1. Three charges +Q, q, +Q are placed respectively, at distance d/2 and d from the origin, on the $x$-axis. If the net force experienced by +Q, placed at $x=0$, is zero, then value of $q$ is:

(a) $-Q/4$ (b) $+Q/2$

(c)$+Q/4$ (d) $-Q/2$

1. A charge $Q$ is distributed over three concentric spherical shells of radii a, b, c (a < b < c) such that their surface charge densities are equal to one another.

The total potential at a point at distance r from their common centre, where r<a, would be:

 (a) $\frac{Q}{12π\in \_{0}}\frac{ab+bc+ca}{abc}$

(b) $\frac{Q\left(a^{2}+b^{2}+c^{2}\right)}{4π\in \_{0}\left(a^{3}+b^{3}+c^{3}\right)}$

 (c) $\frac{Q}{4π\in \_{0}\left(a+b+c\right)}$

(d) $\frac{Q\left(a+b+c\right)}{4π\in \_{0}\left(a^{2}+b^{2}+c^{2}\right)}$

1. Two electric dipoles, A, B with respective dipole moments $\vec{d}\_{A}=-4qa \hat{i}$ and $\vec{d}\_{B}=-2qa \hat{i}$ are placed on $x$-axis with a separation R, as shown in the figure

 

 The distance from A at which both of them produce the same potential is:

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

1. Charges $–q$ and $+q$ located at A and B, respectively constitute an electric dipole. Distance $AB = 2a, O$ is the mid point of the dipole and $OP$ is perpendicular to $AB$. A charge $Q$ is placed at P where $OP = y$and $y>> 2a$. The charge $Q$ experiences and electrostatic force $F$. If Q is now moved along the equatorial line to $P'$ such that $OP'=\left(\frac{y}{3}\right)$ the force on $Q$ will be close to: $\left(\frac{y}{3}>>2a\right)$

 

 (a) 3F (b) $\frac{F}{3}$

(c) 9F (d) 27F

1. Four equal point charges Q each are placed in the $xy$ plane at $\left(0,2\right)\left( 4,2\right)\left(4, -2\right)$and $\left(0,-2\right)$. The work required to put a fifth Q at the origin of the coordinate system will be:

(a) $\frac{Q^{2}}{4π\in \_{0}}\left(1+\frac{1}{\sqrt{3}}\right)$

(b) $\frac{Q^{2}}{4π\in \_{0}}\left(1+\frac{1}{\sqrt{5}}\right)$

(c) $\frac{Q^{2}}{2\sqrt{2}π\in \_{0}}$

(d) $\frac{Q^{2}}{4π\in \_{0}}$

1. Three charges Q, +q and +q are placed at the vertices of a right-angle isosceles triangle as shown below. The net electrostatic energy of the configuration is zero if the value of Q is :



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

(c) $\frac{–q}{1+\sqrt{2}}$ (d) $-2q$

1. The given graph shows variation (with distance r from centre) of:

 

(a) Electric field of a uniformly charged sphere

(b) Potential of a uniformly charged spherical shell

(c) Potential of a uniformly charged sphere

(d) Electric field of uniformly charged spherical shell

1. An electric field of 1000 V/m is applied to an electric dipole at angle of 45°. The value of electric dipole moment is $10^{-29}$C.m. What is the potential energy of the electric dipole?

(a) $-20×10^{-18}J$

(b) $-7×10^{-27}J$

(c) $-10×10^{-29}J$

(d) $-9×10^{-20}J$

1. Determine the electric dipole moment of the system of three charges, placed on the vertices of an equilateral triangle, as shown in figure:

 

 (a) $\sqrt{3}ql\frac{\hat{j}-\hat{i}}{\sqrt{2}}$ (b) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$

(c)$2ql \hat{j}$ (d) $-\sqrt{3}ql \hat{j}$

1. The bob of a simple pendulum has mass 2 g and a charge of $5.0μC$. It is at rest in a uniform. It is at rest in a uniform horizontal electric field of intensity 2000V/m. At equilibrium, the angle that the pendulum makes with the vertical is: (take $g=10m/s^{2}$)

(a) $tan^{-1}\left(2.0\right)$ (b)$tan^{-1}\left(0.2\right)$

(c)$tan^{-1}\left(5.0\right)$ (d) $tan^{-1}\left(0.5\right)$

1. A solid conducting sphere, having a charge Q, is surrounded by an uncharged conducting hollow spherical shell. Let the potential difference between the surface of the solid sphere and that of the outer surface of the hollow shell be V. If the shell is now given charge of $-4Q$, the new potential difference between the same two surfaces is:

(a) $-2V$ (b) 2V

(c) 4V (d) V

1. An electric dipole is formed by two equal and opposite charges $q$ with separation $d$. The charges have same mass $m$. It is kept in a uniform electric  field$E$. If it is slightly rotated from its equilibrium orientation, then its angular frequency $ω$ is :-

(a) $\sqrt{\frac{qE}{md}}$ (b) $\sqrt{\frac{2qE}{md}}$

(c)$2\sqrt{\frac{qE}{md}}$ (d) $\sqrt{\frac{qE}{2md}}$

1. The electric field in a region is given by $\vec{E}=\left(Ax+B\right)\hat{i}$, where $E$ is in $NC^{-1}$ and $x$ is in metres. The values of constants are $A=20SI$ unit and $B=10SI$ unit. If the potential at $x=1$ is $V\_{1}$​ and that at $x=-5$ is $V\_{2}$​, then $V\_{1}-V\_{2}$​ is :-

(a) 320 V (b) –48V

(c) 180 V (d) –520 V

1. A uniformly charged ring of radius 3a and total charge q is placed in $xy$-plane centred at origin. A point charge q is moving towards. A uniformly charged ring of radius $3a$ and total charge q is placed in $xy$-plane centred at origin. A point charge $q$ is moving towards the ring along the $z$-axis and has speed $v$at $z = 4a$. The minimum value of $v$ such that it crosses the origin is:

(a) $\sqrt{\frac{2}{m}}\left(\frac{4}{15}\frac{q^{2}}{4πε\_{0}a}\right)^{\frac{1}{2}}$

(b) $\sqrt{\frac{2}{m}}\left(\frac{1}{5}\frac{q^{2}}{4πε\_{0}a}\right)^{\frac{1}{2}}$

(c) $\sqrt{\frac{2}{m}}\left(\frac{2}{15}\frac{q^{2}}{4πε\_{0}a}\right)^{\frac{1}{2}}$

(d) $\sqrt{\frac{2}{m}}\left(\frac{1}{15}\frac{q^{2}}{4πε\_{0}a}\right)^{\frac{1}{2}}$

1. In free space, a particle A of charge $1μC$ is held fixed at a point P. Another particle B of the same charge and mass $4μg$ is kept at a distance of 1mm from $P$. if $B$ is released, then its velocity at a distance of $9mm$ from P is :

 $\left[Take\frac{1}{4πε\_{0}}=9×10^{9}Nm^{2}C^{-2}\right]$

 (a) $1.0m/s$ (b) $3.0×10^{4}m/s$

 (c) $2.0×10^{3}m/s$ (d) $1.5×10^{2}m/s$

1. Electric field at a point varies as  for

 (a) An electric dipole

 (b) A point charge

 (c) A plane infinite sheet of charge

 (d) A line charge of infinite length

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

 (a)  (b) 

 (c)  (d) 

1. Total electric flux coming out of a unit positive charge put in air is

 (a)  (b) 

 (c)  (d) 

1. For a given surface the Gauss's law is stated as . From this we can conclude that

 (a)  is necessarily zero on the surface

 (b)  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

1. A cube of side  is placed in a uniform field , where . The net electric flux through the cube is

 (a) Zero (b) 

 (c)  (d) 

1. Eight dipoles of charges of magnitude  are placed inside a cube. The total electric flux coming out of the cube will be

 (a)  (b) 

 (c)  (d) Zero

1. A point charge  is placed at the centre of a cube of side . The electric flux emerging from the cube is

 (a)  (b) Zero

 (c)  (d) 

1. A charge  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) 

 (c)  (d) 

1. 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

1. 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) 

50*cm*

1*m*

*+*

*+*

*+*

*+*

*+*

*+*

(b) 

(c) 

(d) 

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

(a) *Weber* (b) *Newton per coulomb*

(c) *Volt* × *metre* (d) *Joule* per *coulomb*

1. The inward and outward electric flux for a closed surface in units of  are respectively  and  Then the total charge inside the surface is [where  permittivity constant]

 (a)  *C* (b)  *C*

(c)  *C* (d) *C*

1. If a spherical conductor comes out from the closed surface of the sphere then total flux emitted from the surface will be

 (a)  (the charge enclosed by surface)

(b)  (charge enclosed by surface)

(c)  (charge enclosed by surface)

(d) 0

1. A charge *q* is located at the centre of a cube. The electric flux through any face is

(a)  (b) 

(c)  (d) 

1. Two infinite plane parallel sheets separated by a distance  have equal and opposite uniform charge densities . Electric field at a point between the sheets is

 (a) Zero

 (b) 

 (c) 

 (d) Depends upon the location of the point

1. 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) 103 *Nm*2 *C*–1

*q*1

*q*2

*q*3

Gaussian surface *B*

Gaussian surface *A*

(b) 103 *CN*-1 *m*–2

(c) 6.32 × 103 *Nm*2 *C*–1

(d) 6.32 × 103 *CN*-1 *m*–2

1. The electric intensity due to an infinite cylinder of radius  and having charge *q* per unit length at a distance from its axis is

 (a) Directly proportional to 

 (b) Directly proportional to 

 (c) Inversely proportional to *r*

 (d) Inversely proportional to 

1. A sphere of radius *R* has a uniform distribution of electric charge in its volume. At a distance *x* from its centre, for , the electric field is directly proportional to

 (a)  (b) 

 (c)  (d) 