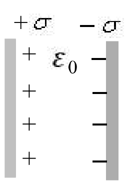
470. The electric field inside a spherical shell of uniform surface charge density is

a) Zero
b) Constant, less than zero
c) Directly proportional to the distance from the centre
d) None of the above

471. Which of the following is the correct statement of Gauss law for electrostatics in a region of charge distribution in free space

a) $\oint E.ds = 0$ b) $\oint E.ds = \rho/\varepsilon_0$ c) $\oint E.ds = \rho$ d) $\oint E.ds = \varepsilon_0 \rho$

472. Two large metal plates are placed parallel to each other. The inner surfaces of plates are charged by $+\sigma$ and$-\sigma$ (Coulomb/m^2). The outer surfaces are neutral. The electric field is …… in the region between the plates and …… outside the plates



a) $\frac{2\sigma}{\epsilon_0}, \frac{\sigma}{\epsilon_0}$ b) $\frac{\sigma}{\epsilon_0}$, zero c) $\frac{2\sigma}{\epsilon_0}$, zero d) zero, $\frac{2\sigma}{\epsilon_0}$

473. Capacitance (in F) of a spherical conductor with radius $1m$ is

a) 1.1×10^{-10} b) 10^{-6} c) 9×10^{-9} d) 10^{-3}

474. An electric dipole coincides on Z-axis and its mid point is on origin of the co-ordinate system. The electric field at an axial point at a distance z from origin is $\vec{E}_{(z)}$ and electric field at an equatorial point at a distance y from origin is $\vec{E}_{(y)}$ Here

$z = y \gg a$, so $\left|\frac{\vec{E}_{(z)}}{\vec{E}_{(y)}}\right| = \cdots$

a) 1 b) 4 c) 3 d) 2

475. Two conducting spheres of radii 3 cm and 1 cm are separated by a distance of 10 cm in free space. If the spheres are charged to same potential of 10 V each, the force of repulsion between them is

a) $\frac{1}{3} \times 10^{-9}$ N b) $\frac{2}{9} \times 10^{-9}$N c) $\frac{1}{9} \times 10^{-9}$ N d) $\frac{4}{3} \times 10^{-9}$ N

476. If a charged spherical conductor of radius $10cm$ 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

a) $\frac{1}{3}V$ b) $\frac{2}{3}V$ c) $\frac{3}{2}V$ d) $3V$

477. A charge of 1 μC is divided into two parts such that their charges are in the ratio of 2:3. These two charges are kept at a distance 1 m apart in vacuum. Then, the electric force between them (in N) is

a) 0.216 b) 0.00216 c) 0.0216 d) 2.16

478. Infinite charges of magnitude q each are lying at $x = 1,2,4,8..$metre on X-axis. The value of intensity of electric field at point $x = 0$ due to these charges will be

a) $12 \times 10^9\ q\ \text{NC}^{-1}$ b) zero c) $6 \times 10^9\ q\ \text{NC}^{-1}$ d) $4 \times 10^9\ q\ \text{NC}^{-1}$

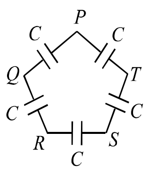
479. The electric field due to an extremely short dipole at distance r from it is proportional to

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

480. 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 $2.5 \times 10^{-5} N$. The dielectric constant of oil is

a) 2.5 b) 0.25 c) 2.0 d) 4.0

481. Five capacitors, each of capacitance value C are connected as shown in the figure. The ratio of capacitance between P and R, and the capacitance between P and Q, is

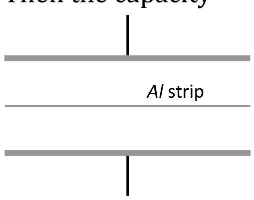


a) 3 : 1 b) 5 : 2 c) 2 : 3 d) 1 : 1

482. An electric dipole of moment **p** placed in a uniform electric field **E** has minimum potential energy when the angle between **p** and **E** is

a) Zero b) $\frac{\pi}{2}$ c) π d) $\frac{3\pi}{2}$

483. As shown in the figure, a very thin sheet of aluminium is placed in between the plates of the condenser. Then the capacity

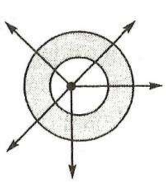
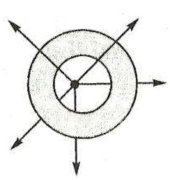
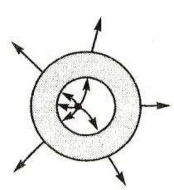
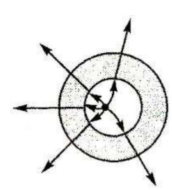


a) Will increase
b) Will decrease
c) Remains unchanged
d) May increase or decrease

484. An electric dipole is placed in an electric field generated by a point charge

a) The net electric force on the dipole must be zero
b) The net electric force on the dipole may be zero
c) The torque on the dipole due to the field must be zero
d) The torque on the dipole due to the field may be zero

485. A metallic shell has a point charge q kept inside its cavity. Which one of the following diagrams correctly represents the electric lines or forces?

a)  b)  c)  d) 

486. The electric field that can balance a deuteron of mass 3.2×10^{-27} kg is

a) $19.6 \times 10^{-10}\ \text{NC}^{-1}$ b) $19.6 \times 10^{-8}\ \text{NC}^{-1}$ c) $19.6 \times 10^{10}\ \text{NC}^{-1}$ d) $19.6 \times 10^{8}\ \text{NC}^{-1}$

487. A parallel plate capacitor has circular plates of $0.08m$ radius and $1.0 \times 10^{-3}m$ separation. If a P.D. of 100 $volt$ is applied, the charge will be

a) $1.8 \times 10^{-10}C$ b) $1.8 \times 10^{-8}C$ c) $1.8 \times 10^{-20}C$ d) None of these

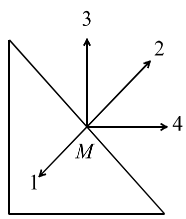
488. An electric dipole is situated in an electric field of uniform intensity E whose dipole moment is p and moment of inertia is I. If the dipole is displaced slightly from the equilibrium position, then the angular frequency of its oscillations is

a) $\left(\frac{pE}{I}\right)^{1/2}$ b) $\left(\frac{pE}{I}\right)^{3/2}$ c) $\left(\frac{I}{pE}\right)^{1/2}$ d) $\left(\frac{p}{IE}\right)^{1/2}$

489. A force F acts between sodium and chlorine ions of salt (sodium chloride) when put $1cm$ 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 $1cm$ apart is

a) $\frac{F}{K}$ b) $\frac{FK}{\varepsilon_0}$ c) $\frac{F}{K\varepsilon_0}$ d) $\frac{F\varepsilon_0}{K}$

490. 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

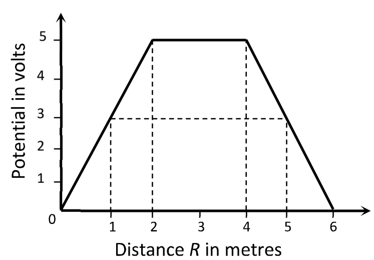


a) 1
b) 2
c) 3
d) 4

491. The electric field in the space between the plates of a discharge tube is 3.25×10^4 NC^{-1}. If mass of proton is 1.67×10^{-27} kg and its charge is 1.6×10^{-19}C, the force often the proton in the field is

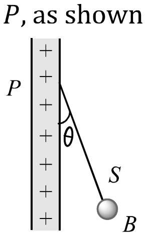
a) 10.4×10^{-15} N b) 2.0×10^{-23} N c) 5.40×10^{-15} N d) 5.20×10^{-15} N

492. The variation of potential with distance R from a fixed point is as shown below. The electric field at $R = 5m$ is



a) $2.5\ volt/m$ b) $-2.5\ volt/m$ c) $2/5\ volt/m$ d) $-2/5\ volt/m$

493. 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



a) $\sin\theta$

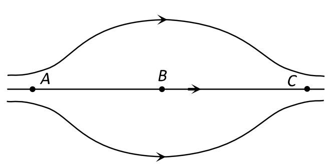
b) $\tan\theta$
c) $\cos\theta$
d) $\cot\theta$

494. Two capacitors of capacities C_1 and C_2 are charged to voltages V_1 and V_2 respectively. There will be no exchange of energy in connecting them in parallel, if
a) $C_1 = C_2$ b) $C_1V_1 = C_2V_2$ c) $V_1 = V_2$ d) $\frac{C_1}{V_1} = \frac{C_2}{V_2}$

495. A parallel plate air capacitor is charged to a potential difference of V. After disconnecting the battery, distance between the plates of the capacitor is increased using an insulating handle. As a result, the potential difference between the plates
a) Decreases b) Increases c) Becomes zero d) Does not change

496. The wrong statement about electric lines of force is
a) These originate from positive charge and end on negative charge
b) They do not intersect each other at a point
c) They have the same form for a point charge and a sphere
d) They have physical existence

497. The figure shows some of the electric field lines corresponding to an electric field. The figure suggest

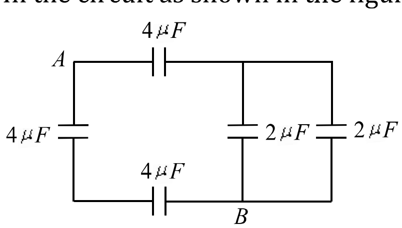


a) $E_A > E_B > E_C$ b) $E_A = E_B = E_C$ c) $E_A = E_C > E_B$ d) $E_A = E_C < E_B$

498. A potential difference of 300 $volts$ is applied to a combination of $2.0\mu F$ and $8.0\mu F$ capacitors connected in series. The charge on the $2.0\mu F$ capacitor is
a) $2.4 \times 10^{-4}C$ b) $4.8 \times 10^{-4}C$ c) $7.2 \times 10^{-4}C$ d) $9.6 \times 10^{-4}C$

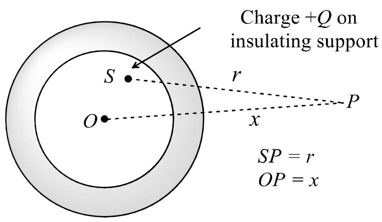
499. The work done in bringing a 20 $coulomb$ charge from point A to point B for distance $0.2m$ is $2j$. The potential difference between the two points will be (in $volt$)
a) 0.2 b) 8 c) 0.1 d) 0.4

500. In the circuit as shown in the figure the effective capacitance between A and B is



a) $3\ \mu F$
b) $2\ \mu F$
c) $4\ \mu F$
d) $8\ \mu F$

501. The adjacent diagram shows a charge $+Q$ held on an insulating support S and enclosed by a hollow spherical conductor. O represents the centre of the spherical conductor and P is a point such that $OP = x$ and $SP = r$
The electric field at point P will be

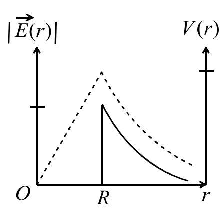


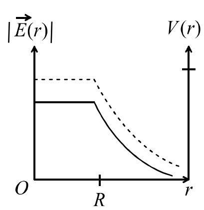
a) $\frac{Q}{4\pi\varepsilon_0 x^2}$ b) $\frac{Q}{4\pi\varepsilon_0 r^2}$ c) 0 d) None of the above

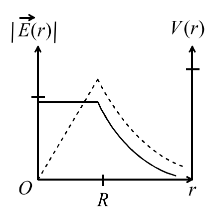
502. When a dielectric material is introduced between the plates of a charged condenser then electric field between the plates

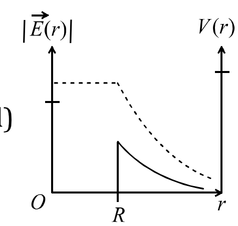
a) Decreases b) Increases c) Remain constant d) First (b) and (a)

503. Consider a thin spherical shell of radius R with its centre at the origin, carrying uniform positive surface charge density. The variation of the magnitude of the electric field $|\vec{E}(r)|$ and the electric potential $V(r)$ with the distance r from the centre, is best represented by which graph

a) 

b) 

c) 

d) 

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

a) $150\sqrt{2}\ volt$

b) $1500\sqrt{2}\ volt$

c) $900\sqrt{2}\ volt$

d) $900\ volt$

505. A body of capacity $4\ \mu\ F$ is charged to $80\ V$ and another body of capacity $6\mu\ F$ is charged to $30V$. When they are connected the energy lost by $4\mu\ F$ capacitor is

a) $7.8\ mJ$ b) $4.6\ mJ$ c) $3.2\ mJ$ d) $2.5\ mJ$

506. An electric dipole consists of two opposite charges, each of magnitude 1.0 μC separated by a distance of 2.0 cm. the dipole is placed in an external electric field of 10^5 NC^{-1}. The maximum torque on the dipole is

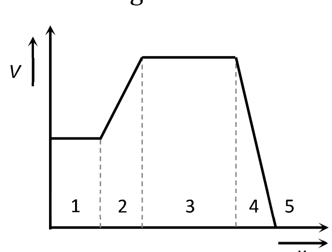
a) 0.2×10^{-3}N-m b) 1×10^{-3}N-m c) 2×10^{-3}N-m d) 4×10^{-3}N-m

507. A conductor has been given a charge $-3 \times 10^{-7} C$ by transferring electrons. Mass increase (in kg) of the conductor and the number of electrons added to the conductor are respectively

a) 2×10^{-16} and 2×10^{31} b) 5×10^{-31} and 5×10^{19}

c) 3×10^{-19} and 9×10^{16} d) 2×10^{-18} and 2×10^{12}

508. The figure gives the electric potential V as a function of distance through five regions on x-axis. Which of the following is true for the electric field E in these regions



a) $E_1 > E_2 > E_3 > E_4 > E_5$ b) $E_1 = E_3 = E_5$ and $E_2 < E_4$

c) $E_2 = E_4 = E_5$ and $E_1 < E_3$ d) $E_1 < E_2 < E_3 < E_4 < E_5$

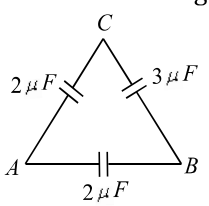
509. A parallel plate capacitor has plate area A and separation d. It is charged to a potential difference V_0. The charging battery is disconnected and the plates are pulled apart to three times the initial separation. The work required to separate the plates is

a) $\frac{3\varepsilon_0 A V_0^2}{d}$ b) $\frac{\varepsilon_0 A V_0^2}{2d}$ c) $\frac{\varepsilon_0 A V_0^2}{3d}$ d) $\frac{\varepsilon_0 A V_0^2}{d}$

510. The electric potential inside a conducting sphere

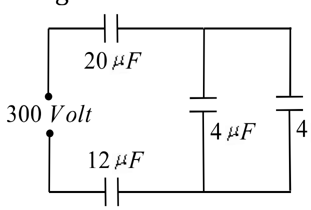
a) Increases from centre to surface b) Decreases from centre to surface
c) Remains constant from centre to surface d) Is zero at every point inside

511. Three capacitors are connected in the arms of a triangle ABC as shown in figure 5 V is applied between A and B. The voltage between B and C is



a) 2 V b) 1 V c) 3 V d) 1.5 V

512. In the adjoining figure, four capacitors are shown with their respective capacities and the P.D. applied. The charge and the P.D. across the $4\mu F$ capacitor will be



a) $600\mu C$; 150 $volts$ b) $300\mu C$; 75 $volts$ c) $800\mu C$; 200 $volts$ d) $580\mu C$; 145 $volts$

513. Two condensers of capacities $1\mu F$ and $2\mu F$ are connected in series and the system is charged to 120 $volts$. Then the P.D. on $1\mu F$ capacitor (in volts) will be

a) 40 b) 60 c) 80 d) 120

514. A piece of cloud having area $25 \times 10^6 m^2$ and electric potential of 10^5 volts. If the height of cloud is 0.75 km, then energy of electric field between earth and cloud will be

a) 250 J b) 750 J c) 1225 J d) 1475 J

515. If there are n capacitors in parallel connected to V $volt$ source, then the energy stored is equal to

a) CV b) $\frac{1}{2}nCV^2$ c) CV^2 d) $\frac{1}{2n}CV^2$

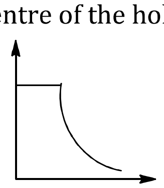
516. Two charges $+3.2 \times 10^{-19}C$ and $-3.2 \times 10^{-9}C$ kept 2.4 Å apart forms a dipole. If it is kept in uniform electric field of intensity 4×10^5 $volt/m$ then what will be its electrical energy in equilibrium

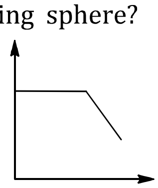
a) $+3 \times 10^{-23}J$ b) $-3 \times 10^{-23}J$ c) $-6 \times 10^{-23}J$ d) $-2 \times 10^{-23}J$

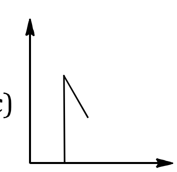
517. The intensity of the electric field required to keep a water drop of radius $10^{-5}cm$ just suspended in air when charged with one electron approximately
($g = 10$ $newton/kg$, $e = 1.6 \times 10^{-19}$ $coulomb$)

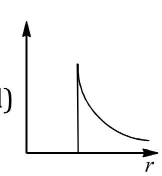
a) 260 $volt/cm$ b) 260 $newtons/coulomb$
c) 130 $volt/cm$ d) 130 $newton/coulomb$

518. Which one of the following graphs, shows the variation of electric field strength E with distance d from the centre of the hollow conducting sphere?

a) 

b) 

c) 

d) 

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

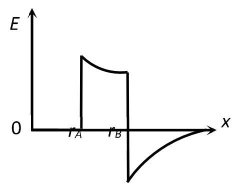
be

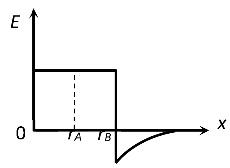
a) $Q \times 2\pi r$ b) $\frac{q \times 2\pi Q}{r}$ c) Zero d) $\frac{Q}{2\varepsilon_0 r}$

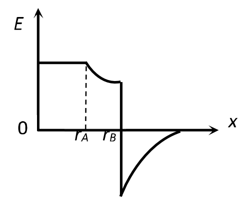
520. Which of the following will represent coulomb's law

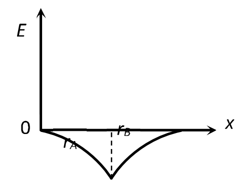
a) $\oint \vec{E}.d\vec{S} = \frac{q}{\epsilon_0}$ b) $\oint \vec{E}.d\vec{l} = 0$ c) $\oint \vec{H}.d\vec{S} = 0$ d) $\oint \vec{H}.d\vec{l} = \mu_0 I$

521. Two concentric conducting thin spherical shells A, and B having radii r_A and $r_B (r_B > r_A)$ are charged to Q_A and $-Q_B (|Q_B| > |Q_A|)$. The electrical field along a line, (passing through the centre) is

a) 

b) 

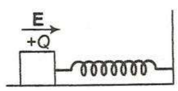
c) 

d) 

522. Two identical spheres with charges $4q, -2q$ kept some distance apart exert a force F on each other. If they are made to touch each other and replaced at their old positions, the force between them will be

a) $\frac{1}{9}F$ b) $\frac{1}{8}F$ c) $\frac{9}{8}F$ d) $\frac{8}{9}F$

523. A wooden block performs SHM on a frictionless surface with frequency v_0. The block carries a charge $+Q$ on its surface. If now a uniform electric field **E** is switched on as shown, then the SHM of the block will be



a) of the same frequency and with shifted mean position
b) of the same frequency and with same mean position
c) of changed frequency and with shifted mean position
d) of changed frequency and with same mean position

524. A soap bubble is given a negative charge, then its radius

a) Decreases b) Increases
c) Remains unchanged d) Nothing can be predicted as information is insufficient

525. Two unit negative charges are placed on straight line. A positive charge q is placed exactly at the mid-point between these unit charges. If the system of these three charges is in equilibrium, the value of q (in C) is

a) 1.0 b) 0.75 c) 0.5 d) 0.25

526. An electron initially at rest falls a distance of 1.5 cm in a uniform electric field of magnitude 2×10^4 N/C. The time taken by electron to fall this distance is

a) 1.3×10^2 s b) 2.1×10^{-12} s c) 1.6×10^{-10} s d) 2.9×10^{-9} s

527. The capacity of a spherical conductor in MKS system is

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

528. A conducting sphere of radius $10 cm$ is charged $10 \mu\ C$. Another uncharged sphere of radius 20 cm is allowed to touch it for some time. After that if the sphere are separated, then surface density of charges, on the spheres will be in the ratio of

a) 1 : 4 b) 1 : 3 c) 2 : 1 d) 1 : 1

529. What about Gauss theorem is not incorrect?

a) It can be derived by using Coulomb's law
b) It is valid for conservative field, obeys inverse square root law
c) Gauss theorem is not applicable in gravitation
d) Both (a) and (b)

530. Two conducting sphere of radii r_1 and r_2 are charged to the same surface charge density. The ratio of electric field near their surface is

a) r_1^2 / r_2^2 b) r_2^2 / r_1^2 c) r_1 / r_2 d) 1 : 1

531. Force between two identical charges placed at a distance of r in vacuum is F. Now a slab of dielectric of dielectric constant 4 is inserted between these two charges. If the thickness of the slab is $r/2$, then the force between the charges will become

a) F b) $\frac{3}{5}F$ c) $\frac{4}{9}F$ d) $\frac{F}{4}$

532. 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 $l\ cm$

a) $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{l}$ b) $\frac{1}{4\pi\varepsilon_0}\frac{2q^2}{l}$ c) $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{l}$ d) $\frac{1}{4\pi\varepsilon_0}\frac{4q^2}{l}$

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

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

534. The electric potential at a point (x, y) in the $x - y$ plane is given by $V = -kxy$. The field intensity at a distance r from the origin varies as

a) r^2 b) r c) $\frac{1}{r}$ d) $\frac{1}{r^2}$

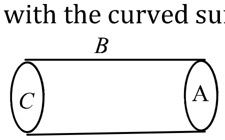
535. Two charges q_1 and q_2 are placed in vacuum at a distance d and the force acting between them is F. If a medium of dielectric constant 4 is introduced between them, the force now will be

a) $4F$ b) $2F$ c) $\frac{F}{2}$ d) $\frac{F}{4}$

536. Two identical charges repel each other with a force equal to 10 $mg\ wt$ when they are 0.6 m apart in the air. $g = (10 ms^{-2})$. The value of each charge is

a) 2 mC b) $2 \times 10^{-7}\ C$ c) 2 nC d) 2 μC

537. A hollow cylinder has a charge q coulomb within it. If ϕis the electric flux in unit of voltmeter associated with the curved surface B, the flux linked with the plane surface A in unit of voltmeter will be

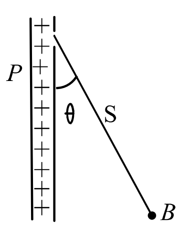


a) $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$ b) $\frac{q}{2\varepsilon_0}$ c) $\frac{\phi}{3}$ d) $\frac{q}{\varepsilon_0} - \phi$

538. The total electric flux through a cube when a charge $8q$ is placed at one corner of the cube is

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

539. 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



a) cos θ b) cot θ c) sin θ d) tan θ

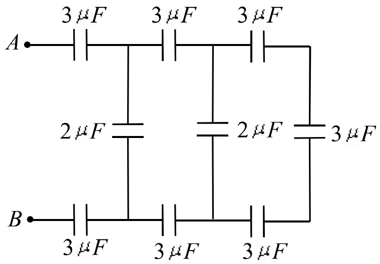
540. Charge Q is placed on each of $(n - 1)$ corners of a polygon of n sides. The distance of centre of the polygon from each corners is $'r'$, then electric field at centre is

a) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ b) $\frac{(n-1)}{4\pi\varepsilon_0}\frac{Q}{r^2}$ c) $\frac{n}{(n-1)}\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ d) Zero

541. What is the potential energy of the equal positive point charges of $1\mu C$ each held 1 m apart in air

a) $9 \times 10^{-3}\ J$ b) $9 \times 10^{-3} eV$ c) $2eV/m$ d) Zero

542. The resultant capacitance between A and B in the following figure is equal to



a) $1\mu F$ b) $3\mu F$ c) $2\mu F$ d) $1.5\mu F$

543. The electric field in a region is radially outward with magnitude $E = A\gamma_0$. The charge contained in a sphere of radius γ_0 centered at the origin is

a) $\frac{1}{4\pi\varepsilon_0}A\gamma_0^3$ b) $4\pi\varepsilon_0 A\gamma_0^3$ c) $\frac{4\pi\varepsilon_0 A}{\gamma_0}$ d) $\frac{1}{4\pi\varepsilon_0}\frac{A}{\gamma_0^3}$

544. 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

a) $2.0 \times 10^{-6}m$ b) $1.7 \times 10^{-6}m$ c) $1.4 \times 10^{-6}m$ d) $1.1 \times 10^{-6}m$

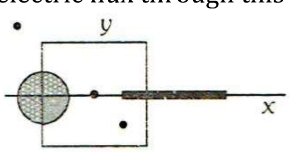
545. A hollow conducting sphere of radius R has a charge $(+Q)$ on its surface. What is the electric potential within the sphere at a distance $r = R/3$ from its centre

a) Zero b) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$ c) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$ d) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$

546. Identify the wrong statement in the following. Coulomb's law correctly describes the electric force that

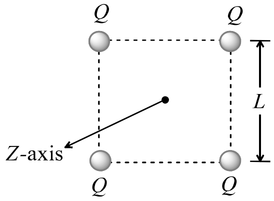
a) Binds the electrons of an atom to its nucleus
b) Binds the protons and neutrons in the nucleus of an atom
c) Binds atoms together to form molecules
d) Binds atoms and molecules together to form solids

547. A disk of radius $a/4$ having a uniformly distributed charge $6C$ is placed in the $x - y$ plane with its centre at $(-a/2, 0,0)$. A rod of length a carrying a uniformly distributed charge $8C$ is placed on the x-axis from $x = a/4$ to $x = 5a/4$. Two point charges $-7C$ and $3C$ are placed at $(a/4, -a/4,0)$ and $(-3a/4,3a/4,0)$, respectively. Consider a cubical surface formed by six surfaces $x = \pm a/2, y = \pm a/2, z = \pm a/2$. The electric flux through this cubical surface is



a) $\frac{-2C}{\varepsilon_0}$ b) $\frac{2C}{\varepsilon_0}$ c) $\frac{10C}{\varepsilon_0}$ d) $\frac{12C}{\varepsilon_0}$

548. 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



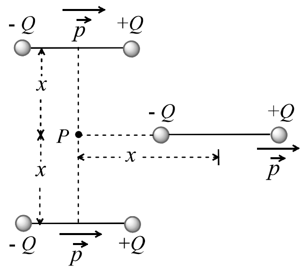
a) $-ve$ charge oscillates along the $Z -$ axis
b) It moves away from the frame
c) It moves slowly towards the frame and stays in the plane of the frame

d) It passes through the frame only once

549. If the charge on a capacitor is doubled, the value of its capacitance C will be

a) Doubled b) Halved c) Remain the same d) None of these

550. Three identical dipoles are arranged as shown below. What will be the net electric field at $P\left(k=\frac{1}{4\pi\varepsilon_0}\right)$



a) $\frac{k.p}{x^3}$ b) $\frac{2kp}{x^3}$ c) Zero d) $\frac{\sqrt{2}kp}{x^3}$

551. 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

a) $54e.s.u.$

b) $1/4e.s.u.$

c) $30e.s.u.$

d) $36e.s.u.$

552. When the 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is

a) $-1.6\ C$ b) $+1.6\ C$ c) $10^{+19}\ C$ d) $10^{-19}C$

553. A charged particle of mass m and charge q is released from rest in an electric field of constant magnitude E. The kinetic energy of the particle after time t is

a) $\frac{E^2q^2t^2}{2m}$ b) $\frac{2\,E^2t^2}{qm}$ c) $\frac{E\,q\,m}{2t}$ d) $\frac{Eq^2m}{2t^2}$

554. An electron is moving towards x −axis. An electric field is along y −direction then path of electron is

a) Circular b) Elliptical c) Parabola d) None of these

555. In a charged capacitor, the energy resides

a) The positive charges b) Both the positive and negative charges

c) The field between the plates d) Around the edge of the capacitor plates

556. A cylindrical capacitor has charge Q and length L. If both the charge and length of the capacitor are doubled, by keeping other parameters fixed, the energy stored in the capacitor

a) Remains same b) Increases two times c) Decreases two times d) Increases four times

557. Dimensions of ε_0 are

a) $M^{-1}L^{-3}T^4A^2$ b) $M^0L^{-3}T^3A^3$ c) $M^{-1}L^{-3}T^3A$ d) $M^{-1}L^{-3}T\,A^2$

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

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

c) 8 along positive X-axis d) 16 along negative X-axis

559. A particle of $'m'$ and charge $'q'$ is accelerated through a potential difference of $V\ volt$, its energy will be

a) qV b) mqV c) $\left(\frac{q}{m}\right)V$ d) $\frac{q}{mV}$

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

a) $\frac{4\pi\in_0 Fd^2}{q^2}$ b) $\frac{4\pi\in_0 Fd^2}{e^2}$ c) $\sqrt{\frac{4\pi\in_0 Fe^2}{d^2}}$ d) $\sqrt{\frac{4\pi\in_0 Fd^2}{e^2}}$

561. N identical spherical drops charged to the same potential V are combined to form a big drop. The potential

of the new drop will be

a) V b) V/N c) $V \times N$ d) $V \times N^{2/3}$

562. ABC is a right angled triangle in which $AB = 3cm$ and $BC = 4cm$. 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 acing on B is

a) 125 $dynes$ b) 35 $dynes$ c) 25 $dynes$ d) Zero

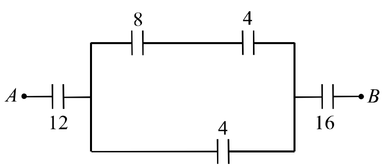
563. A point charge causes an electric flux of $-1.0 \times 10^3 Nm^2C^{-1}$ to pass through a spherical Gaussian surface of 10.0 cm radius centred on the charge. If the radius of the Gaussian surface were three times, how much flux would pass through the surface

a) $3.0 \times 10^3 Nm^2/C$ b) $-1.0 \times 10^3 Nm^2/C$ c) $-3.0 \times 10^3 Nm^2/C$ d) $-2.0 \times 10^3 Nm^2/C$

564. The capacitance of an air capacitor is $15\mu F$ the separation between the parallel plates is $6mm$. A copper plate of $3mm$ thickness is introduced symmetrically between the plates. The capacitance now becomes

a) $5\mu F$ b) $7.5\mu F$ c) $22.5\mu F$ d) $30\mu F$

565. What is the equivalent capacitance between A and B in the given figure (all are in farad)



a) $\frac{13}{18}F$ b) $\frac{48}{13}F$ c) $\frac{1}{31}F$ d) $\frac{240}{71}F$

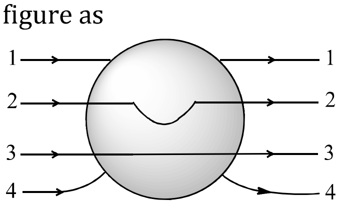
566. A parallel plate air capacitor has a capacitance of $100\mu\mu F$. The plates are at a distance d apart. If a slab of thickness $t(t \leq d)$ and dielectric constant 5 is introduced between the parallel plates, then the capacitance will be

a) 50 $\mu\mu F$ b) 100 $\mu\mu F$ c) 200 $\mu\mu F$ d) 500 $\mu\mu F$

567. In a parallel plate capacitor the separation between the plates is 3 mm with air between them. Now a $1mm$ thick layer of a material of dielectric constant 2 is introduced between the plates due to which the capacity increases. In order to bring its capacity to the original value the separation between the plates must be made

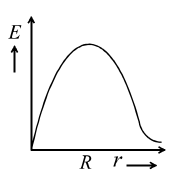
a) 1.5 mm b) 2.5 mm c) 3.5 mm d) 4.5 mm

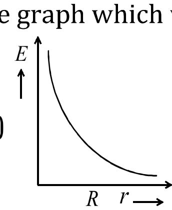
568. A metallic solid sphere is placed in a uniform electric field. The lines of force follow the path(s) shown in figure as

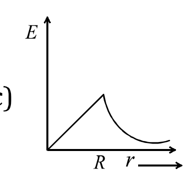


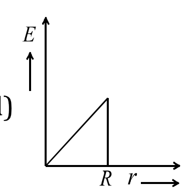
a) 1 b) 2 c) 3 d) 4

569. In a uniformly charged sphere of total charge Q and radius R, the electric field E is plotted as function of distance from the centre. The graph which would correspond to the above will be

a) 

b) 

c) 

d) 

570. Three capacitors of capacitance 3 μ F are connected in a circuit. Then their maximum and minimum capacitance will be

a) 9 μF, 1 μF b) 8 μF, 2 μF c) 9 μF, 0 μF d) 3 μF, 2 μF

571. Torque acting on an electric dipole in a uniform electric field is maximum if the angle between **p** and **E** is

a) 180° b) 0° c) 90° d) 45°

572. A solid metallic sphere has a charge $+3Q$. Concentric with this sphere is a conducting spherical shell

having charge $-Q$. The radius of the sphere is a and that of the spherical shell is $b(b > a)$. What is the electric field at a distance $R(a < R < b)$ from the centre

a) $\frac{Q}{2\pi\varepsilon_0 R}$ b) $\frac{3Q}{2\pi\varepsilon_0 R}$ c) $\frac{3Q}{4\pi\varepsilon_0 R^2}$ d) $\frac{4Q}{4\pi\varepsilon_0 R^2}$

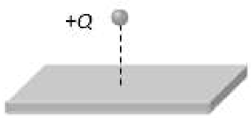
573. A particle has a mass 400 times than that of the electron and charge is double than that of a electron. It is accelerated by $5V$ of potential difference. Initially the particle was at rest, then its final kinetic energy will be

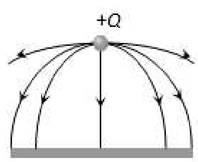
a) 5 eV b) 10 eV c) 100 eV d) 2000 eV

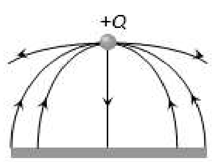
574. A parallel plate capacitor is first charged and then a dielectric slab is introduced between the plates. The quantity that remains unchanged is

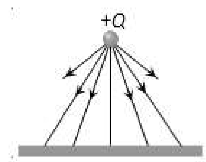
a) Charge Q b) Potential V c) Capacity C d) Energy U

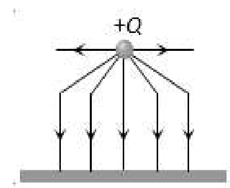
575. A charge Q is fixed at a distance d in front of an infinite metal plate. The lines of force are represented by



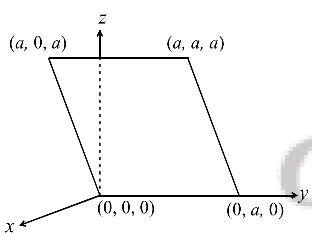
a) 

b) 

c) 

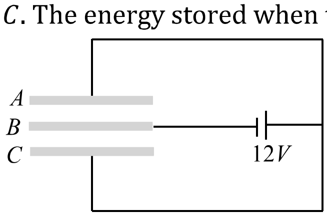
d) 

576. Consider an electric field $\vec{E} = E_0\hat{x}$, where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is



a) $2E_0a^2$ b) $\sqrt{2}E_0a^2$ c) E_0a^2 d) $\frac{E_0a^2}{\sqrt{2}}$

577. Three plates A, B, C each of area $50cm^2$ have separation $3mm$ between A and B and $3mm$ between B and C. The energy stored when the plates are fully charged is



a) $1.6 \times 10^{-9}\,J$ b) $2.1 \times 10^{-9}\,J$ c) $5 \times 10^{-9}\,J$ d) $7 \times 10^{-9}\,J$

578. Electric charge 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 charge at C is

a) $0.9N$ b) $1.8N$ c) $2.7N$ d) $3.6N$

579. An electric dipole of length 1 cm is placed with the axis making an angle of 30^o to an electric field of strength $10^4\ NC^{-1}$. If it experiences a torque of $10\sqrt{2}\ Nm$, the potential energy of the dipole is

a) 0.245 J b) 2.45 J c) 0.0245 J d) 24.5 J

580. Capacitance of a capacitor made by a thin metal foil is $2\mu F$. If the foil is filled with paper of thickness $0.15mm$, dielectric constant of paper is 2.5 and width of paper is $400mm$, then length of foil will be

a) 0.34 m b) 1.33 m c) 13.4 m d) 33.9 m

581. Charges $4Q, q$ and Q and placed along x −axis at positions $x = 0, x = l/2$ and $x = l$, reapectively. Find the

value of q so that force on charge Q is zero

a) Q b) $Q/2$ c) $-Q/2$ d) $-Q$

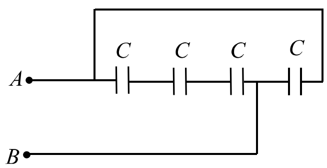
582. Two spherical conductors A and B of radii 1 mm and 2 mm are separated by a distance of 5 cm and are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium condition, the ratio of the magnitude of the electric fields at the surfaces of spheres A and B is

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

583. Let V be the electric potential at a given point. Then the electric field E_x along x direction at that point is given by

a) $\int_0^\infty V dx$ b) $\frac{dV}{dx}$ c) $-\frac{dV}{dx}$ d) $-V\frac{dV}{dx}$

584. The equivalent capacitance between A and B is

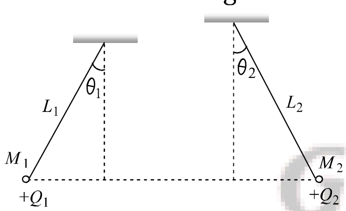


a) $C/4$ b) $3C/4$ c) $C/3$ d) $4C/3$

585. The net charge on capacitor is

a) $2q$ b) $q/2$ c) 0 d) ∞

586. Two small spheres of masses M_1 and M_2 are suspended by weightless insulating threads of lengths L_1 and L_2. The spheres carry charges Q_1 and Q_2 respectively. The spheres are suspended such that they are in level with one another and the threads are inclined to the vertical at angles of θ_1 and θ_2 as shown. Which one of the following conditions is essential, if $\theta_1 = \theta_2$

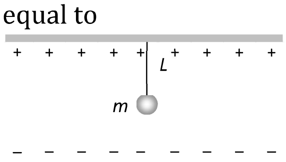


a) $M_1 \neq M_2$ but $Q_1 = Q_2$ b) $M_1 = M_2$ c) $Q_1 = Q_2$ d) $L_1 = L_2$

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

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

588. A small sphere carrying a charge $'q'$ is hanging in between two parallel plates by a string of length L. Time period of pendulum is T_0. When parallel plates are charged, the time period charges to T. The ratio T/T_0 is equal to

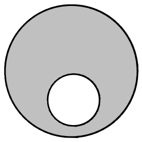


a) $\left(\frac{g+\frac{qE}{m}}{g}\right)^{1/2}$ b) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{3/2}$ c) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{1/2}$ d) None of these

589. A 20F capacitor is charged to 5V and isolated. It is then connected in parallel with an uncharged 30F capacitor. The decrease in the energy of the system will be

a) 25 J b) 200 J c) 125 J d) 150 J

590. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume in the figure. The electric field inside the emptied space is



a) Zero everywhere
b) Non-zero and uniform
c) Non-uniform
d) Zero only at its center

591. Energy stored in capacitor and dissipated during charging a capacitor bear a ratio
a) 1 : 1
b) 1 : 2
c) 1 : 1/2
d) 2 : 1

592. 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
a) $\frac{a}{b}$
b) $\frac{b}{a}$
c) $\frac{a^2}{b^2}$
d) $\frac{b^2}{a^2}$

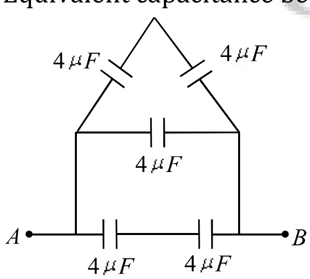
593. An electric dipole is situated in an electric field of uniform intensity E whose dipole moment is p and moment of inertia is I. If the dipole is displaced slightly from the equilibrium position, then the angular frequency of its oscillations is
a) $\left(\frac{pE}{I}\right)^{1/2}$
b) $\left(\frac{pE}{I}\right)^{3/2}$
c) $\left(\frac{I}{pE}\right)^{1/2}$
d) $\left(\frac{p}{IE}\right)^{1/2}$

594. Potential and field strength at a certain distance from a point charge are 600V and 200 NC^{-1}. Distance of the point from the charge is
a) 2m
b) 4m
c) 8m
d) 3m

595. Three capacitor each of $6\mu F$ are available. The minimum and maximum capacitances which may be obtained are
a) $6\mu F, 18\mu F$
b) $3\mu F, 12\mu F$
c) $2\mu F, 12\mu F$
d) $2\mu F, 18\mu F$

596. Three concentric metallic spherical shells of radii $R, 2R, 3R$, are given charges Q_1, Q_2, Q_3, respectively. It is found that the surface charge densities on the outer surfaces of the shells are equal. Then, the ratio of the charges given to the shells, $Q_1 : Q_2 : Q_3$, is
a) 1:2:3
b) 1:3:5
c) 1:4:9
d) 1:8:18

597. Equivalent capacitance between A and B is

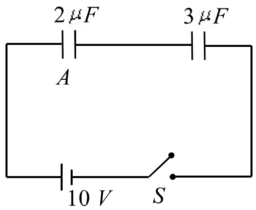


a) 8 μ F
b) 6 μ F
c) 26 μ F
d) 10/3 μ F

598. A particle of mass $2 \times 10^{-5} Kg$ and charge $4 \times 10^{-3} C$ moves from rest in a uniform electric field of magnitude 5 V/m. its kinetic energy after 10 seconds is
a) $2 \times 10^3 J$
b) $10^3 J$
c) $2 \times 10^{-3} J$
d) $10^2 J$

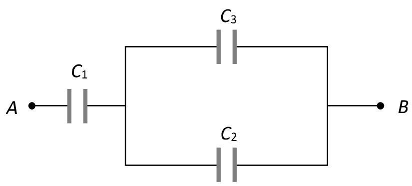
599. A point charge $+q$ is placed at the centre of a cube of side L. The electric flux emerging from the cube is
a) $\frac{q}{\varepsilon_0}$
b) Zero
c) $\frac{6qL^2}{\varepsilon_0}$
d) $\frac{q}{6L^2\varepsilon_0}$

600. Two capacitor A and B are connected in series with a battery as shown in the figure. When the switch S is closed and the two capacitors get charged fully, then



a) The potential difference across the plates of A is $4V$ and across the plates of B is $6V$
b) The potential difference across the plates of A is $6V$ and across the plates of B is $4V$
c) The ratio of electrical energies stored in A and B is $2:3$
d) The ratio of charges on A and B is $3:2$

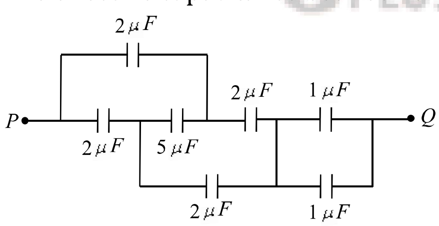
601. The combination of capacitors with $C_1 = 3\mu\ F, C_2 = 4\mu\ F$ and $C_3 = 2\mu\ F$ is charged by connecting AB to a battery
Consider the following statements
I. Energy stored in C_1 = Energy stored in C_2 + Energy stored in C_3
II. Charge on C_1 = Charge on C_2 + Charge on C_2
III. Potential drop across C_1 = Potential drop across C_2 = Potential drop across C_3
Which of these is/are correct



a) I and II
b) II only
c) I and III
d) III only

602. 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 related to be anti-parallel to the field the work required to be done by an external agency is
a) $-2pE$
b) $-pE$
c) pE
d) $2pE$

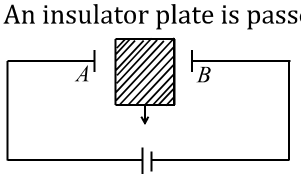
603. The effective capacitance between the points P and Q of the arrangement shown in the figure is



a) $\frac{1}{2}\mu F$
b) $1\mu F$
c) $2\mu F$
d) $1.33\mu F$

604. Two charges +q and $-q$ are kept apart. Then at any point on the right bisector of line joining the two charges
a) The electric field strength is zero
b) The electric potential is zero
c) Both electric potential and electric field strength are zero
d) Both electric potential and electric field strength are non- zero

605. An insulator plate is passed between the plates of a capacitor. Then the displacement current



a) First flows from A to B and then from B to A
b) First flows from B to A then from A to B
c) Always flows from B to A
d) Always flows from A to B

606. An electron and a proton are in a uniform electric field, the ratio of their accelerations will be
a) Zero
b) Unity
c) The ratio of the masses of proton and electron
d) The ratio of the masses of electron and proton

607. 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
a) Zero
b) $\frac{\pi}{2}$
c) π
d) $\frac{3\pi}{2}$

608. The energy stored in a condenser of capacity C which has been raised to a potential V is given by
a) $\frac{1}{2}CV$
b) $\frac{1}{2}CV^2$
c) CV
d) $\frac{1}{2VC}$

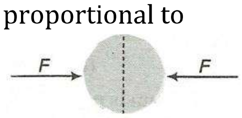
609. Two conducting spheres of radii 3 cm and 1 cm are separated by a distance of 10 cm in free space. If the spheres are charged to same potential of 10 V each, the force of repulsion between them is
a) $\left(\frac{1}{3}\right) \times 10^{-9}N$
b) $\left(\frac{2}{9}\right) \times 10^{-9}N$
c) $\left(\frac{1}{9}\right) \times 10^{-9}N$
d) $\left(\frac{4}{3}\right) \times 10^{-9}N$

610. Two identical capacitors each of capacitance 5 μF are charged to potential 2 kV and 1 kV respectively. The −ve ends are connected together. When the +ve ends are also connected together, the loss of energy of the system is
a) 160 J
b) 0 J
c) 5 J
d) 1.25 J

611. A capacitor of $20\mu F$ is charged to 500 $volts$ and connected in parallel with another capacitor of $10\mu F$ and charged to 200 $volts$. The common potential is
a) 200 $volts$
b) 300 $volts$
c) 400 $volts$
d) 500 $volts$

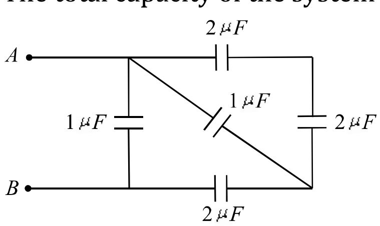
612. A conductor has been given a charge $-3 \times 10^{-7}C$ by transferring electron. Mass increase (in kg) of the conductor and the number of electron added to the conductor are respectively
a) 2×10^{-16} and 2×10^{31}
b) 5×10^{-31} and 5×10^{19}
c) 3×10^{-19} and 9×10^{16}
d) 2×10^{-18} and 2×10^{12}

613. A uniformly charged thin spherical shell of radius R carries uniform surface charge density of σ per unit area. It is made of two hemispherical shells, held together by pressing them with force F (see figure). F is proportional to



a) $\frac{1}{\varepsilon_0}\sigma^2 R^2$
b) $\frac{1}{\varepsilon_0}\sigma^2 R$
c) $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R}$
d) $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R^2}$

614. The total capacity of the system of capacitors shown in the adjoining figure between the points A and B is



a) $1\mu F$
b) $2\mu F$
c) $3\mu F$
d) $4\mu F$

615. An air capacitor is connected to a battery. The effect of filling the space between the plates with a dielectric is to increase
a) The charge and the potential difference
b) The potential difference and the electric field
c) The electric field and the capacitance
d) The charge and the capacitance

616. 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

a) $\frac{Q}{4}$ b) $\frac{Q}{2}$ c) Q d) $\frac{3Q}{2}$

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

a) $V_A < V_B$ b) $V_A > V_B$ c) $V_A < V_C$ d) $V_A > V_C$

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

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

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

a) $V_{(x)} = +x\,E_0$ b) $V_x = -xE_0$ c) $V_x = +x^2E_0$ d) $V_x = -x^2E_0$

620. Two parallel large thin metal sheets have equal surface charge densities ($\sigma = 26.4 \times 10^{-12}\text{Cm}^{-2}$)of opposite signs. The electric field between these sheets is

a) $1.5\ \text{NC}^{-1}$ b) $1.5 \times 10^{-10}\text{NC}^{-1}$ c) $3\ \text{NC}^{-1}$ d) $3 \times 10^{-10}\text{NC}^{-1}$

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

a) $4.8 \times 10^{-19}C, 3$ b) $5.8 \times 10^{-19}C, 4$ c) $3.8 \times 10^{-19}C, 2$ d) $2.8 \times 10^{-19}C, 1$

622. 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

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

623. Two parallel metal plates having charges $+Q$ and $-Q$ face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will

a) Become zero b) Increase c) Decrease d) Remain same

624. If the force exerted by an electric dipole on a charge q at a distance of 1 m is F, the force at a point 2 m away in the same direction will be

a) $\frac{F}{2}$ b) $\frac{F}{4}$ c) $\frac{F}{6}$ d) $\frac{F}{8}$

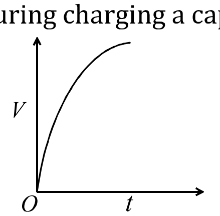
625. If a unit positive charge is taken from one point to another over an equipotential surface, then

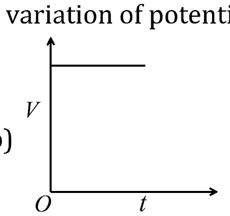
a) Work is done on the charge b) Work is done by the charge
c) Work done is constant d) No work is done

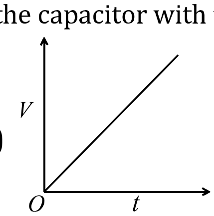
626. A 4 μF capacitor, a resistance of 2.5 $M\Omega$ is in series with 12 V battery. Find the time after which the potential difference across the capacitor is 3 times the potential difference across the resistor. [Given $\ln(2) = 0.693$]

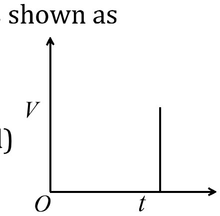
a) 13.86 s b) 6.93 s c) 7 s d) 14 s

627. During charging a capacitor variation of potential V of the capacitor with time t is shown as

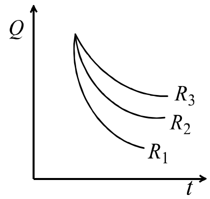
a) 

b) 

c) 

d) 

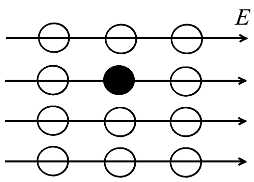
628. Three identical capacitors are given a charge Q each and they are then allowed to discharge through resistance R_1, R_2 and R_3. Their charges, as a function of time shown in the graph below. The smallest of the three resistance is



a) R_3 b) R_2 c) R_1 d) Cannot be predicted

629. An electric dipole consists of two opposite charges of magnitude $q = 1 \times 10^{-6}$ C separated by 2.0 cm. the dipole is placed in an external field of 1×10^5 NC^{-1}. What maximum torque does the field exert on the dipole? How much work must an external agent do to turn the dipole end for end, starting from position of alignment ($\theta = 0^0$)
a) 4.4×10^6 N − m, 3.2×10^{-4} J
b) -2×10^3 N − m, -4×10^3 J
c) 4×10^3 N − m, 2×10^{-3} J
d) 2×10^{-3} N − m, 4×10^{-3} J

630. There is a uniform electric field of intensity E which is as shown. How many labelled points have the same electric potential as the fully shaded point



a) 2 b) 3 c) 8 d) 11

631. In an hydrogen atom, the electron revolves around the nucleus in an orbit of radius $0.53 \times 10^{-10}\ m$. Then the electrical potential produced by the nucleus at the position of the electron is
a) $-13.6\ V$ b) $-27.2\ V$ c) $27.2\ V$ d) $13.6\ V$

632. A hollow sphere of charge does not produce an electric field at any
a) Point beyond 2 metres
b) Point beyond 10 metres
c) Interior point
d) Outer point

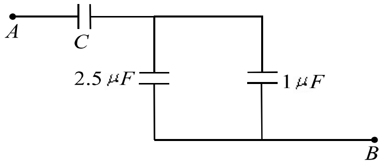
633. The charge given to any conductor resides on its outer surface, because
a) The free charge tends to be in its minimum potential energy state
b) The free charge tends to be in its minimum kinetic energy state
c) The free charge tends to be in its maximum potential energy state
d) The free charge tends to be in its maximum kinetic energy state

634. A variable condenser is permanently connected to a 100 V battery. If the capacity is changed from $2\mu\ F$ to $10\ \mu\ F$, then change in energy is equal to
a) $2 \times 10^{-2}\ J$ b) $2.5 \times 10^{-2}\ J$ c) $3.5 \times 10^{-2} J$ d) $4 \times 10^{-2}\ J$

635. Identify the WRONG statement
a) In an electric field two equipotential surface can never intersect
b) A charged particle free to move in an electric field shall always move in the direction of $\vec{E}$
c) Electric field at the surface of a charged conductor is always normal to the surface
d) The electric potential decrease along a line of force in an electric field

636. 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
a) $8\ L$
b) $4\ L$
c) $2\ L$
d) $\frac{L}{4}$

637. The equivalent capacitance between A and B in the figure is $1\mu F$. Then the value of capacitance C is



a) $1.4\mu F$ b) $2.5\mu F$ c) $3.5\mu F$ d) $1.2\mu F$

638. 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

a) $\frac{1}{x^2}$

b) $\frac{1}{x}$

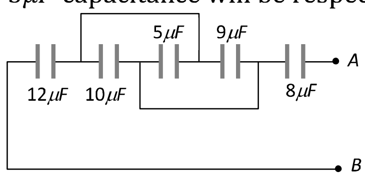
c) x

d) x^2

639. Number of electrons in one coulomb of charge will be

a) 5.46×10^{29} b) 6.25×10^{18} c) $1.6 \times 10^{+19}$ d) 9×10^{11}

640. The capacities and connection of five capacitors are shown in the adjoining figure. The potential difference between the points A and B is 60 $volts$. Then the equivalent capacity between A and B and the charge on $5\mu F$ capacitance will be respectively



a) $44\mu F; 300\mu C$ b) $16\mu F; 150\mu C$ c) $15\mu F; 200\mu C$ d) $4\mu F; 50\mu C$

641. 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

a) 1/2 b) 1 c) 2 d) 3

642. The capacities of two conductors are C_1 and C_2 and their respective potentials are V_1 and V_2. If they are connected by a thin wire, then the loss of energy will be given by

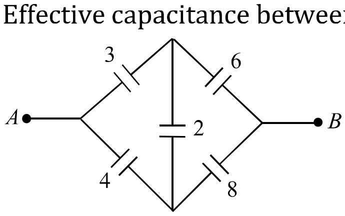
a) $\frac{C_1C_2(V_1+V_2)}{2(C_1+C_2)}$ b) $\frac{C_1C_2(V_1-V_2)}{2(C_1+C_2)}$ c) $\frac{C_1C_2(V_1-V_2)^2}{2(C_1+C_2)}$ d) $\frac{(C_1+C_2)(V_1-V_2)}{C_1C_2}$

643. Three identical capacitors are combined differently. For the same voltage to each combination, the one that stores the greatest energy is

a) Two in parallel and the third in series with it b) Three in series

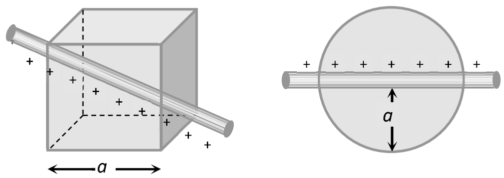
c) Three in parallel d) Two in series and third in parallel with it

644. Effective capacitance between A and B in the figure shown is (all capacitance are in μF)



a) $21\ \mu F$ b) $23\ \mu F$ c) $\frac{3}{14}\mu F$ d) $\frac{14}{3}\mu F$

645. A linear charge having linear charge density λ, penetrates a cube diagonally and then it penetrate a sphere diametrically as shown. What will be the ratio of flux coming cut of cube and sphere



a) $\frac{1}{2}$ b) $\frac{2}{\sqrt{3}}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{1}{1}$

646. A parallel plate capacitor has capacitance C. If it is equally filled with parallel layers of materials of dielectric constants K_1 and K_2 its capacity becomes C_1. The ratio of C_1 to C is

a) $K_1 + K_2$ b) $\frac{K_1 K_2}{K_1 - K_2}$ c) $\frac{K_1 + K_2}{K_1 K_2}$ d) $\frac{2K_1 K_2}{K_1 + K_2}$

647. What is the value of capacitance if the thin metallic plate is introduced between two parallel plates of area A and separated at distance d

a) $\frac{\epsilon_0 A}{d}$ b) $\frac{2 \epsilon_0 A}{d}$ c) $\frac{4 \epsilon_0 A}{d}$ d) $\frac{\epsilon_0 A}{2d}$

648. Two metallic charged spheres whose radii are $20 cm$ and $10\ cm$ respectively, have each 150 $micro-coulomb$ positive charge. The common potential after they are connected by a conducting wire is

a) $9 \times 10^6\ volts$ b) $4.5 \times 10^6\ volts$ c) $1.8 \times 10^7\ volts$ d) $13.5 \times 10^6\ volts$

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

a) Vertical velocity changes but horizontal velocity remains constant
b) Horizontal velocity changes but vertical velocity remains constant
c) Both vertical and horizontal velocities change
d) Neither vertical nor horizontal velocity changes

650. A particle of mass m carrying charge q is kept at rest in a uniform electric field E and then released. The kinetic energy gained by the particle, when it moves through a distance y is

a) $\frac{1}{2} qEy^2$ b) qEy c) qEy^2 d) $qE^2 y$

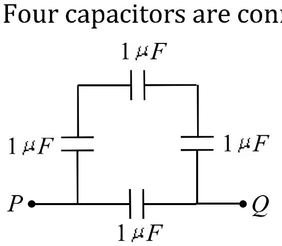
651. Charge q is uniformly distributed over a thin half ring of radius R. The electric field at the centre of the ring is

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

652. The unit of electric field is not equivalent to

a) N/C b) J/C c) V/m d) $J/C - m$

653. Four capacitors are connected as shown in the equivalent capacitance between the points P and Q is



a) $4\mu F$ b) $\frac{1}{4}\mu F$ c) $\frac{3}{4}\mu F$ d) $\frac{4}{3}\mu F$

654. An electric dipole in a uniform electric field experiences (When it is placed at an angle θ with the field)

a) Force and torque both b) Force but no torque
c) Torque but no force d) No force and no torque

655. Let there be a spherically symmetric charge distribution with charge density varying as $\rho(r) = \rho_0 \left(\frac{5}{4} - \frac{r}{R}\right)$ upto $r = R$, and $\rho(r) = 0$ for $r > R$, where r is the distance from the origin. The electric field at a distance

$r(r < R)$ from the origin is given by

a) $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{4}-\frac{r}{R}\right)$ b) $\frac{4\pi\rho_0 r}{3\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$ c) $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$ d) $\frac{4\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4}-\frac{r}{R}\right)$

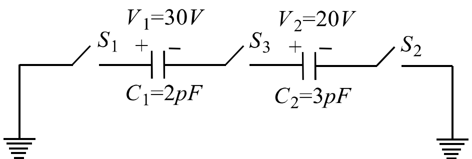
656. Capacitance of a parallel plate capacitor becomes $4/3$ times its original value if a dielectric slab of thickness $t = d/2$ is inserted between the plates (d is the separation between the plates). The dielectric constant of the slab is

a) 8 b) 4 c) 6 d) 2

657. The potential energy of a charged parallel plate capacitor is U_0. if a slab of dielectric constant k is inserted between the plates, than the new potential energy will be

a) $\frac{U_0}{k}$ b) $U_0 k^2$ c) $\frac{U_0}{k^2}$ d) U_0^2

658. For the circuit shown, which of the following statements is true



a) With S_1 closed, $V_1 = 15\,V, V_2 = 20\,V$ b) With S_3 closed $V_1 = V_2 = 25V$

c) With S_1 and S_2 closed $V_1 = V_2 = 0$ d) With S_1 and S_3 closed, $V_1 = 30V, V_2 = 20V$

659. A charge of $40\mu C$ is given to a capacitor having capacitance $C = 10\mu F$. The stored energy in ergs is

a) 80×10^{-6} b) 800 c) 80 d) 8000

660. Force of attraction between the plates of a parallel plate capacitor is

a) $\frac{q^2}{2\varepsilon_0 AK}$ b) $\frac{q^2}{\varepsilon_0 AK}$ c) $\frac{q}{2\varepsilon_0 A}$ d) $\frac{q^2}{2\varepsilon_0 A^2 K}$

661. A semi-circular are of radius a is charged uniformly and the charge per unit length is λ. the electric field at its centre is

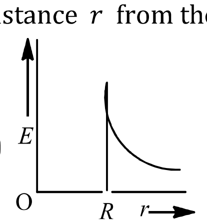
a) $\frac{\lambda}{2\pi\varepsilon_0 a^2}$ b) $\frac{\lambda}{4\varepsilon_0 a}$ c) $\frac{\lambda^2}{4\pi\varepsilon_0 a}$ d) $\frac{\lambda}{2\pi\varepsilon_0 a}$

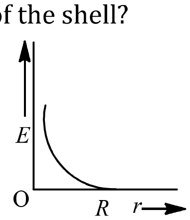
662. 100 capacitors each having a capacity of $10\mu F$ are connected in parallel and are charged by a potential difference of 100 kV. The energy stored in the capacitors and the cost of charging them, if electrical energy costs 108 $paise\ per\ kWh$, will be

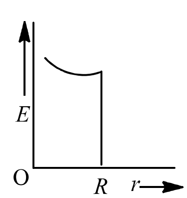
a) 10^7 $joule$ and 300 $paise$ b) 5×10^6 joule and 300 $paise$

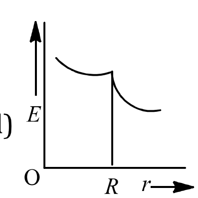
c) 5×10^6 joule and 150 $paise$ d) 10^7 $joule$ and 150 $paise$

663. A metallic spherical shell of radius R has a charge $-Q$ on it. A point charge $+Q$ is placed at the centre of the shell. Which of the graphs shown below may correctly represent the variation of the electric field E with distance r from the centre of the shell?

a) 

b) 

c) 

d) 

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

a) Gains electrons from silk b) Gives electrons to silk

c) Gains protons from silk d) Gives protons to silk

665. An electric dipole is placed at an angle of 30° to a non-uniform electric field. The dipole will experience

a) A translational force only in the direction of the field

b) A translational force only in a direction normal to the direction of the field

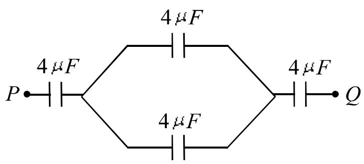
c) A torque as well as a translational force

d) A torque only

666. 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 $R/2$ from the centre of the shell is

a) $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$ b) $\frac{2Q}{4\pi\varepsilon_0 R}$ c) $\frac{2Q}{4\pi\varepsilon_0 R}-\frac{2q}{4\pi\varepsilon_0 R}$ d) $\frac{2Q}{4\pi\varepsilon_0 R}+\frac{2q}{4\pi\varepsilon_0 R}$

667. Four condenser each of capacity $4\mu F$ are connected as shown in figure. $V_P - V_Q = 15\ volts$. The energy stored in the system is



a) 2400 $ergs$ b) 1800 $ergs$ c) 3600 $ergs$ d) 5400 $ergs$

668. Putting a dielectric substance between two plates of condenser, capacity, potential and potential energy respectively

a) Increase, decrease, decrease b) Decrease, increase, increase c) Increase, increase, increase d) Decrease, decrease, decrease

669. 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

a) $F/4$
b) $3F/4$
c) $F/8$
d) $3F/8$

670. A parallel plate capacitor with air between the plates has a capacitance of 9 pF. The separation between its plates is $'d'$. The space between the plates is now filled with two dielectrics. One of the dielectrics has dielectric constant $k_1 = 3$ and thickness $d/3$ while the other one has dielectric constant $k_2 = 6$ and thickness $2d/3$. Capacitance of the capacitor is now

a) 45 pF b) 40.5 pF c) 20.25 pF d) 1.8 pF

671. A spherical condenser has inner and outer spheres of radii a and b respectively. The space between the two is filled with air. The difference between the capacities of two condensers formed when outer sphere is earthed and when inner sphere is earthed will be

a) Zero b) $4\pi\varepsilon_0 a$ c) $4\pi\varepsilon_0 b$ d) $4\pi\varepsilon_0 a\left(\frac{b}{b-a}\right)$

672. Flux coming out from a unit positive charge enclosed in air is

a) ε_0 b) $(\varepsilon_0)^{-1}$ c) $(4\pi\varepsilon_0)^{-1}$ d) $4\pi\varepsilon_0$

673. 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

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

674. When a piece of polythene is rubbed with wool, a charge of -2$\times 10^{-7}$ C is developed on polythene. What mass, is transferred to polythene?

a) 5.69$\times 10^{-19}$ kg b) 2.25$\times 10^{-19}$ kg c) 9.63$\times 10^{-19}$ kg d) 11.38$\times 10^{-19}$ kg

675. Consider the following statements about electric dipole and select the correct ones

S1 : Electric dipole moment vector $\vec{p}$ is directed from the negative charge to the positive charge

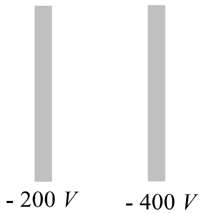
S2 : The electric field of a dipole at a point with position vector $\vec{r}$ depends on $|\vec{r}|$ as well as the angle between $\vec{r}$ and $\vec{p}$

S3 : The electric dipole potential falls off as $\frac{1}{r^2}$ and not as $\frac{1}{r}$

S4 : In a uniform electric field, the electric dipole experiences no net forces but a torque $\vec{\tau} = \vec{p} \times \vec{E}$

a) S2, S3 and S4 b) S3 and S4 c) S2 and S3 d) All four

676. In the following figure two parallel metallic plates are maintained at different potential. If an electron is released midway between the plates, it will move

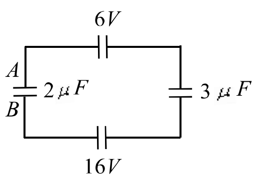


a) Right ward at constant speed
b) Left ward at constant speed
c) Accelerated right ward
d) Accelerated left ward

677. A parallel plate capacitor is made by stacking n equally spaced plates connected alternately. If the capacitance between any two plates is C then the resultant capacitance is
a) C
b) nC
c) $(n-1)C$
d) $(n+1)C$

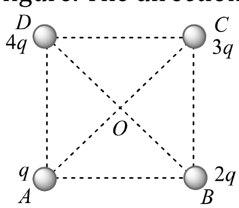
678. If n drops, each of capacitance C, coalesce to form a single big drop, then the ratio of the energy stored in the big drop to that in each small drop will be
a) $n:1$
b) $n^{1/3}:1$
c) $n^{5/3}:1$
d) $n^2:1$

679. The potential difference between A and B is



a) $13.2V$
b) $-13.2V$
c) $-6V$
d) $6V$

680. Charges $q, 2q, 3q$ and $4q$ 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



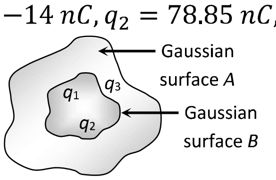
a) AB
b) CB
c) BD
d) AC

681. Two long conductors, separated by a distance d carry currents I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to $3d$. The new value of the force between them is
a) -$2F$
b) $F/3$
c) -$2F/3$
d) -$F/3$

682. A negatively charged plate has charge density of $2 \times 10^{-6} C/m^2$. The initial distance of an electron which is moving towards the plate, cannot strike the plate, if it is having energy of $200eV$
a) 1.77 mm
b) 3.51 mm
c) 1.77 cm
d) 3.51 cm

683. If the capacity of a spherical conductor is 1 $picofarad$, then its diameter, would be
a) $1.8 \times 10^{-3} m$
b) $18 \times 10^{-3} m$
c) $1.8 \times 10^{-5} m$
d) $18 \times 10^{-7} m$

684. The electric flux for Gaussian surface A that enclose the charged particles in free space is (given $q_1 = -14\ nC, q_2 = 78.85\ nC, q_3 = -56\ nC$)



a) $10^3 Nm^2C^{-1}$
b) $10^3 CN^{-1}m^{-2}$
c) $6.32 \times 10^3 Nm^2C^{-1}$

d) $6.32 \times 10^3 CN^{-1}m^{-2}$

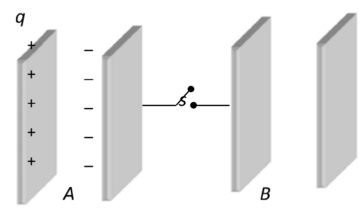
685. The electric field due to a dipole at a distance r on its axis is

a) Directly proportional to r^3
b) Inversely proportional to r^3
c) Directly proportional to r^2
d) Inversely proportional to r^2

686. Electric field strength due to a point charge of 5 μC at a distance of 80 cm from the charge is

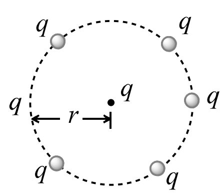
a) $8 \times 10^4 N/C$
b) $7 \times 10^4 N/C$
c) $5 \times 10^4 N/C$
d) $4 \times 10^4 N/C$

687. Consider the situation shown in the figure. The capacitor A has a charge q on it whereas B is uncharged. The charge appearing on the capacitor B a long time after the switch is closed is



a) Zero
b) $q/2$
c) q
d) $2q$

688. A point charge is surrounded symmetrically by six identical charges at distance r as shown in the figure. How much work is done by the forces of electrostatic repulsion when the point charge q at the centre is removed at infinity

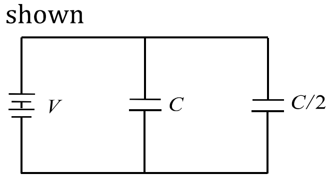


a) Zero
b) $6q^2/4\pi\varepsilon_0 r$
c) $q^2/4\pi\varepsilon_0 r$
d) $12q^2/4\pi\varepsilon_0 r$

689. Two condensers of capacities $2C$ and C are joined in parallel and charged upto potential V. The battery is removed and the condenser of capacity C is filled completely with a medium of dielectric constant K. The p.d. across the capacitors will now be

a) $\frac{3V}{K+2}$
b) $\frac{3V}{K}$
c) $\frac{V}{K+2}$
d) $\frac{V}{K}$

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



The work done in charging fully both the condensers is

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

691. Gauss's law should be invalid if

a) There were magnetic monopoles
b) The inverse square law were not exactly true
c) The velocity of light were not a universal constant
d) None of these

692. The electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10 cm surrounding the total charge is 20 Vm. The flux over a concentric sphere of radius 20 cm will be

a) 20 Vm
b) 25 Vm
c) 40 Vm
d) 200 Vm

693. Two identical charges repel each other with a force equal to 10 mg wt when they are 0.6 m apart in air ($g = 10ms^{-2}$). The value of each charge is

a) 2mC
b) 2×10^{-7} C
c) 2 nC
d) 2μ C

694. The potential of the electric field produced by point charge at any point (x, y, z) is given by $V = 3x^2 + 5$,

where x, y are in metres and V is in volts. The intensity of the electric field at (-2,1,0) is

a) $+17\ \text{Vm}^{-1}$ b) $-17\ \text{Vm}^{-1}$ c) $+12\ \text{Vm}^{-1}$ d) $-12\ \text{Vm}^{-1}$

695. A thin metal plate P is inserted half way between the plates of a parallel plate capacitor of capacitance C in such a way that it is parallel to the two plates. The capacitance now becomes

a) C b) $C/2$ c) $4C$ d) None of these

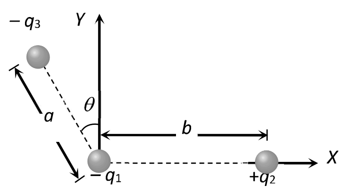
696. Two protons are a distance of $1 \times 10^{-10} cm$ from each other. The forces acting on them are

a) Nuclear force and coulomb force b) Nuclear force and gravitational force
c) Coulomb force and gravitational force d) Nuclear, coulomb and gravitational force

697. A parallel plate capacitor has an electric field of $10^5 V/m$ between the plates. If the charge on the capacitor plate is $1\mu\ C$, the force on each capacitor plate is

a) $0.5\ N$ b) $0.05\ N$ c) $0.005\ N$ d) None of these

698. Three charges $-q_1, +q_2$ and $-q_3$ are placed as shown in the figure. The x-component of the force on $-q_1$ is proportional to



a) $\frac{q_2}{b^2} - \frac{q_3}{a^2} \sin\theta$ b) $\frac{q_2}{b^2} - \frac{q_3}{a^2} \cos\theta$ c) $\frac{q_2}{b^2} + \frac{q_3}{a^2} \sin\theta$ d) $\frac{q_2}{b^2} + \frac{q_3}{a^2} \cos\theta$

699. The radii of the inner and outer spheres of a condenser are $9cm$ and $10cm$ respectively. If the dielectric constant of the medium between the two spheres is 6 and charge on the inner sphere is 18×10^{-9} *coulomb*, then the potential of inner sphere will be, if the outer sphere is earthed

a) 180 *volts* b) 30 *volts* c) 18 *volts* d) 90 *volts*

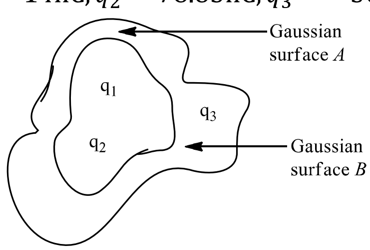
700. Two capacitors each of capacity $2\mu F$ are connected in parallel. This system is connected in series with a third capacitor of $12\mu F$ capacity. The equivalent capacity of the system will be

a) $16\mu F$ b) $13\mu F$ c) $4\mu F$ d) $3\mu F$

701. Two equal and opposite charge ($+q$ and $-q$) are situated at x distance from each other, the value of potential at very far point will depend upon

a) Only on q b) Only on x c) On qx d) On $\frac{q}{x}$

702. The electric flux for Gaussian surface A that enclose the charged particles in free space is (given $q_1 = -14\text{nC}, q_2 = 78.85\text{nC}, q_3 = -56\text{nC}$)



a) $10^3\text{Nm}^2\text{C}^{-1}$ b) $10^3\text{CN}^{-1}\text{m}^{-2}$ c) $6.32 \times 10^3\text{Nm}^2\text{C}^{-1}$ d) $6.32 \times 10^3\text{CN}^{-1}\text{m}^{-1}$

703. Two identical parallel plate capacitors are connected in series to a battery of $100\ V$. A dielectric slab of dielectric constant 4.0 is inserted between the plates of second capacitor. The potential difference across the capacitors will now be respectively

a) $50\ V, 50\ V$ b) $80\ V, 20\ V$ c) $20\ V, 80\ V$ d) $75\ V, 25\ V$

704. Electric potential at any point is $V = -5x + 3y + \sqrt{15z}$, then the magnitude of the electric field is

a) $3\sqrt{2}$ b) $4\sqrt{2}$ c) $5\sqrt{2}$ d) 7

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

a) $x = 2$ and $x = 9$

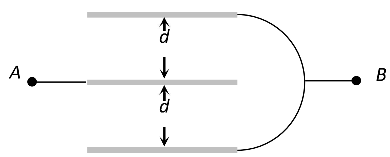
b) $x = 1$ and $x = 5$
c) $x = 4$ and $x = 12$
d) $x = -2$ and $x = 2$

706. A parallel plate condenser has a capacitance $50\mu F$ in air and $110\mu F$ when immersed in an oil. The dielectric constant $'k'$ of the oil is
a) 0.45 b) 0.55 c) 1.10 d) 2.20

707. The magnitude of electric field E in the annular region of a charged cylindrical capacitor
a) Is same throughout
b) Is higher near the outer cylinder than near the inner cylinder
c) Varies as $1/r$, where r is the distance from the axis
d) Varies as $1/r^2$, where r is the distance from the axis

708. Electric lines of force about negative point charge are
a) Circular, anticlockwise
b) Circular, clockwise
c) Radial, inward
d) Radial, outward

709. Three plates of common surface area A are connected as shown. The effective capacitance will be

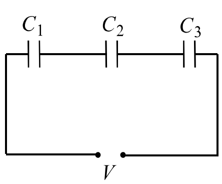


a) $\frac{\varepsilon_0 A}{d}$ b) $\frac{3\varepsilon_0 A}{d}$ c) $\frac{3}{2}\frac{\varepsilon_0 A}{d}$ d) $\frac{2\varepsilon_0 A}{d}$

710. A solid sphere of radius R has a charge Q distributed in its volume with a charge density$\rho = kr^a$, where k and a are constants and $r$is the distance from its centre. If the electric field at $r = \frac{R}{2}$ is$\frac{1}{8}$ times that at $r = R$, find the value of a.
a) 2 b) 3 c) 2.5 d) 0.2

711. An air capacitor is charged with an amount of charge q and dipped into an oil tank. If the oil is pumped out, the electric field between the plates of capacitor will
a) Increase b) Decrease c) Remain the same d) Become zero

712. In the figure, three capacitors each of capacitance 6 pF are connected in series. The total capacitance of the combination will be



a) $9 \times 10^{-12} F$ b) $6 \times 10^{-12} F$ c) $3 \times 10^{-12} F$ d) $2 \times 10^{-12} F$

713. 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
a) Hit the disc at the centre
b) Return back along its path after touching the disc
c) Return back along its path without touching the disc
d) Any of the above three situations is possible depending on the magnitude of E

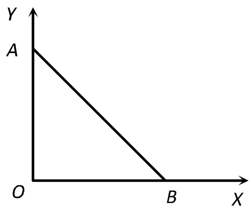
714. The capacitance of a parallel plate capacitor is $12\mu F$. If the distance between the plates is doubled and area is halved, then new capacitance will be
a) 8 μF b) 6 μF c) 4 μF d) 3 μF

715. 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

a) 2000 V/m b) 1000 V/m c) 500 V/m d) 3000 V/m

716. Choose the incorrect statement from the following. When two identical capacitors are charged individually to different potentials and connected parallel to each other after disconnecting them from the source
a) Net charge equals the sum of initial charges
b) The net energy stored in the two capacitors is less than the sum of the initial individual energies
c) The net potential difference across them is different from the sum of the individual initial potential difference
d) The net potential difference across them equals the sum of the individual initial potential differences

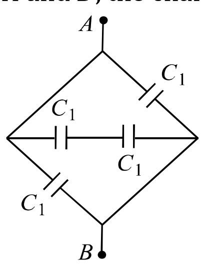
717. As per this diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point A [co-ordinates $(0, a)$] to another point B[co-ordinates $(a, 0)$] along the straight path AB is



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

718. 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
a) 1840 keV b) 1/1840 keV c) 1 keV d) 920 keV

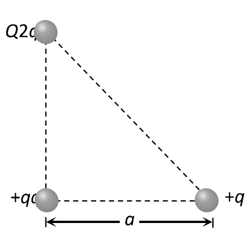
719. Four identical capacitors are connected as shown in diagram. When a battery of 6 V is connected between A and B, the charge stored is found to be 1.5 μC. The value of C_1 is



a) 2.5 μF b) 15 μF c) 1.5 μF d) 0.1 μF

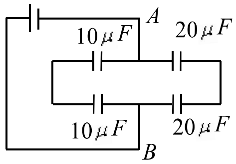
720. Two small spheres each having the charge $+Q$ are suspended by insulating threads of length L from a hook. This arrangement is taken in space where there is no gravitational effect, then the angle between the two suspensions and the tension in each will be
a) $180^0, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{(2L)^2}$ b) $90^0, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$ c) $180^0. \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{2L^2}$ d) $180^o, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

721. The 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



a) $\frac{-q}{1+\sqrt{2}}$ b) $\frac{-2q}{2+\sqrt{2}}$ c) $-2q$ d) $+q$

722. The equivalent capacitance between A and B as shown in the figure is

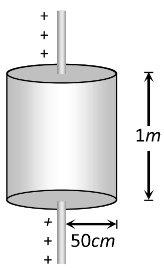


a) $\frac{85}{3}\mu F$ b) $30\mu F$ c) $15\mu F$ d) $75\mu F$

723. An electric dipole has a pair of equal and opposite point charges q and $-q$ separated by a distance $2x$. The axis of the dipole is defined as
   a) Direction from positive charge to negative charge
   b) Direction from negative charge to positive charge
   c) Perpendicular to the line joining the two charges drawn at the centre and pointing upward direction
   d) Perpendicular to the line joining the two charges drawn at the centre and pointing downward direction

724. 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
   a) $V \neq 0$ and $\vec{E} \neq 0$ b) $V \neq 0$ and $\vec{E} = 0$ c) $V = 0$ and $\vec{E} = 0$ d) $V = 0$ and $\vec{E} \neq 0$

725. 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



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

726. A negatively charged oil drop is prevented from falling under gravity by applying a vertical electric field $100V\ m^{-1}$. If the mass of the drop is $1.6 \times 10^{-3}g$, the number of electrons carried by the drop is $(g = 10ms^{-2})$
   a) 10^{18} b) 10^{15} c) 10^{6} d) 10^{12}

727. Tow positive charges of magnitude q are placed at the ends of a side1 of a square of side $2a$. Two negative charges of the same magnitude are kept at the other corners. Starting from rest, if a charge Q moves from the middle of side 1 to the centre of square, its kinetic energy at the centre of square is
   a) $\frac{1}{4\pi\varepsilon_0}\frac{2qQ}{a}\left(1-\frac{1}{\sqrt{5}}\right)$ b) Zero c) $\frac{1}{4\pi\varepsilon_0}\frac{2qQ}{a}\left(1+\frac{1}{\sqrt{5}}\right)$ d) $\frac{1}{4\pi\varepsilon_0}\frac{2qQ}{a}\left(1-\frac{2}{\sqrt{5}}\right)$

728. Two metallic spheres of radii 1 cm and $2cm$ are given charges 10^{-2} C and $5 \times 10^{-2}C$ respectively. If they are connected by a conducting wire, the final charge on the smaller sphere is
   a) $3 \times 10^{-2}C$ b) $1 \times 10^{-2}C$ c) $4 \times 10^{-2}C$ d) $2 \times 10^{-2}C$

729. A charged particle q is shot towards another charged particle Q which is fixed, with a speed v. It approaches$Q$ upto a closest distance r and then returns. If q is shot with speed$2v$, the closest distance of approach would be
   a) $\frac{r}{4}$ b) $\frac{r}{2}$ c) $2r$ d) r

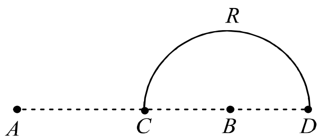
730. On increasing the plate separation of a charged condenser, the energy
   a) Increases b) Decreases c) Remains unchanged d) Becomes zero

731. Under the action of a given coulombic force the acceleration of an electron is $2.5 \times 10^{22}m/s^2$. Then the magnitude of the acceleration of a proton under the action of same force is nearly
   a) $1.6 \times 10^{-19}m/s^2$ b) $9.1 \times 10^{31}m/s^2$ c) $1.5 \times 10^{19}m/s^2$ d) $1.6 \times 10^{27}m/s^2$

732. The electric field created by a point charge falls with distance r from the point charge as

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

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



a) $\frac{qQ}{4\pi \epsilon_0 L}$ b) $\frac{qQ}{2\pi \epsilon_0 L}$ c) $\frac{qQ}{6\pi \epsilon_0 L}$ d) $-\frac{qQ}{6\pi \epsilon_0 L}$

734. Below figure (1) and (2) represent lines of force. Which is correct statement


(1)


(2)

a) Figure (1) represents magnetic lines of force
b) Figure (2) represents magnetic lines of force
c) Figure (1) represents electric lines of force
d) Both figure (1) and figure (2) represent magnetic lines of force

735. A charged particle q is shot towards another charged particle Q which is fixed, with a speed v. It approaches Q upto a closest distance r and then returns. If q is shot with speed $2v$, the closest distance of approach would be

a) $\frac{r}{4}$ b) $\frac{r}{2}$ c) $2r$ d) r

736. Electric field strength due to a dipole at a point on the axial line of dipole is

a) From positive charge to negative charge
b) From negative charge to positive charge
c) Along the equatorial line
d) At an angle to axial line

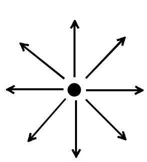
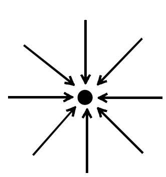
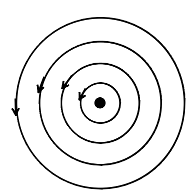
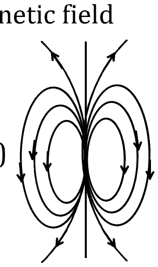
737. While a capacitor remains connected to a battery and dielectric slab is applied between the plates, then

a) Potential difference between the plates is changed
b) Charge flows from the battery to the capacitor
c) Electric field between the plates increases
d) Energy store in the capacitor decreases

738. What is the total charge in coulomb of 75.0 kg of electrons?

a) 0.32×10^{13}C b) 3.2×10^{16}C c) -1.32×10^{13}C d) $+1.32 \times 10^{-13}$C

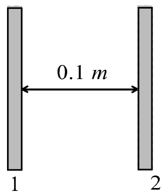
739. Which of the field patterns given below is valid for electric field as well as for magnetic field

a) 
b) 
c) 
d) 

740. Two identical conducting balls A and B have positive charges q_1 and q_2 respectively but $q_1 \neq q_2$. The balls are brought together so that they touch each other and then kept in their original positions. The force between them is

a) Less than that before the balls touched
b) Greater than that before the balls touched
c) Same as that before the balls touched
d) Zero

741. Two insulating plates are both uniformly charged in such a way that the potential difference between them is $V_2 - V_1 = 20V$. ($i.e.$ plate 2 is at a higher potential). The plates are separated by $d = 0.1m$ and can be treated as infinitely large. An electron is released from rest on the inner surface of plate 1. What is its speed when it hits plate 2
($e = 1.6 \times 10^{-19}C, m_e = 9.11 \times 10^{-31}kg$)



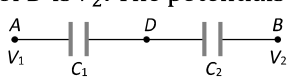
a) $7.02 \times 10^{12}\ m/s$ b) $1.87 \times 10^6\ m/s$ c) $32 \times 10^{-19}\ m/s$ d) $2.65 \times 10^6\ m/s$

742. The capacity of a parallel plate capacitor with no dielectric substance but with a separation of 0.4 cm is $2\mu F$. The separation is reduced to half and it is filled with a dielectric substance of value 2.8. The final capacity of the capacitor is
a) $11.2\mu F$ b) $15.6\mu F$ c) $19.2\mu F$ d) $22.4\mu F$

743. A regular hexagon of side $'a'$ has a charge Q at each vertex. Potential at the centre of the hexagon is $\left(K = \frac{1}{4\pi\varepsilon_0}\right)$
a) Zero b) $\frac{KQ}{a} Volts$ c) $12\frac{KQ}{a}$ d) $6\frac{KQ}{a}$

744. The law, governing the force between electric charges is known as
a) Ampere's law b) Ohm's law c) Faraday's law d) Coulomb's law

745. Two condensers C_1 and C_2 in a circuit are joined as shown in figure. The potential of point A is V_1 and that of B is V_2. The potentials of point D will be



a) $\frac{1}{2}(V_1 + V_2)$ b) $\frac{C_2V_1 + C_1V_2}{C_1 + C_2}$ c) $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$ d) $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

746. Two positive point charges of $12\mu C$ and $8\mu C$ are 10 cm apart. The work done in bringing them 4 cm closer is
a) 5.8 J b) 5.8 eV c) 13 J d) 13 eV

747. When a proton is accelerated through $1V$, then its kinetic energy will be
a) 1840 eV b) 13.6 eV c) 1 eV d) 0.54 eV

748. A water molecule has an electric dipole moment $6.4 \times 10^{-30}\ cm$ when it is in vapour state. The distance in metre between the centre of positive and negative charge of the molecule is
a) 4×10^{-10} b) 4×10^{-11} c) 4×10^{-12} d) 4×10^{-13}

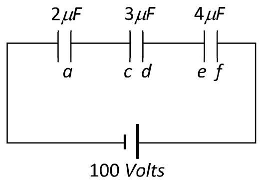
749. A sample of HCl gas is placed in an electric field of $3 \times 10^4\ NC^{-1}$. The dipole moment of each HCl molecule is $6 \times 10^{-30} c \times m$. The maximum torque that can act on a molecule is
a) $2 \times 10^{-34}C^2N^{-1}m$ b) $2 \times 10^{-34}Nm$
c) $18 \times 10^{-26}\ Nm$ d) $0.5 \times 10^{34}C^{-2}N^{-1}m^{-1}$

750. 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
a) $(\phi_1 + \phi_2)\varepsilon_0$ b) $(\phi_2 - \phi_1)\varepsilon_0$ c) $(\phi_1 + \phi_2)/\varepsilon_0$ d) $(\phi_2 - \phi_1)/\varepsilon_0$

751. Which of the following statement(s) is/are correct
a) If the electric field due to a point charge varies as $r^{-2.5}$ instead of r^{-2}, then the Gauss law will still be valid
b) The Gauss law can be used to calculate the field distribution around an electric dipole
c) If the electric field between two point charges is zero somewhere, then the sign of the two charges is the same

d) The work done by the external force in moving a unit positive charge from point A at potential V_A is $(V_B - V_A)$

752. Three capacitors are connected to $D.C.$ source of 100 $volts$ shown in the adjoining figure. If the charge accumulated on plates of C_1, C_2 and C_3 are q_a, q_b, q_c, q_d, q_e and q_f respectively, then



a) $q_b + q_d + q_f = \frac{100}{9} C$ b) $q_b + q_d + q_f = 0$ c) $q_a + q_c + q_e = 50\ C$ d) $q_b = q_d = q_f$

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

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

754. Capacitors are used in electrical circuits where appliances need more

a) Current b) Voltage c) Watt d) Resistance

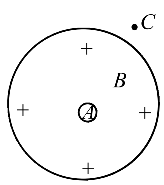
755. A pendulum bob carries a negative charge $-q$ .A positive charge $+q$ is held at the point of support. Then, the time period of the bob is

a) Greater than $2\pi\sqrt{\frac{L}{g}}$ b) Less than $2\pi\sqrt{\frac{L}{g}}$ c) equal to $2\pi\sqrt{\frac{L}{g}}$ d) Equal to $2\pi\sqrt{\frac{2L}{g}}$

756. Two large metal plates are placed parallel to each other. The inner surfaces of plates are charged by $+\sigma$ and $-\sigma(\text{cm}^{-2})$. The outer surfaces are neutral. The electric field in the region between the plates and outside the plates is

a) $\frac{2\sigma}{\varepsilon_0}, \frac{\sigma}{\varepsilon_0}$ b) $\frac{\sigma}{\varepsilon_0}$, zero c) $\frac{2\sigma}{\varepsilon_0}$, zero d) zero, $\frac{2\sigma}{\varepsilon_0}$

757. Two equal metal balls are charged to 10 and -20 units of electricity. Then they are brought in contact with each other and then again separated to the original distance. The ratio of magnitudes of the force between the two balls before and after contact is



a) 8:1 b) 1:8 c) 2:1 d) 1:2

758. An infinite number of electric charges each equal to 5 $nano - coulomb$ (magnitude) are placed along X-axis at $x = 1\ cm,\ x = 2\ cm,\ x = 4\ cm\ x = 8\ cm$ ……… and so on. In the setup if the consecutive charges have opposite sign, then the electric field in $Newton/Coulomb$ at $X = 0$ is $\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2/c^2\right]$

a) 12×10^4 b) 24×10^4 c) 36×10^4 d) 48×10^4

759. 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 t_1/t_2 is nearly equal to

a) 1 b) $\sqrt{M_p/M_e}$ c) $\sqrt{M_e/M_p}$ d) 1836

760. Eight small drops, each of radius r and having same charge q are combined to form a big drop. The ratio between the potentials of the bigger drop and the smaller drop is

a) 8 : 1 b) 4 : 1 c) 2 : 1 d) 1 : 8

761. N identical drops of mercury are charged simultaneously to 10 volt. When combined to form one large

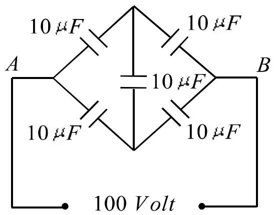
drop, the potential is found to be 40 volt, the value of N is

a) 4　b) 6　c) 8　d) 10

762. A solid sphere of radius R has a charge Q distributed in its volume with a charge density $\rho = k\,r^a$, where k and a are constants and r is the distance from its centre. If the electric field at $r = \frac{R}{2}$ is $\frac{1}{8}$ times that at $r = R$, find the value of a

a) 3　b) 5　c) 2　d) Both (a) and (b)

763. Five capacitors of $10\mu F$ capacity each are connected to a $d.c.$ potential of 100 $volts$ as shown in the adjoining figure. The equivalent capacitance between the points A and B will be equal to



a) $40\mu F$　b) $20\mu F$　c) $30\mu F$　d) $10\mu F$

764. An elementary particle of mass m and charge $+e$ is projected with velocity v at a much more massive particle of charge Ze, where $Z > 0$. What is the closest possible approach of the incident particle

a) $\frac{Ze^2}{2\pi\varepsilon_0 mv^2}$　b) $\frac{Ze}{4\pi\varepsilon_0 mv^2}$　c) $\frac{Ze^2}{8\pi\varepsilon_0 mv^2}$　d) $\frac{Ze}{8\pi\varepsilon_0 mv^2}$

765. Angle between equipotential surface and lines of force is

a) Zero　b) 180°　c) 90°　d) 45°

766. Consider two point charges of equal magnitude and opposite sign separated by a certain distance. Then neutral point between them

a) Does not exist

b) Will be in mid way between them

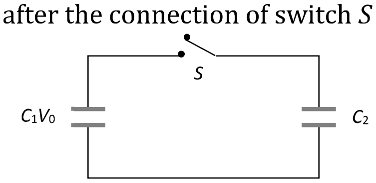
c) Lies on the perpendicular bisector of the line joining the two

d) Will be closer to the negative charge

767. A capacitor is charged by a battery and the energy stored is U. The battery is now removed and the separation distance between the plates is doubled. The energy stored now is

a) $\frac{U}{2}$　b) U　c) $2U$　d) $4U$

768. A capacitor of capacity C_1 is charged to the potential of V_0. On disconnecting with the battery, it is connected with a capacitor of capacity C_2 as shown in the adjoining figure. The ratio of energies before and after the connection of switch S will be



a) $(C_1 + C_2)/C_1$　b) $C_1/(C_1 + C_2)$　c) C_1C_2　d) C_1/C_2

769. Two identical spheres carrying charges $-9\mu C$ and $5\mu C$ respectively are kept in contact and then separated from each other. Point out true statement from the following. In each sphere

a) 1.25×10^{13} electrons are in deficit　b) 1.25×10^{13} electrons are in excess

c) 2.15×10^{13} electrons are in excesss　d) 2.15×10^{13} electrons are in deficit

770. An electron falls through a small distance in a uniform electric field of magnitude $2 \times 10^4 NC^{-1}$. The direction of the field is reversed keeping the magnitude unchanged and a proton falls through the same distance. The time of fall will be

a) Same in both cases　b) More in the case of an electron

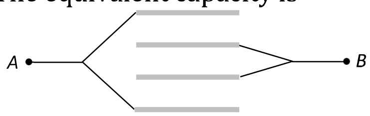
c) More in the case of proton　d) Independent of charge

771. Two point charges exert on each other a force F when they are placed r distance apart in air. When they

are placed R distance apart in a medium of dielectric constant K, they exert the same force. The distance R equals

a) $\frac{r}{k}$ b) rK c) $r\sqrt{K}$ d) $\frac{r}{\sqrt{K}}$

772. Four plates of equal area A are separated by equal distances d and are arranged as shown in the figure. The equivalent capacity is



a) $\frac{2\varepsilon_0 A}{d}$ b) $\frac{3\varepsilon_0 A}{d}$ c) $\frac{4\varepsilon_0 A}{d}$ d) $\frac{\varepsilon_0 A}{d}$

773. Dielectric constant for metal is

a) Zero b) Infinite c) 1 d) Greater than 1

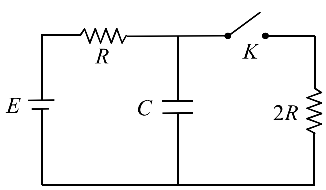
774. The capacitance of a parallel plate condenser does not depend on

a) Area of the plates b) Medium between the plates
c) Distance between the plates d) Metal of the plates

775. The force between two charges $0.06m$ apart is $5N$. If each charge is moved towards the other by $0.01m$, then the force between them will become

a) $7.20N$ b) $11.25N$ c) $22.50N$ d) $45.00N$

776. In the circuit, shown in fig. $''K''$ is open. The charge on capacitor C in steady state is q_1. Now key is closed and at steady state, the charge on C is q_2. The ratio of charges $\left(\frac{q_1}{q_2}\right)$ is



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

777. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of $40N$. If a charge of $-5\mu C$ is added to each of them, then the force between them will become

a) $-10N$ b) $+10N$ c) $+20N$ d) $-20N$

778. 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 $6m$. Calculate the potential to which the bigger sphere would be raised

a) $20\ V$ b) $60\ V$ c) $80\ V$ d) $40\ V$

779. A capacitor having capacitance C is charged to a voltage V. It is then removed and connected in parallel with another identical capacitor which is uncharged. The new charge on each capacitor is now

a) CV b) $CV/2$ c) $2\ CV$ d) $CV/4$

780. The combined capacity of the parallel combination of two capacitors is four times their combined capacity when connected in series. This means that

a) Their capacities are equal b) Their capacities are $1\mu F$ and $2\mu F$
c) Their capacities are $0.5\mu F$ and $1\mu F$ d) Their capacities are infinite

781. A body can be negatively charged by

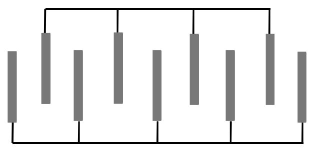
a) Giving excess of electrons to it b) Removing some electrons from it
c) Giving some protons to it d) Removing some neutrons from it

782. The ratio of electric fields on the axis and at equator of an electric dipole will be

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

783. A gang capacitor is formed by interlocking a number of plates as shown in figure. The distance between the consecutive plates is $0.885\ cm$ and the overlapping area of the plate is $5\ cm^2$. The capacity of the unit

is



a) 1.0 b) 4 pF c) 6.36 pF d) 12.72 pF

784. Two point charges of 1μC and −1μC are separated by a distance of 100 Å. A point P is at a distance of 10 cm from the mid-point and on the perpendicular bisector of the line joining the two charges. The electric field at P will be

a) 9 NC^{-1} b) 0.9 Vm^{-1} c) 90 Vm^{-1} d) 0.09 NC^{-1}

785. An electric dipole is placed at an angle of 60^0 with an electric field of intensity 10^5 NC^{-1}. It experiences a torque equal to $8\sqrt{3}$ Nm. Calculate the charge on the dipole, if the dipole length is 2 cm.

a) -8×10^3 C b) 8.54×10^{-4} C c) 8×10^{-3} C d) 0.85×10^{-6} C

786. The relation between the intensity of the electric field of an electric dipole at a distance r from its centre on its axis and the distance r is where $(r \gg 2l)$

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

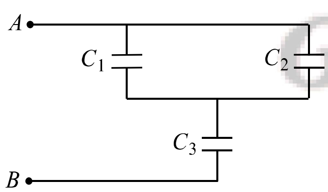
787. The ratio of electrostatic and gravitational forces acting between electron and proton separated by a distance $5 \times 10^{-11} m$, will be (Charge on electron $= 1.6 \times 10^{-19} C$, mass of electron $= 9.1 \times 10^{-31} kg$, mass of proton $= 1.6 \times 10^{-27} kg, G = 6.7 \times 10^{-11} Nm^2/kg^2$)

a) 2.36×10^{39} b) 2.36×10^{40} c) 2.34×10^{41} d) 2.34×10^{42}

788. Three concentric spherical shells have radii a, b and $c (a < b < c)$ and have surface charge densities $\sigma, -\sigma$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then, for $c = a + b$, we have

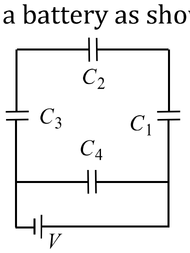
a) $V_C = V_A \neq V_B$ b) $V_C = V_B \neq V_A$ c) $V_C \neq V_B \neq V_A$ d) $V_C = V_B = V_A$

789. In the given network capacitance, $C_1 = 10\mu F, C_2 = 5\mu F$ and $C_3 = 4\mu F$. What is the resultant capacitance between A and B



a) 2.2 μF b) 3.2 μF c) 1.2 μF d) 4.7 μF

790. A network of four capacitors of capacities equal to $C_1 = C, C_2 = 2C, C_3 = 3C$ and $C_4 = 4C$ are connected to a battery as shown in the figure



The ratio of the charges on C_2 and C_4 is

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

791. The angle subtended by a circular disk of diameter 2 cm at a distance 1000 cm from your eye is

a) 0.2° b) 0.002° c) 0.11° d) 0.22°

792. When a body is earth connected, electrons from the earth flow into the body. This means the body is

a) Unchanged b) Charged positively c) Charged negatively d) An insulator

793. Positive and negative point charges of equal magnitude are kept at $\left(0,0,\frac{a}{2}\right)$ and $\left(0,0,\frac{-a}{2}\right)$, respectively. The work done by the electric field when another positive point charge

is moved from $(-a, 0,0)$ to $(0, a, 0)$ is

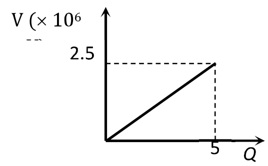
a) Positive

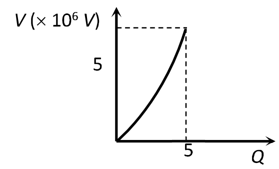
b) Negative

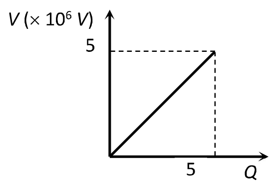
c) Zero

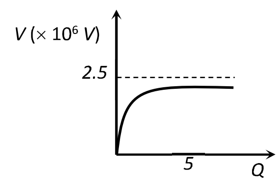
d) Depends on the path connecting the initial and final positions

794. A condenser of $2\mu F$ capacitance is charged steadily from 0 to 5 $coulomb$. Which of the following graphs correctly represents the variation of potential difference across its plates with respect to the charge on the condenser

a) 

b) 

c) 

d) 

795. Given that $q_1 + q_2 = q$. For what ratio q_1/q will the force between q_1 and q_2 be maximum?

a) 0.25 b) 0.5 c) 1 d) 2

796. A capacitor of capacitance $C_1 = 1\ \mu F$ can with stand maximum voltage $V_1 = 6kV$ $(kilo - volt)$ and another capacitor of capacitance $C_2 = 3\mu F$ can withstand maximum voltage $V_2 = 4\ kV$. When the two capacitors are connected in series, the combined system can withstand a maximum voltage of

a) $4kV$ b) $6kV$ c) $8kV$ d) $10kV$

797. Two point charges $+q$ and $-q$ are held fixed at $(-d, 0)$ and $(d, 0)$ respectively of a (X, Y) coordinate system. Then

a) E at all points on the $Y -$ axis is along $\hat{\boldsymbol{\imath}}$

b) The electric field $\vec{E}$ at all points on the X-axis has the same direction

c) Dipole moment is $2qd$ directed along $\hat{\boldsymbol{\imath}}$

d) Work has to be done in bringing a test charge from infinity to the origin

798. Can a metal be used as a medium for dielectric

a) Yes b) No

c) Depends on its shape d) Depends on dielectric

799. An electric dipole consists of two opposite charges each 0.05μC separated by 30 mm. The dipole is placed in an uniform external electric field of $10^6 NC^{-1}$. The maximum torque exerted by the field on the dipole is

a) $6 \times 10^{-3} N - m$ b) $3 \times 10^{-3} N - m$ c) $15 \times 10^{-3} N - m$ d) $1.5 \times 10^{-3} N - m$

800. The charge q is projected into a uniform electric field E, work done when it moves a distance Y is

a) qEY b) $\frac{qY}{E}$ c) $\frac{qE}{Y}$ d) $\frac{Y}{qE}$

801. A long, hollow conducting cylinder is kept coaxially inside another long, hollow conducting cylinder of larger radius. Both the cylinders are initially electrically neutral

a) A potential difference appears between the two cylinders when a charge density is given to the inner cylinder

b) A potential difference appears between the two cylinders when a charge density is given to the outer cylinder

c) No potential difference appears between the two cylinders when a uniform line charge is kept along the axis of the cylinders

d) No potential difference appears between the two cylinders when same charge density is given to both the cylinders

802. The energy of a charged capacitor is given by the expression ($q =$ charge on the conductor and $C =$ its capacity)

a) $\frac{q^2}{2C}$ b) $\frac{q^2}{C}$ c) $2qC$ d) $\frac{q}{2C^2}$

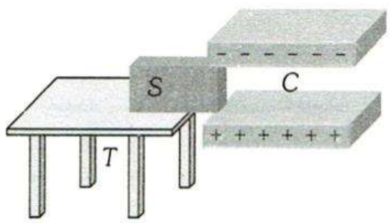
803. There is a uniform electric field of strength $10^3 V/m$ along y-axis. A body of mass $1g$ and charge $10^{-6}C$ is projected into the field from origin along the positive x-axis with a velocity $10m/s$. Its speed in m/s after $10s$ is (Neglect gravitation)

a) 10 b) $5\sqrt{2}$ c) $10\sqrt{2}$ d) 20

804. A infinite number of charges, each of charge 1μ C, 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 1C charge?

a) 9000 N b) 12000 N c) 24000 N d) 36000 N

805. A frictionless dielectric plate S is kept on a frictionless table T. A charged parallel plate capacitance C (of which the plates are frictionless) is kept near it. The plate S is in between the plates. When the plate S is left between the plates



a) It will remain stationary on the table

b) It is pulled by the capacitor and will pass on the other end

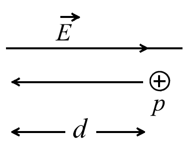
c) It is pulled between the plates and will remain there

d) All the above statements are false

806. The ratio of electric field and potential (E/V) at mid-point of electric dipole, for which separation $l$is

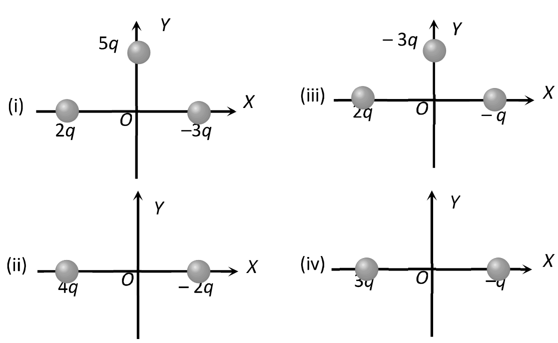
a) $1/l$ b) l c) $2/l$ d) None of these

807. In the figure, a proton moves a distance d in a uniform electric field $\vec{E}$ as shown in the figure. Does the electric field do a positive or negative work on the proton? Does the electric potential energy of the proton increase or decrease



a) Negative, increase b) Positive, decrease c) Negative, decrease d) Positive, increase

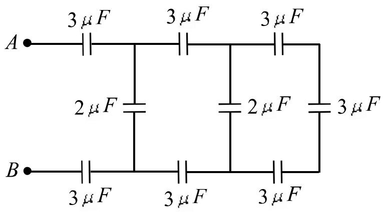
808. In the following four situations charged particles are at equal distance from the origin. Arrange them the magnitude of the net electric field at origin greatest first



a) (i) > (ii) > (iii) > (iv) b) (ii) > (i) > (iii) > (iv)

c) (i) > (iii) > (ii) > (iv) d) (iv) > (iii) > (ii) > (i)

809. The equivalent capacitance between A and B is (in μF)



a) 25 b) $\frac{84}{25}$ c) 9 d) 1

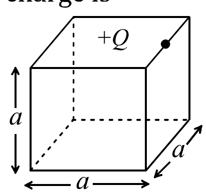
810. Two condensers of capacity $0.3\mu F$ and $0.6\mu F$ respectively are connected in series. The combination is connected across a potential of 6 $volts$. The ratio of energies stored by the condensers will be

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

811. Separation between the plates of a parallel plate capacitor is d and the area of each plate is A. When a slab of material of dielectric constant k and thickness $t(t < d)$ is introduced between the plates, its capacitance becomes

a) $\frac{\varepsilon_0 A}{d + t\left(1 - \frac{1}{k}\right)}$ b) $\frac{\varepsilon_0 A}{d + t\left(1 + \frac{1}{k}\right)}$ c) $\frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{k}\right)}$ d) $\frac{\varepsilon_0 A}{d - t\left(1 + \frac{1}{k}\right)}$

812. In figure $+Q$ charge is located at one of the edge of the cube, then electric flux through cube due to $+Q$ charge is



a) $\frac{+Q}{\epsilon_0}$ b) $\frac{+Q}{2\,\epsilon_0}$ c) $\frac{+Q}{4\,\epsilon_0}$ d) $\frac{+Q}{8\,\epsilon_0}$

813. In nature, the electric charge of any system is always equal to

a) Half integral multiple of the least amount of charge
b) Zero
c) Square of the least amount of charge
d) Integral multiple of the least amount charge

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

a) Decrease b) Increase c) Remain unchanged d) Become zero

815. Two metal spheres of capacitance C_1 and C_2 carry some charges. They are put in contact and then separated. The final charges Q_1 and Q_2 on them will satisfy

a) $\frac{Q_1}{Q_2} < \frac{C_1}{C_2}$ b) $\frac{Q_1}{Q_2} = \frac{C_1}{C_2}$ c) $\frac{Q_1}{Q_2} > \frac{C_1}{C_2}$ d) $\frac{Q_1}{Q_2} < \frac{C_2}{C_1}$

816. A parallel plate capacitor is charged. If the plates are pulled apart

a) The capacitance increases
b) The potential difference increases
c) The total charge increases
d) The charge and potential difference remain the same

817. 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

a) Zero having no direction
b) $8F$ towards $+q$ charge
c) $8F$ towards $-q$ charge
d) $4F$ towards $+q$ charge

818. A parallel plate capacitor of capacitance C is connected to a battery and is charged to a potential difference V. Another capacitor of capacitance $2C$ is connected to another battery and is charged to potential

difference $2V$. The charging batteries are now disconnected and the capacitors are connected in parallel to each other in such a way that the positive terminal of one is connected to the negative terminal of the other. The final energy of the configuration is

a) Zero b) $\frac{25CV^2}{6}$ c) $\frac{3CV^2}{2}$ d) $\frac{9CV^2}{2}$

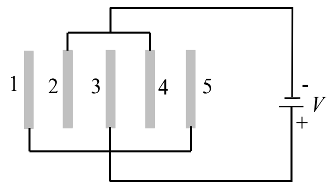
819. The potential at a point due to an electric dipole will be maximum and minimum when the angles between the axis of the dipole and the line joining the point to the dipole are respectively

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

820. When air in a capacitor is replaced by a medium of dielectric constant K, the capacity

a) Decreases K times b) Increases K times c) Increases K^2 times d) Remains constant

821. Five identical plates each of area A are joined as shown in the figure. The distance between the plates is d. The plates are connected to a potential difference of V $volts$. The charge on plates 1 and 4 will be



a) $\frac{\varepsilon_0 AV}{d}, \frac{2\varepsilon_0 AV}{d}$ b) $\frac{-\varepsilon_0 AV}{d}, \frac{2\varepsilon_0 AV}{d}$ c) $\frac{\varepsilon_0 AV}{d}, \frac{-2\varepsilon_0 AV}{d}$ d) $\frac{-\varepsilon_0 AV}{d}, \frac{-2\varepsilon_0 AV}{d}$

822. Charges +2q, +q and +q are placed at the corners A, B and C of an equilateral triangle ABC. If E is the electric field at the circumcentre O of the triangle, due to the charge +q, then the magnitude and direction of the resultant electric field at O is

a) E along AO b) $2E$ along AO c) E along BO d) E along CO

823. The capacitance of a parallel plate capacitor with air as medium is $3\mu F$. With the introduction of a dielectric medium between the plates, the capacitance becomes $15\mu F$. The permittivity of the medium is

a) 5
b) 15
c) $0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$
d) $8.854 \times 10^{-11} C^2 N^{-1} m^{-2}$

824. Condenser A has a capacity of $15\mu F$ when it is filled with a medium of dielectric constant 15. Another condenser B has a capacity of $1\pi F$ with air between the plates. Both are charged separately by a battery of $100\ V$. After charging, both are connected in parallel without the battery and the dielectric medium being removed. The common potential now is

a) $400\ V$ b) $800\ V$ c) $1200\ V$ d) $1600\ V$

825. A capacitor with air as the dielectric is charged to a potential of 100 $volts$. If the space between the plates is now filled with a dielectric of dielectric constant 10, the potential difference between the plates will be

a) 1000 $volts$ b) 100 $volts$ c) 10 $volts$ d) Zero

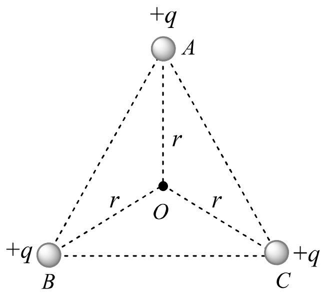
826. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and work done by the battery will be

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

827. An infinite number of charges, each of charge 1 μC, are placed on the x −axis with co-ordinates $x = 1,2,4,8, \dots . \infty$. If a charge of $1C$ is kept at the origin, then what is the net force acting on $1C$ charge

a) $9000\ N$ b) $12000\ N$ c) $24000\ N$ d) $36000\ N$

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



a) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$ b) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r}$ c) Zero d) $\frac{1}{4\pi\varepsilon_0}\frac{3q}{r^2}$

829. When we touch the terminals of a high voltage capacitor, even after a high voltage has been cut off, then the capacitor has a tendency to

a) Restore energy b) Discharge energy c) Affect dangerously d) Both (b) and (c)

830. Four capacitor of equal capacitance have an equivalent capacitance C_1 when connected in series and an equivalent capacitance C_2 when connected in parallel. The ratio C_1/C_2 is

a) 1/4 b) 1/16 c) 1/8 d) 1/12

831. The top of the atmosphere is at about 400 kV with respect to the surface of the earth, corresponding to an electric field that decreases with attitude. Near the surface of the earth, the field is about 100 Vm^{-1}. Still, we do not get an electric shock as we step out of our house into the open house because (assume the house to be a steel cage so that there is no field inside)

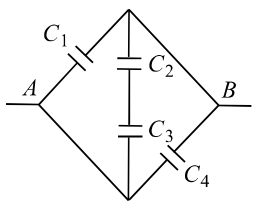
a) There is a potential difference between our body and the ground

b) 100 Vm^{-1} is not a high electric field so that we do not feel the shock

c) Our body and the ground forms and Equipotential surface

d) The atmosphere is not a conductor

832. In a given network the equivalent capacitance between A and B is $[C_1 = C_4 = 1\mu F, C_2 = C_3 = 2\mu F]$



a) 3 μF b) 6 μF c) 4.5 μF d) 2.5 μF

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

a) $\sqrt{R_1} : \sqrt{R_2}$ b) $R_1 : R_2$ c) $R_1^2 : R_2^2$ d) $R_1^3 : R_2^3$

834. If on the concentric hollow spheres of radii r and $R(> r)$ the charge Q is distributed such that their surface densities are same then the potential at their common centre is

a) $\frac{Q(R^2 + r^2)}{4\pi\varepsilon_0(R + r)}$ b) $\frac{QR}{R + r}$ c) Zero d) $\frac{Q(R + r)}{4\pi\varepsilon_0(R^2 + r^2)}$

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

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

836. The outer sphere of a spherical air capacitor is earthed. For increasing its capacitance

a) Vacuum is created between two spheres

b) Dielectric material is filled between the two spheres

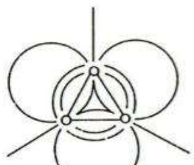
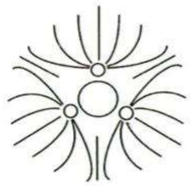
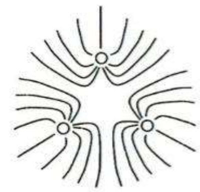
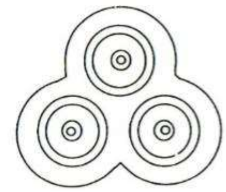
c) The space between two spheres is increased

d) The earthing of the outer sphere is removed

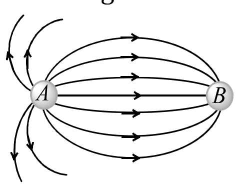
837. An electric dipole of moment $'p'$ is placed in an electric field of intensity $'E'$. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when $\theta = 90^\circ$, the torque and the potential energy of the dipole will respectively be

a) $pE \sin\theta, -pE\cos\theta$ b) $pE\sin\theta, -2pE\cos\theta$ c) $pE\sin\theta, 2pE\cos\theta$ d) $pE\cos\theta, -pE\cos\theta$

838. Three positive charges of equal value q are placed at the vertices of an equilateral triangle. The resulting lines of force should be sketched as in

a)  b)  c)  d) 

839. The spatial distribution of the electric field due to charges (A, B) is shown in figure. Which one of the following statements is correct



a) A is $+ve$ and $B - ve$ and $|A| > |B|$ b) A is $-ve$ and $B + ve$; $|A| = |B|$
c) Both are $+ve$ but $A > B$ d) Both are $-ve$ but $A > B$

840. An electric charge $10^{-3}\ \mu C$ is placed at the origin (0,0) of $X - Y$ co-ordinate system. Two points A and B are situated at $(\sqrt{2}, \sqrt{2})$ and $(2, 0)$ respectively. The potential difference between the points A and B will be

a) 9 $volt$ b) Zero c) 2 $volt$ d) 3.5 $volt$

841. A hollow charged metal sphere has a radius r. If the potential difference between its surface and a point at a distance $3r$ from the centre is V, then electrical intensity at distance $3r$ from the centre is

a) $\frac{V}{2r}$ b) $\frac{V}{3r}$ c) $\frac{V}{4r}$ d) $\frac{V}{6r}$

842. In infinite parallel plane sheet of a metal is charged to charge density σ coulomb per square metre in a medium of dielectric constant K. Intensity of electric field near the metallic surface will be

a) $E = \frac{\sigma}{\varepsilon_0 K}$ b) $E = \frac{K}{3\varepsilon_0}$ c) $E = \frac{\sigma}{2\varepsilon_0 K}$ d) $E = \frac{K}{2\varepsilon_0}$

843. A region surrounding a stationary electric dipoles has

a) Magnetic field only b) Electric field only
c) Both electric and magnetic fields d) No electric and magnetic fields

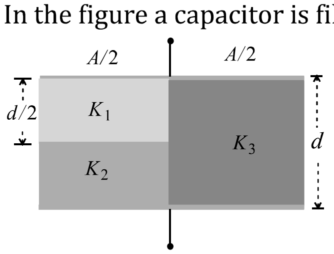
844. The Value (in vacuum) of energy density at a place in a region of electric field intensity E, due to it, is given by

a) $\frac{\varepsilon_0 E^2}{2}$ b) $\frac{\varepsilon_0 E}{2}$ c) $\frac{E^2}{2\varepsilon_0}$ d) $\frac{E\varepsilon_0^2}{2}$

845. An infinite line charge produce a field of $7.182 \times 10^8 \text{NC}^{-1}$ at a distance of 2 cm. The linear charge density is

a) $7.27 \times 10^{-4}\text{Cm}^{-1}$ b) $7.98 \times 10^{-4}\text{Cm}^{-1}$ c) $7.11 \times 10^{-4}\text{Cm}^{-1}$ d) $7.04 \times 10^{-4}\text{Cm}^{-1}$

846. In the figure a capacitor is filled with dielectrics. The resultant capacitance is



a) $\frac{2\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$ b) $\frac{\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$ c) $\frac{2\varepsilon_0 A}{d}[k_1+k_2+k_3]$ d) None of these

847. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be

a) $\frac{C}{3}, \frac{V}{3}$ b) $3C, \frac{V}{3}$ c) $\frac{C}{3}, 3V$ d) $3C, 3V$

848. A charged water drop whose radius is 0.1 μm 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 ($g = 10ms^{-1}$)

a) 1.61 N/C b) 26.2 N/C c) 262 N/C d) 1610 N/C

849. 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

a) $E_e = 2E_a$ b) $E_a = 2E_e$ c) $E_a = E_e$ d) None of the above

850. 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

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

851. 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

a) $F/8$ b) $F/4$ c) $4F$ d) $F/16$

852. The charge q is projected into a uniform electric field E, work done when it moves a distance Y is

a) qEY b) $\frac{qY}{E}$ c) $\frac{qE}{Y}$ d) $\frac{Y}{qE}$

853. 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 the electric intensity E at Q is proportional to

a) r^{-2} b) r^{-4} c) r^{-1} d) r^{-3}

854. A point charge of 1.8μC is at the centre of cubical Gaussian surface 55cm on edge. What is the net electric flux through the surface?

a) $1.0 \times 10^5 \text{N} - \text{m}^2\text{C}^{-1}$ b) $3.0 \times 10^5 \text{N} - \text{m}^2\text{C}^{-1}$
c) $2.0 \times 10^5 \text{N} - \text{m}^2\text{C}^{-1}$ d) $4.0 \times 10^5 \text{N} - \text{m}^2\text{C}^{-1}$

855. Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

a) $\frac{8e}{\varepsilon_0}$ b) $\frac{16e}{\varepsilon_0}$ c) $\frac{e}{\varepsilon_0}$ d) Zero

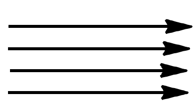
856. Two identical metal spheres charged with + 12μF and -8μF are kept at certain distance in air. They are brought into contact and then kept at the same distance. The ratio of the magnitudes of electrostatic forces between them before them and after contact is

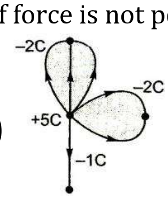
a) 12:1 b) 8:1 c) 24:1 d) 4:1

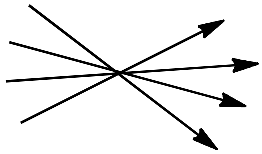
857. Two spherical conductors A and B of radius a and $b (b > a)$ are placed in air concentrically B is given charge + Q $coulomb$ and A is grounded. The equivalent capacitance of these is

a) $4\pi\varepsilon_0 \frac{ab}{b-a}$ b) $4\pi\varepsilon_0 (a+b)$ c) $4\pi\varepsilon_0 b$ d) $4\pi\varepsilon_0 \frac{b^2}{b-a}$

858. Which of the following configurations of electric lines of force is not possible?

a) 

b) 

c) 

d) Both (b) and (c)

859. A $500\mu F$ capacitor is charged at a steady rate of $100\mu C$/second. The potential difference across the capacitor will be 10 V after an interval of

a) 5 sec b) 25 sec c) 20 sec d) 50 sec

860. 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

a) $\left(\frac{q}{\varepsilon_0}\right)$ normal to surface
b) $\left(\frac{q}{2\varepsilon_0}\right)$ normal to surface
c) $\left(\frac{q}{\varepsilon_0}\right)$ tangential to surface
d) $\left(\frac{q}{2\varepsilon_0}\right)$ tangential to surface

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

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

862. Energy associated with a moving charge is due to a

a) Electric field
b) Magnetic field
c) Both electric field and magnetic field
d) None of these

863. If 10^{10} electrons are acquired by a body every second, the time required for the body to get a total charge of 1 C will be

a) Two hours b) Two days c) Two years d) 20 years

864. The energy stored in a condenser is in the form of

a) Kinetic energy
b) Electrostatic potential energy
c) Elastic energy
d) Magnetic energy

865. The energy required to charge a capacitor of $5\mu F$ by connecting a $d.c.$ source of $20kV$ is

a) 10 kJ b) 5 kJ c) 2 kJ d) 1 kJ

866. A resistor 'R' and $2\mu F$ capacitor in series is connected through a switch to 200 V direct supply. Across the capacitor is a neon bulb that lights up at 120 V. Calculate the value of R to make the bulb light up 5s after the switch has been closed. ($\log_{10} 2.5 = 0.4$)

a) $1.3 \times 10^4 \Omega$ b) $1.7 \times 10^5 \Omega$ c) $2.7 \times 10^6 \Omega$ d) $3.3 \times 10^7 \Omega$

867. Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l', then the relation between E_a and E_q will be

a) $E_a = 4E_q$ b) $E_q = 2E_a$ c) $E_a = 2E_q$ d) $E_q = 3E_a$

868. The plates of parallel plate capacitor are charged upto 100 V. A 2mm thick plate is inserted between the plates. Then to maintain the same potential difference, the distance between the plates is increased by 1.6 mm. The dielectric constant of the plate is

a) 5 b) 1.25 c) 4 d) 2.5

869. Which is known as capacitive time constant

a) R/L b) R/C c) R/LC d) $\frac{R \in_0 A}{d}$

870. The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

a) $\frac{WQ}{x}$ b) W c) $\frac{W}{x}$ d) WQ

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

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

872. Two insulates metallic spheres of $3\mu F$ and $5\mu F$ capacitances are charged to $300V$ and $500V$ respectively. The energy loss, when they are connected by a wire is

a) $0.012\,J$ b) $0.0218\,J$ c) $0.0375\,J$ d) $3.75\,J$

873. In a medium of dielectric constant K, the electric field is $\vec{E}$. If ε_0 is permittivity of the free space, the electric displacement vector is

a) $\frac{K\vec{E}}{\varepsilon_0}$ b) $\frac{\vec{E}}{K\varepsilon_0}$ c) $\frac{\varepsilon_0\vec{E}}{K}$ d) $K\varepsilon_0\vec{E}$

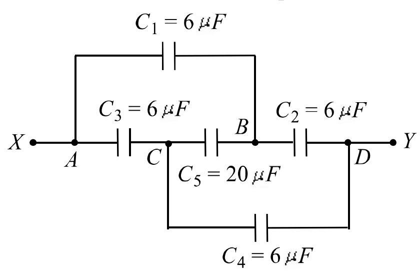
874. The value of electric potential at any point due to any electric dipole is

a) $k.\frac{\vec{p}\times\vec{r}}{r^2}$ b) $k.\frac{\vec{p}\times\vec{r}}{r^3}$ c) $k.\frac{\vec{p}.\vec{r}}{r^2}$ d) $k.\frac{\vec{p}.\vec{r}}{r^3}$

875. Let $p(r)=\frac{Qr}{\pi R^4}$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point P inside the sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is

a) Zero b) $\frac{Q}{4\pi\varepsilon_0 r_1^2}$ c) $\frac{Qr_1^2}{4\pi\varepsilon_0 R^4}$ d) $\frac{Qr_1^2}{3\pi\varepsilon_0 R^4}$

876. What is the effective capacitance between points X and Y

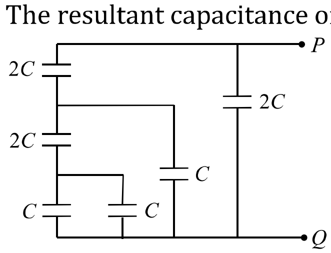


a) $24\mu F$ b) $18\mu F$ c) $12\mu F$ d) $6\mu F$

877. A solid spherical conductor of radius R has a spherical cavity of radius $a(a<R)$ at its centre. A charge $+Q$ is kept at the centre. The charge at the inner surface, outer surface and at a position $r(a<r<R)$ are respectively

a) $+Q,-Q,0$ b) $-Q,+Q,0$ c) $0,-Q,0$ d) $+Q,0,0$

878. The resultant capacitance of given circuit is

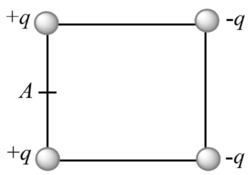


a) $3C$ b) $2C$ c) C d) $\frac{C}{3}$

879. A dipole of electric dipole moment p is placed in a uniform electric field of strength E. If θ is the angle between positive directions of p and E, then the potential energy of the electric dipole is largest when θ is

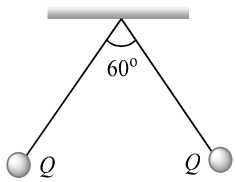
a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) π d) Zero

880. Four electric charges $+q,+q,-q$ and $-q$ are placed at the corners of a square of side $2L$ (see figure). The electric potential at point A, midway between the two charges $+q$



a) Zero
b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1+\sqrt{5})$
c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$
d) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$

881. Two small spherical balls each carrying a charge $Q = 10\mu C$ ($10\ micro - coulomb$) are suspended by two insulating threads of equal lengths $1m$ 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 : $\frac{1}{(4\pi\varepsilon_0)} = 9 \times 10^9 Nm/C^2$)



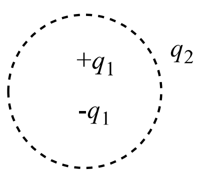
a) 18 N
b) 1.8 N
c) 0.18 N
d) None of the above

882. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium, if q is equal to
a) $-\frac{Q}{2}$
b) $-\frac{Q}{4}$
c) $+\frac{Q}{4}$
d) $+\frac{Q}{2}$

883. When a negative charge is taken at a height from earth's surface, then its potential energy
a) Decrease
b) Increases
c) Remains unchanged
d) Will become infinity

884. To obtain $3\mu F$ capacity from three capacitors of $2\mu F$ each, they will be arranged
a) All the three in series
b) All the three in parallel
c) Two capacitors in series and the third in parallel with the combination of first two
d) Two capacitors in parallel and the third in series with the combination of first two

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



a) q_2
b) Only the positive charges
c) All the charges
d) $+q_1$ and $-q_1$

886. 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
a) $-2\ pE$
b) $-pE$
c) pE
d) $2\ pE$

887. Electric intensity due to an electric dipole varies with distance (r) as $E \propto r^n$, where n is
a) -3
b) -2
c) -1
d) Zero

888. A condenser of capacity C_1 is charged to a potential V_0. The electrostatic energy stored in it is U_0. It is connected to another uncharged condenser of capacity C_2 in parallel. The energy dissipated in the process is
a) $\frac{C_2}{C_1+C_2}U_0$
b) $\frac{C_1}{C_1+C_2}U_0$
c) $\left(\frac{C_1-C_2}{C_1+C_2}\right)U_0$
d) $\frac{C_1C_2}{2(C_1+C_2)}U_0$

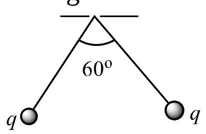
889. The area of the plates of a parallel plate condenser is A and the distance between the plates is $10mm$. There are two dielectric sheets in it, one of dielectric constant 10 and thickness $6mm$ and the other of dielectric constant 5 and thickness $4mm$. The capacity of the condenser is

a) $\frac{12}{35}\varepsilon_0 A$ b) $\frac{2}{3}\varepsilon_0 A$ c) $\frac{5000}{7}\varepsilon_0 A$ d) $1500\ \varepsilon_0 A$

890. The distance between charges $5\times10^{-11}C$ and $-2.7\times10^{-11}C$ 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

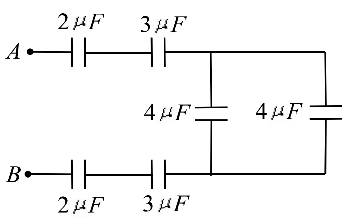
a) $0.44\ m$
b) $0.65\ m$
c) $0.556\ m$
d) $0.350\ m$

891. Two small sphere balls each carrying charges $q=10\mu$C are suspended by two insulated threads of equal length 1m each, from a point fixed in the ceiling. It is found that in equilibrium, threads are separated by an angle 60° between them as shown in figure, the tension in the thread is



a) 0.18 N b) 18 N c) 1.8 N d) None of the above

892. The effective capacity between A and B in the figure given is



a) $\frac{43}{24}\mu F$ b) $\frac{24}{43}\mu F$ c) $\frac{43}{12}\mu F$ d) $\frac{12}{43}\mu F$

893. A small conducting sphere of radius r is lying concentrically inside a bigger hollow conducting sphere of radius R. The bigger and smaller spheres are charged with Q and $q(Q>q)$ and are insulated from each other. The potential difference between the spheres will be

a) $\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}-\frac{Q}{R}\right)$ b) $\frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{R}+\frac{q}{r}\right)$ c) $\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}-\frac{q}{R}\right)$ d) $\frac{1}{4\pi\varepsilon r_0}\left(\frac{q}{R}-\frac{Q}{r}\right)$

894. Two parallel plates separated by a distance of $5mm$ are kept at a potential difference of $50V$ 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

a) $10^8\ m/s^2$ b) $5\times10^5\ m/s^2$ c) $10^5\ m/s^2$ d) $2\times10^3\ m/s^2$

895. The capacity of a condenser in which a dielectric of dielectric constant 5 has been used, is C. If the dielectric is replaced by another with dielectric constant 20, the capacity will become

a) $\frac{C}{4}$ b) $4C$ c) $\frac{C}{2}$ d) $2C$

896. Two point charges+3μC and +8μC repel each other with a force of 40 N. If a charge of +5μC is added to each of them, then the force between them will become

a) −10 N b) +10 N c) +20 N d) −20 N

897. Two identical charged spheres are suspended by strings of equal lengths. The stings make an angle of 30° with each other. When suspended in a liquid of density $0.8g\ cm^{-3}$, the angle remains the same. If density of the material of the sphere is $1.6g\ cm^{-3}$, the dielectric constant of the liquid is

a) 1 b) 4 c) 3 d) 2

898. Let C be the capacitance of a capacitor discharging through a resistor R. Suppose t_1 is the time taken for

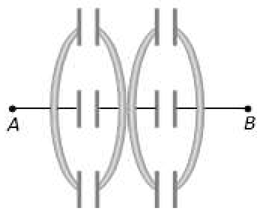
the energy stored in the capacitor to reduce to half its initial value and t_2 is the time taken for the charge to reduce to one-fourth its initial value. Then the ratio t_1/t_2 will be

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

899. If 4×10^2 eV energy is required to moves a charge of 0.25 $coulomb$ between two points. Then what will be the potential difference between them

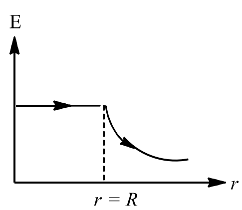
a) 178 V b) 256 V c) 356 V d) None of these

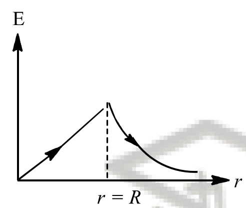
900. All six capacitor shown are identical, Each can withstand maximum 200 $volts$ between its terminals. The maximum voltage that can be safely applied between A and B is

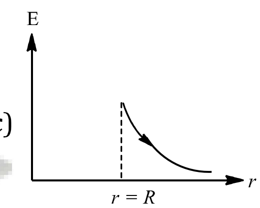


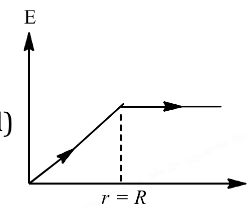
a) 1200 V b) 400 V c) 800 V d) 200 V

901. Which one of the following graphs represents the variation of electric field with distance r from the centre of a charged spherical conductor of radius R?

a) 

b) 

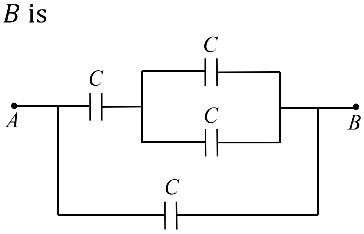
c) 

d) 

902. The electrostatic potential inside a charged spherical ball is given by $\phi = ar^2 + b$ where r is the distance from the centre a, b are constants. Then the charge density inside the ball is

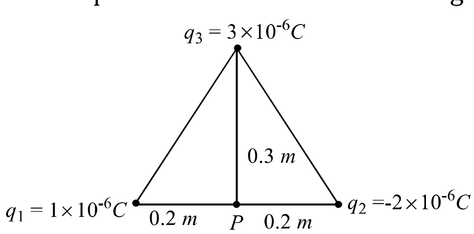
a) $-6a\varepsilon_0 r$ b) $-24\pi a\varepsilon_0$ c) $-6a\varepsilon_0$ d) $-24\pi a\varepsilon_0 r$

903. Four equal capacitors, each of capacity C, are arranged as shown. The effective capacitance between A and B is



a) $\frac{5}{8}C$ b) $\frac{3}{5}C$ c) $\frac{5}{3}C$ d) C

904. Figure shows a triangular array of three point charges. The electric potential V of these source charges at the midpoint P of the base of the triangle is



$\left[\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 Nm^2C^{-2}\right]$

a) 55 kV b) 45 kV c) 63 kV d) 49 kV

905. Two charges is equal to $2\mu C$ are $0.5m$ apart. If both of them exist inside vacuum, then the force between

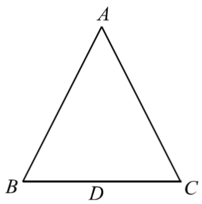
them is

a) 1.89 N b) 2.44 N c) 0.144 N d) 3.144 N

906. 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

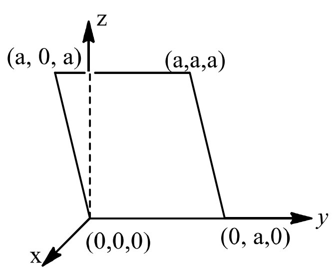
a) $3.2 \times 10^{-10}\,J$ b) $3.2 \times 10^{-18}\,J$ c) 1 N d) 1 $dyne$

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



a) Zero b) $\frac{3qQ}{4\pi \in_o a}$ c) $\frac{3qQ}{8\pi \in_o a}$ d) $\frac{qQ}{4\pi \in_o a}$

908. Consider an electric field $\mathbf{E}=E_0\hat{\mathbf{x}}$, where E_0 is a constant. The flux through the shaded area(as shown in the figure) due to this field is



a) $2E_0a^2$ b) $\sqrt{2}E_0a^2$ c) E_0a^2 d) $\frac{E_0a^2}{\sqrt{2}}$

909. Two identical thin rings each of radius R meters are coaxially placed at a diatance R meters apart. If Q_1 coulomb and Q_2 coulomb are respectively the charges uniformly spread on the two rings, the work done in moving a charge q from the centre of one ring to that of other is

a) Zero b) $\frac{q(Q_1 - Q_2)(\sqrt{2}-1)}{\sqrt{2}.4\pi\varepsilon_0 R}$ c) $\frac{q\sqrt{2}(Q_1 + Q_2)}{4\pi\varepsilon_0 R}$ d) $\frac{q(Q_1 + Q_2)(\sqrt{2}+1)}{\sqrt{2}.4\pi\varepsilon_0 R}$

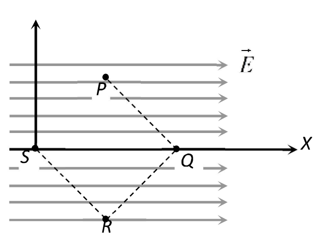
910. The charges on two spheres are $+7\mu C$ and $-5\mu C$ respectively. They experience a force F. If each of them is given and additional charge of $-2\mu C$, the new force of attraction will be

a) F b) $F/2$ c) $F/\sqrt{3}$ d) $2F$

911. Equal charges are given to two spheres of different radii. The potential will

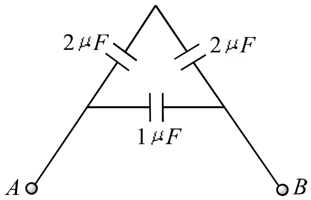
a) Be more on the smaller sphere
b) Be more on the bigger sphere
c) Be equal on both the spheres
d) Depend on the nature of the materials of the spheres

912. Point charge q moves from point P to point S along the path $PQRS$ (figure shown) in a uniform electric field E pointing coparallel to the positive direction of the X-axis. The coordinates of the points P, Q, R and S are $(a, b, 0)(2a, 0, 0)(a, -b, 0)$ and $(0,0,0)$ respectively. The work done by the field in the above process is given by the expression



a) qEa b) $-qEa$ c) $qEa\sqrt{2}$ d) $qE\sqrt{[(2a)^2 + b^2]}$

913. What is the effective capacitance between A and B in the following figure



a) $1\mu\ F$ b) $2\mu\ F$ c) $1.5\mu\ F$ d) $2.5\mu\ F$

914. A Gaussian sphere encloses an electric dipole within it. The total flux across the sphere is

a) Zero
b) Half that due to a single charge
c) Double that due to a single charge
d) Dependent on the position of the dipole

915. Positive and negative point charges of equal magnitude are kept at $\left(0,0,\frac{a}{2}\right)$ and $\left(0,0,\frac{-a}{2}\right)$, respectively. The work done by the electric field when another positive point charge is moved from $(-a, 0, 0)$ to $(0, a, 0)$ is

a) Positive
b) Negative
c) Zero
d) Depends on the path connecting the initial and final positions

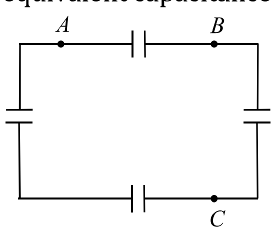
916. The electric potential at a point on the axis of an electric dipole depends on the distance r of the point from the dipole as

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

917. In identical mercury droplets charged to the same potential V coalesce to form a single bigger drop. The potential of new drop will be

a) $\frac{V}{n}$ b) nV c) nV^2 d) $n^{2/3}V$

918. Four capacitors of each of capacity $3\mu F$ are connected as shown in the adjoining figure. The ratio of equivalent capacitance between A and B and between A and C will be



a) 4 : 3 b) 3 : 4 c) 2 : 3 d) 3 : 2

919. Consider $\overrightarrow{E_1} = x\hat{\imath} + J$ and $\overrightarrow{E_2} = xy^2\hat{\imath} + x^2y\,\hat{\jmath}$; then

a) Only E_1 is electrostatic
b) Only E_2 is electrostatic
c) Both are electrostatic
d) None of these

920. An infinitely long thin straight wire has uniform linear charge density of $\frac{1}{3}cm^{-1}$. Then, the magnitude of the electric intensity at a point 18 cm away is
(Given $\varepsilon_0 = 8.8 \times 10^{-12}C^2Nm^{-2}$)

a) $0.33 \times 10^{11}NC^{-1}$ b) $3 \times 10^{11}\ NC^{-1}$ c) $0.66 \times 10^{11}NC^{-1}$ d) $1.32 \times 10^{11}NC^{-1}$

921. The number of ways one can arrange three identical capacitors to obtain distinct effective capacitances is

a) 8 b) 6 c) 4 d) 3

922. The plates of a parallel plate capacitor of capacity $50\mu C$ are charged to a potential of 100 $volts$ and then separated from each other so that the distance between them is doubled. How much is the energy spent in doing so

a) $25 \times 10^{-2}\,J$ b) $-12.5 \times 10^{-2}\,J$ c) $-25 \times 10^{-2}\,J$ d) $12.5 \times 10^{-2}\,J$

923. If a dielectric substance is introduced between the plates of a charged air-gap capacitor. The energy of the capacitor will

a) Increase
b) Decrease
c) Remain unchanged
d) First decrease and then increase

924. 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

a) l
b) $\sqrt{\frac{\pi\varepsilon_0}{G}}$
c) $\sqrt{\frac{G}{4\pi\varepsilon_0}}$
d) $\sqrt{4\pi\varepsilon_0 G}$

925. The capacity of the conductor does not depend upon

a) Charge
b) Voltage
c) Nature of the material
d) All of these

926. Two identical conducting spheres carrying different charges attract each other with a force F when placed in air medium at a distance $'d'$ apart. The spheres are brought into contact and then taken to their original positions. Now the two spheres repel each other with a force whose magnitude is equal to that of the initial attractive force. The ratio between initial charges on the spheres is

a) $-(3+\sqrt{8})$ only
b) $-3+\sqrt{8}$ only
c) $-(3+\sqrt{8})$ or $(-3+\sqrt{8})$
d) $+\sqrt{3}$

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

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

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

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

929. A charge of $10^{-9}C$ is placed on each of the 64 identical drops of radius 2 cm. They are then combined to form a bigger drop. Find its potential

a) 7.2×10^3V
b) 7.2×10^2V
c) 1.44×10^2V
d) 1.44×10^3V

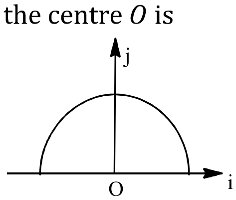
930. Two unlike charges of magnitude q are separated by a distance $2d$. The potential at a point midway between them is

a) Zero
b) $\frac{1}{4\pi\varepsilon_0}$
c) $\frac{1}{4\pi\varepsilon_0}.\frac{q}{d}$
d) $\frac{1}{4\pi\varepsilon_0}.\frac{2q}{d^2}$

931. 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

a) Zero
b) $\frac{\sigma}{\varepsilon_0}$
c) $\frac{\sigma}{2\varepsilon_0}$
d) Depends upon the location of the point

932. A thin semi-circular ring of radius r has a positive charge q distributed uniformly over it. The net field **E** at the centre O is



a) $\frac{q}{4\pi^2\varepsilon_0 r^2}\hat{\mathbf{i}}$
b) $-\frac{q}{4\pi^2\varepsilon_0 r^2}\hat{\mathbf{j}}$
c) $-\frac{q}{2\pi^2\varepsilon_0 r^2}\hat{\mathbf{i}}$
d) $\frac{q}{2\pi^2\varepsilon_0 r^2}\hat{\mathbf{j}}$

933. A spherical drop of capacitance 1 μF is broken into eight drops of equal radius. Then, the capacitance of each small drop is ……

a) $\frac{1}{8}\mu F$
b) $8\mu F$
c) $\frac{1}{2}\mu F$
d) $\frac{1}{4}\mu F$

934. 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

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

935. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is

a) $-\frac{Q}{4}(1+2\sqrt{2})$ b) $\frac{Q}{4}(1+2\sqrt{2})$ c) $-\frac{Q}{2}(1+2\sqrt{2})$ d) $\frac{Q}{2}(1+2\sqrt{2})$

936. A charge of $5C$ is given a displacement of $0.5m$. The work done in the process is $10J$. The potential difference between the two points will be

a) $2V$ b) $0.25V$ c) $1V$ d) $25V$

937. The electrostatic potential of a uniformly charged thin spherical shell of charge Q and radius R at a distance r from the centre is

a) $\frac{Q}{4\pi\varepsilon_0 r}$ for points outside and $\frac{Q}{4\pi\varepsilon_0 R}$ for points inside the shell

b) $\frac{Q}{4\pi\varepsilon_0 r}$ for both points inside and outside the shell

c) Zero for point outside and $\frac{Q}{4\pi\varepsilon_0 r}$ for points inside the shell

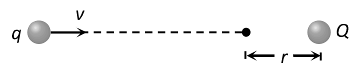
d) Zero for both points inside and outside the shell

938. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at the point is

a) $4\pi \in_0 \ Q \times 10^{20} V/m$ b) $12\pi \in_0 \ Q \times 10^{22} V/m$

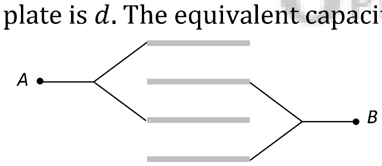
c) $4\pi \in_0 \ Q \times 10^{22} V/m$ d) $12\pi \in_0 \ Q \times 10^{20} V/m$

939. A charged particle q is shot towards another charged particle Q which is fixed, with a speed v. It approaches Q upto a closest distance r and then returns. If q were given a speed $2v$, the closest distances of approach would be



a) r b) $2r$ c) $r/2$ d) $r/4$

940. Four plates of the same area of cross-section are joined as shown in the figure. The distance between each plate is d. The equivalent capacity across A and B will be

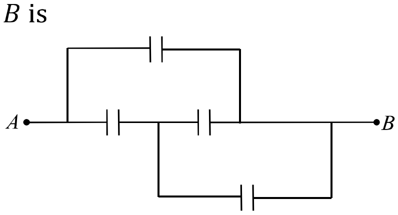


a) $\frac{2\varepsilon_0 A}{d}$ b) $\frac{3\varepsilon_0 A}{d}$ c) $\frac{3\varepsilon_0 A}{2d}$ d) $\frac{\varepsilon_0 A}{d}$

941. 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

a) Zero b) $\frac{q}{\varepsilon_0}$ c) $\frac{q}{2\varepsilon_0}$ d) $\frac{2q}{\varepsilon_0}$

942. In the circuit shown in figure, each capacitor has a capacity of $3\mu F$. The equivalent capacity between A and B is



a) $\frac{3}{4}\mu F$ b) $3\mu F$ c) $6\mu F$ d) $5\mu F$

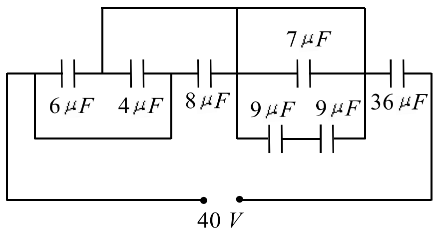
943. There is a solid sphere of radius $'R'$ having uniformly distributed charge. What is the relation between electric field $'E'$ (inside the sphere) and radius of sphere $'R'$ is

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

944. A parallel plate capacitor carries a charge q. The distance between the plates is doubled by application of a force. The work done by the force is
a) Zero b) $\frac{q^2}{C}$ c) $\frac{q^2}{2C}$ d) $\frac{q^2}{4C}$

945. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is
a) $-\frac{Q}{4}(1+2\sqrt{2})$ b) $\frac{Q}{4}(1+2\sqrt{2})$ c) $-\frac{Q}{2}(1+2\sqrt{2})$ d) $\frac{Q}{2}(1+2\sqrt{2})$

946. In the following diagram, the charge and potential difference across 8 μF capacitance will be respectively



a) 320 μC, 40 V b) 420 μC, 50 V c) 214 μC, 27 V d) 360 μC, 45 V

947. A conductor having a cavity is given a positive charge. Then field strengths E_A, E_B and E_C at point A (within cavity), at B (within conductor but outside cavity) and C (near conductor) respectively will be
a) $E_A = 0, E_B = 0, E_c = 0$ b) $E_A = 0, E_B = 0, E_c \neq 0$
c) $E_A \neq 0, E_B = 0, E_C \neq 0$ d) $E_A \neq 0, E_B \neq 0, E_C \neq 0$

948. The value of electric permittivity of free space is
a) $9 \times 10^9\ NC^2/m^2$ b) $8.85 \times 10^{-12} Nm^2/C^2 sec$
c) $8.85 \times 10^{-12} C^2/Nm^2$ d) $9 \times 10^9 C^2/Nm^2$

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

950. There are two charged identical metal spheres A and B repel each other with a force 3×10^{-5} N. Another identical uncharged sphere C is touched with A and then placed at the mid-point between A and B. net force on C is
a) 1×10^{-5} N b) 2×10^{-5} N c) 1.5×10^{-5} N d) 3×10^{-5} N

951. The electric potential at a point (x, y, z) is given by $V = -x^2y - xz^3 + 4$
The electric field $\vec{E}$ at that point is
a) $\vec{E} = \hat{\imath}(2xy + z^3) + \hat{\jmath}x^2 + \hat{k}3xz^2$ b) $\vec{E} = \hat{\imath}\ 2xy + \hat{\jmath}(x^2 + y^2) + \hat{k}(3xz - y^2)$
c) $\vec{E} = \hat{\imath}\ z^3 + \hat{\jmath}\ xyz + \hat{k}\ z^2$ d) $\vec{E} = \hat{\imath}(2xy - z^3) + \hat{\jmath}\ xy^2 + \hat{k}3z^2x$

952. The electric field created by a point charge falls with distance r from the point charge as
a) $\frac{1}{r}$ b) $\frac{1}{r^2}$ c) $\frac{1}{r^3}$ d) $\frac{1}{r^4}$

953. What is the flux through a cube of side $'a'$ if a point charge of q is at one of its corner
a) $\frac{2q}{\varepsilon_0}$ b) $\frac{q}{8\varepsilon_0}$ c) $\frac{q}{\varepsilon_0}$ d) $\frac{q}{2\varepsilon_0}6a^2$

954. Force of attraction between two point charges Q and $-Q$ separated by d *meter* is F_e. When these charges are placed on two identical spheres of radius $R = 0.3d$ whose centres and d *meter* apart, the force of attraction between them is
a) Greater than F_e b) Equal to F_e c) Less then F_e d) None of these

955. A 10pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor
a) $1.25 \times 10^{-8}\ J$ b) $2.5 \times 10^{-7}\ J$ c) $3.5 \times 10^{-5}\ J$ d) $4.5 \times 10^{-2}\ J$

956. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then

a) negative and distributed uniformly over the surface of the sphere
b) negative and appears only at the point on the sphere closest to the point charge
c) Negative and distributed non-uniformly over the entire surface of the sphere
d) Zero

957. 4 point charges each $+q$ is placed on the circumference of a circle of diameter $2d$ in such a way that they form a square. The potential at the centre is

a) 0 b) $\frac{4q}{d}$ c) $\frac{4d}{q}$ d) $\frac{q}{4d}$

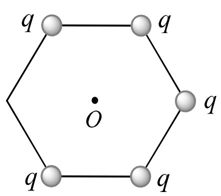
958. The potential to which a conductor is raised, depends on

a) The amount of charge b) Geometry and size of the conductor
c) Both (a) and (b) d) None of these

959. Three capacitors of $2\mu F$, $3\mu F$ and $6\mu F$ are joined in series and the combination is charged by means of a 24 $volt$ battery. The potential difference between the plates of the $6\mu F$ capacitor is

a) 4 $volt$ b) 6 $volt$ c) 8 $volt$ d) 10 $volt$

960. Five point charge each having magnitude $''q''$ are placed at the corner of hexagon as shown in fig. Net electric field at the centre $''O''$ is $\vec{E}$. To get net electric field at $''O''$ be $6\vec{E}$, charge placed on the remaining sixth corner should be



a) 6 q b) $-6\ q$ c) 5 q d) $-5\ q$

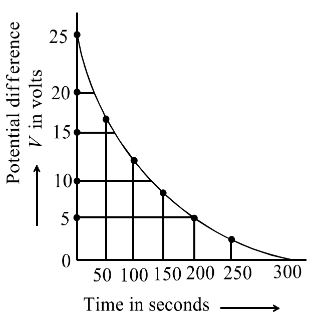
961. Two equal charges as separated by distance$d$. A third charge placed on a perpendicular bisector at x distance from centre will experience maximum coulomb force, when

a) $x = d/\sqrt{2}$ b) $x = d/2$ c) $x = d/2\sqrt{2}$ d) $x = d/2\sqrt{3}$

962. 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

a) $2q.E$ and minimum b) $q.E$ and $p.E$ c) Zero and minimum d) $q.E$ and maximum

963. The figure shows an experimental plot discharging of a capacitor in an RC circuit. The time constant τ of this circuit lies between



a) 150 sec and 200 sec b) 0 and 50 sec c) 50 sec and 100 sec d) 100 sec and 150 sec

964. The electric strength of air is 2×10^7 NC^{-1}. The maximum charge that a metallic sphere of diameter 6 mm can hold is

a) 3 nC b) 20 nC c) 1.5 nC d) 2 nC

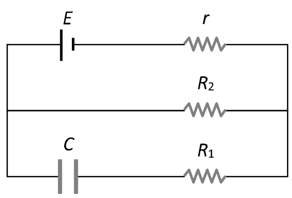
965. The respective radii of the two spheres of a spherical condenser are 12 cm and 9 cm. The dielectric constant of the medium between them is 6. The capacity of the condenser will be

a) 240 pF b) 240 μF c) 240 F d) None of the above

966. A capacitor is kept connected to the battery and a dielectric slab is inserted between the plates. During this process
a) No work is done
b) Work is done at the cost of the energy already stored in the capacitor before the slab is inserted
c) Work is done at the cost of the battery
d) Work is done at the cost of both the capacitor and the battery

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

968. In the given figure each plate of capacitance C has partial value of charge



a) CE b) $\frac{CER_1}{R_2 - r}$ c) $\frac{CER_2}{R_2 + r}$ d) $\frac{CER_1}{R_1 - r}$

969. 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
a) $-20V/m$ b) $6V/m$ c) $11V/m$ d) $-23V/m$

970. A conducting sphere of radius $R = 20\ cm$ is given a charge $Q = 16\mu C$. What is $\vec{E}$ at centre
a) $3.6 \times 10^6\ N/C$ b) $1.8 \times 10^6\ N/C$ c) Zero d) $0.9 \times 10^6\ N/C$

971. Gauss's Law is valid for
a) Any closed surface b) Only regular close surfaces
c) Any open surface d) Only irregular open surfaces

972. The force of interaction between two charges $q_1 = 6\mu$ C and $q_2 = 2\mu$C is 12 N. If charge $q = -2\mu$C is added to each of the charges, then the new force of interaction is
a) 2×10^{-7} N b) Zero c) 30 N d) 2×10^{-3} N

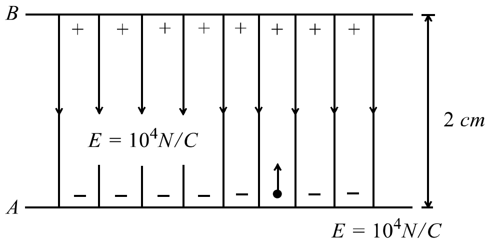
973. The capacitance of a spherical condenser is $1\mu F$. If the spacing between the two spheres is 1 mm, then the radius of the outer sphere is
a) $30cm$
b) $6m$
c) $5cm$
d) $3m$

974. The distance between the circular plates a parallel plate condenser 40 mm in diameter, in order to have same capacity as a sphere of radius 1 $metre$ is
a) $0.01mm$ b) $0.1mm$ c) $1.0mm$ d) $10mm$

975. The surface charge density (in C/m^2) of the earth is about
a) 10^{-9} b) -10^9 c) 10^9 d) -10^{-9}

976. A parallel plate capacitor is connected to a battery. The plates are pulled apart with a uniform speed. If x is the separation between the plates, the time rate of change of electrostatic energy of capacitor is proportional to
a) x^{-2} b) x c) x^{-1} d) x^2

977. An electron is released from the bottom plate A as shown in the figure ($E = 10^4 N/C$). The velocity of the electron when it reaches plate B will be nearly equal to



a) $0.85 \times 10^7\ m/s$ b) $1.0 \times 10^7\ m/s$ c) $1.25 \times 10^7\ m/s$ d) $1.65 \times 10^7\ m/s$

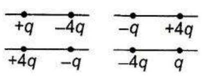
978. Two spherical conductors B and C having equal radii and carrying equal charges in them repel each other with force F when kept apart at some distance. A third spherical conductor having same radius as that of B but uncharged, is brought in contact with B, then brought in contact with C and finally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

a) $\frac{F}{4}$ b) $\frac{3F}{4}$ c) $\frac{F}{8}$ d) $\frac{3F}{8}$

979. 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

a) $2F$ b) $F/2$ c) 0 d) $\sqrt{2}F$

980. The figure shows four situations in which charges as indicated ($q > 0$) are fixed on an axis .In which situation is there a point to the left of the charges where an electron would be in equilibrium?



a) 1 and 2 b) 2 and 4 c) 3 and 4 d) 1 and 3

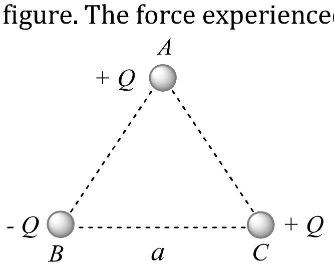
981. For a given surface the Gauss's law is stated as $\oint E . ds = 0$. From this we can conclude that

a) E is necessarily zero on the surface
b) E is perpendicular to the surface at every point
c) The total flux through the surface is zero
d) The flux is only going out of the surface

982. The potentials of the two plates of capacitor are $+10V$ and $-10\ V$. The charge on one of the plates is 40 C. The capacitance of the capacitor is

a) 2 F b) 4 F c) 0.5 F d) 0.25 F

983. 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 in a direction normal to BC is



a) $Q^2/(4\pi\varepsilon_0 a^2)$ b) $-Q^2/(4\pi\varepsilon_0 a^2)$ c) Zero d) $Q^2/(2\pi\varepsilon_0 a^2)$

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

a) 8×10^{-5} b) 80×10^{-17} c) 5×10^{14} d) 1.28×10^{-17}

985. Two equal negative charges $-q$ are fixed at points $(0, a)$ and $(0, -a)$ on the Y-axis. A positive charge $'q'$ is released from rest at the point ($x << a$) on the x-axis. What is the frequency of motion

a) $\sqrt{\frac{2q^2}{4\pi \in_0 ma^3}}$ b) $\sqrt{\frac{4q^2}{2\pi \in_0 ma^3}}$ c) $\sqrt{\frac{q^2}{2\pi \in_0 ma^3}}$ d) $\sqrt{\frac{q^2}{\pi \in_0 ma^3}}$

986. The capacity of a parallel plate condenser is $10\mu F$ without dielectric. Dielectric of constant 2 is used to fill half the distance between the plates, the new capacitance in μF is

a) 10 b) 20 c) 15 d) 13.33

987. C, V, U and Q are capacitance, potential difference, energy stored and charge of parallel plate capacitor respectively. The quantities that increases when a dielectric slab is introduced between the plates without

disconnecting the battery are

a) V and C b) V and U c) U and Q d) V and Q

988. An arc of radius r carries charge. The linear density of charge is λ and the arc subtends a angle $\frac{\pi}{3}$ at the centre. What is electric potential at the centre

a) $\frac{\lambda}{4\varepsilon_0}$ b) $\frac{\lambda}{8\varepsilon_0}$ c) $\frac{\lambda}{12\varepsilon_0}$ d) $\frac{\lambda}{16\varepsilon_0}$

989. Under the influence of the Coulomb field of charge $+Q$, a charge $-q$ is moving around it in an elliptical orbit. Fine out the correct statement(s)

a) The angular momentum of the charge $-q$ is constant

b) The linear momentum of the charge $-q$ is constant

c) The angular velocity of the charge $-q$ is constant

d) The linear speed of the charge $-q$ is constant

990. A parallel plate air capacitor is charged and then isolated. When a dielectric material is inserted between the plates of the capacitor, then which of the following does not change

a) Electric field between the plates b) Potential difference across the plates

c) Charge on the plates d) Energy stored in the capacitor

991. The ratio of the forces between two small spheres with constant charge (a) in air (b) in a medium of dielectric constant K is

a) $1 : K$ b) $K : 1$ c) $1 : K^2$ d) $K^2 : 1$

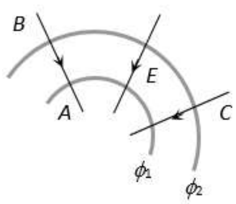
992. In a parallel plate capacitor of capacitance C, a metal sheet is inserted between the plates, parallel to them. If the thickness of the sheet is half of the separation between the plates. The capacitance will be

a) $C/2$ b) $3C/4$ c) $4C$ d) $2C$

993. A cylinder of radius r and length l is placed in an uniform electric field E parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by

a) Zero b) $2\pi r^2 E$ c) $\pi r^2 E$ d) $(\pi r^2 + \pi l^2)E$

994. In moving from A to B along an electric field line, the electric field does $6.4 \times 10^{-19} J$ of work on an electron. If ϕ_1, ϕ_2 are equipotential surfaces, then the potential difference $(V_C - V_A)$ is

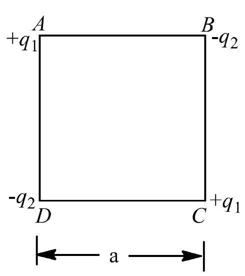


a) $-4\ V$ b) $4\ V$ c) Zero d) $64\ V$

995. A parallel plate capacitor of a capacitance of 1 farad would have the plate area of about

a) $100\ m^2$ b) $1\ km^2$ c) $100\ km^2$ d) $1000\ km^2$

996. Charges are placed at corner of square of side a as shown in following figure. The charge A is in equilibrium. The ratio $\frac{q_1}{q_2}$ is



a) 1 b) $\sqrt{2}$ c) $\frac{1}{\sqrt{2}}$ d) $\frac{2}{\sqrt{2}}$

997. The mean electric energy density between the plates of a charged capacitor is (here q = charge on the capacitor and A = area of the capacitor plate)

a) $\frac{q^2}{2\varepsilon_0 A^2}$ b) $\frac{q}{2\varepsilon_0 A^2}$ c) $\frac{q^2}{2\varepsilon_0 A}$ d) None of the above

998. Two equal charges q of opposite sign separated by a distance $2a$ constitute an electric dipole of dipole moment p. If P is a point at a distance r from the centre of the dipole and the line joining the centre of the dipole to this point makes an angle θ with the axis of the dipole, then the potential at P is given by $(r >> 2a)$(Where $p = 2\,qa$)

a) $V = \frac{p\cos\theta}{4\pi\varepsilon_0 r^2}$ b) $V = \frac{p\cos\theta}{4\pi\varepsilon_0 r}$ c) $V = \frac{p\sin\theta}{4\pi\varepsilon_0 r}$ d) $V = \frac{p\cos\theta}{2\pi\varepsilon_0 r^2}$

999. The plates of a capacitor are charged to a potential difference of 320 *volts* and are then connected across a resistor. The potential difference across the capacitor decays exponentially with time. After 1 *second* the potential difference between the plates of the capacitor is 240 *volts*, then after 2 and 3 *seconds* the potential difference between the plates will be

a) 200 and 180 V b) 180 and 135 V c) 160 and 80 V d) 140 and 20 V

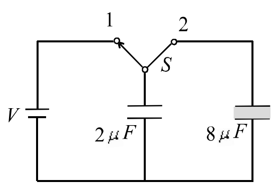
1000. A capacitor is charged to 200 *volt* it has 0.1 *coulomb* charge. When it is discharged, energy will be

a) 1 J b) 4 J c) 10 J d) 20 J

1001. 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

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

1002. A $2\mu F$ capacitor is charged as shown in figure. The percentage of its stored energy dissipated after the switch S is turned to position 2 is



a) 0% b) 20% c) 75% d) 80%

1003. An electric dipole consisting of two opposite charges of $2 \times 10^{-6} C$ each separated by a distance of 3 cm is placed in an electric field of $2 \times 10^5\ N/C$. The maximum torque on the dipole will be

a) $12 \times 10^{-1}\ Nm$ b) $12 \times 10^{-3}\ Nm$ c) $24 \times 10^{-1}\ Nm$ d) $24 \times 10^{-3}\ Nm$

1004. 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

a) 0.10 m
b) 0.15 m
c) 0.20 m
d) 0.25 m

1005. The magnetic potential at a point on the axial line of a bar magnet of dipole moment M is V. What is the magnetic potential due to a bar magnet of dipole moment $\frac{M}{4}$ at the same point?

a) $4V$ b) $2V$ c) $\frac{V}{2}$ d) $\frac{V}{4}$

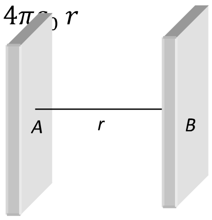
1006. A solid sphere of radius R_1 and volume charge density $\rho = \frac{\rho_0}{r}$ is enclosed by a hollow sphere of radius R_2 with negative surface charge density σ, such that the total charge in the system is zero. ρ_0 is a positive constant and r is the distance from the centre of the sphere. The ratio R_2/R_1 is

a) $\frac{\sigma}{\rho_0}$ b) $\sqrt{\frac{2\sigma}{\rho_0}}$ c) $\sqrt{\frac{\rho_0}{2\sigma}}$ d) $\frac{\rho_0}{\sigma}$

1007. There are two equipotential surfaces as shown in figure. The distance between them is r. The charge of $-q$

7. coulomb taken from the surface A to B, the resultant work done will be

a) $W=\frac{1}{4\pi\varepsilon_0}\frac{q}{r}$ b) $W=\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$ c) $W=-\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$ d) $W=$ zero



1008. The electric field intensity **E**, due to an electric dipole of moment **p**, at a point on the equatorial line is

a) Parallel to the axis of the dipole and opposite to the direction of the dipole moment **p**
b) Perpendicular to the axis of the dipole and is directed away from it
c) Parallel to the dipole moment
d) Perpendicular to the axis of the dipole and is directed towards it

1009. The inward and outward electric flux from a closed surface are respectively $8\times10^3$and 4×10^3 units. Then the net charge inside the closed surface is

a) -4×10^3C b) 4×10^3C c) $\frac{-4\times10^3}{\varepsilon_0}$C d) $-4\times10^3\varepsilon_0$C

1010. 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

a) 0 b) $\frac{\sqrt{2}Q^2}{4\pi\varepsilon_0 a}$ c) $\frac{\sqrt{2}Q^2}{\pi\varepsilon_0 a}$ d) $\frac{Q^2}{2\pi\varepsilon_0 a}$

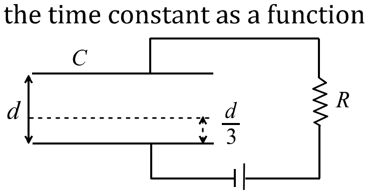
1011. Charge $q_1=+6.0$ nC is on Y-axis at y=+3 cm and charge q_2 =-6.0 nC is on Y-axis at y=-3 cm calculate force on a test charge $q_0=2$nC placed on X-axis at x=4 cm.

a) $-51.8\ \hat{\jmath}\mu$N b) $+51.8\ \hat{\jmath}\mu$N c) $-5.18\ \hat{\jmath}\mu$N d) $5.18\ \hat{\jmath}\mu$N

1012. A $10\mu F$ capacitor is charged to a potential difference of 50 V and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20 $volt$. The capacitance of second capacitor is

a) $10\mu F$ b) $20\mu F$ c) $30\mu F$ d) $15\mu F$

1013. A parallel plate capacitor C with plates of unit area and separation d is filled with a liquid of dielectric constant $K=2$. The level of liquid is $\frac{d}{3}$ initially. Suppose the liquid level decreases at a constant speed V, the time constant as a function of time t is

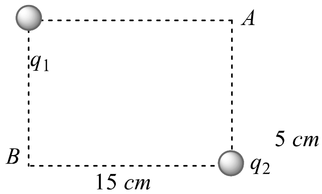


a) $\frac{6\varepsilon_0 R}{5d+3Vt}$ b) $\frac{(15d+9Vt)\varepsilon_0 R}{2d^2-3dVt-9V^2t^2}$ c) $\frac{6\varepsilon_0 R}{5d-3Vt}$ d) $\frac{(15d-9Vt)\varepsilon_0 R}{2d^2+3dVt-9V^2t^2}$

1014. The force between the plates of a parallel plate capacitor of capacitance C and distance of separation of the plates d with a potential difference V between the plates, is

a) $\frac{CV^2}{2d}$ b) $\frac{C^2V^2}{2d^2}$ c) $\frac{C^2V^2}{d^2}$ d) $\frac{V^2d}{C}$

1015. 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 $1/4\,\pi\varepsilon_0=10^{10}\ N-m^2/C^2$)

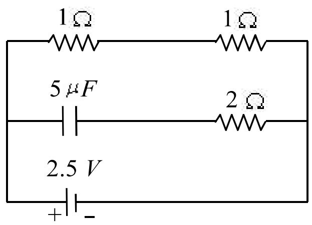


a) 2.8 J b) 3.5 J c) 4.5 J d) 5.5 J

1016. The electrostatic potential inside a charged spherical ball is given by $\phi = ar^2 + b$ where r is the distance from the centre; a, b are constants. Then the charge density inside the ball is

a) $-24\pi a\varepsilon_0 r$ b) $-6a\varepsilon_0 r$ c) $-24\pi a\varepsilon_0$ d) $-6a\varepsilon_0$

1017. A capacitor of capacitance $5\mu F$ is connected as shown in the figure. The internal resistance of the cell is 0.5Ω. The amount of charge on the capacitor plate is



a) $0\mu C$ b) $5\mu C$ c) $10\mu C$ d) $25\mu C$

1018. Charge Q is placed at the diagonal faced corners of a square and charge q is placed at another two corners of square. The condition for net electric force on Q to be zero will be

a) $Q = (-2\sqrt{2})q$ b) $Q = -\frac{q}{2}$ c) $Q = (2\sqrt{2})q$ d) $Q = -\frac{q}{2}$

1019. 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

a) $\frac{\rho R}{3\varepsilon_0}$ b) $\frac{\rho r}{\varepsilon_0}$ c) $\frac{\rho r}{3\varepsilon_0}$ d) $\frac{3\rho R}{\varepsilon_0}$