If two identical balls each of mass m and having charge q are suspended by silk thread of length ℓ from the same point o ,then the distance between the balls is given by :

$$\frac{F}{m\,g} = \tan\,\theta \cong \frac{x}{2\,l}$$

$$\Rightarrow \quad X = 2l\left(\frac{F}{m\,g}\right)$$

Two pith balls each of mass m and charge q are suspended from a point by weightless threads of length ℓ. Both the threads are separated by an angle θ with the vertical. If the value of θ is negligible, the distance between two pith balls will be

(1) $\left[\frac{q^2 l}{2\pi \epsilon_o m g}\right]^{\frac{1}{3}}$ (2) $\left[\frac{q^2 l}{4\pi \epsilon_o m g}\right]^{\frac{1}{3}}$

(3) $\left[\frac{q l^2}{4\pi \epsilon_o m g}\right]^{\frac{1}{3}}$ (4) $\left[\frac{q l^2}{2\pi \epsilon_o m g}\right]^{\frac{1}{3}}$

If the whole arrangement is taken in a satellite in space where there is no gravity, then the angle between two strings is 180^0. Hence , the tension in each string is given by:

$$T = \frac{1}{4\pi\epsilon_o} \frac{q^2}{4l^2}$$

Two small balls having equal positive charge Q C on each are suspended by two insulating strings of equal length L meter, form a hook fixed to a stand. The whole set up is taken in satellite into space where there is no gravity (state of weightlessness). Then the angle θ between the two strings is:

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

(3) 180^0 (4) $0^0 < \theta < 180^0$

If the balls are

suspended in a liquid of

density ρ and the distance between the balls remains same, then the dielectric constant of the liquid is given by:

$$K = \frac{\sigma}{\sigma - \rho}$$

(Where σ density of material of ball)

$$F = (F_{med}) K$$

Therefore ,

$$\frac{F}{\mathrm{m\ g}} = \frac{F_{med}\, K}{\mathrm{m\ g}} \Rightarrow \frac{F}{m\ g} = \frac{F_{med}}{\mathrm{m\ g}\,(\frac{1}{\mathrm{k}})}$$

The dielectric constant K of an insulator can-not be:

(1) 1

(2) 0

(3) ∞

(4) 80

The electric field intensity on the Surface of a charged conductor is :

(1)Zero
(2) Directed normally to the surface
(3)Directed tangentially to the surface
(4)Directed along 45^0 to the surface

At some point in space the electric field is 5 N C^{-1} . The electric lines of force crossing a unit area placed at right angles to electric field at this point is

(1) ϵ_0

(2) $\epsilon_0 / 4\pi$

(3) $4\pi \epsilon_0$

(4) 5

Six charges + Q each are placed at the corners of a regular hexagon of side a. The electric field at the center of hexagon is :

(1)zero

(2) $\frac{1}{4\pi\epsilon_o}\frac{6Q^2}{a^2}$

(3) $\frac{1}{4\epsilon_o\pi}\frac{Q^2}{a^2}$

(4) $\frac{1}{4\epsilon_o\pi}\frac{6Q^2}{a\sqrt{2}}$

An isolated metal sphere of radius r is given a total charge q. The potential energy of sphere is :

(1) $q^2/4\pi\epsilon_o r$ (2) $q / 4\pi\epsilon_o r$

(3) $q / 8\pi\epsilon_o r$ (4) $q^2/ 8\pi\epsilon_o r$

Three charges 2 q, - q , - q are located at the vertices of an equilateral triangle. At the cir- cum centre of the triangle:

(1) The field is zero but potential is not zero
(2) The field is non - zero but the potential is zero.
(3)Both, field and potential are zero
(4) Both, field and potential are non - zero.

The work done in carrying a charge of 5 μ C from a point A to B is 8 m J. The difference of potential between A and B is :

(1) 160 V

(2) 16 V

(3) 1.6 k V

(4) 16 k V

When a charge of 3 C is placed in an uniform electric field, it experiences a force of 3000 N within this field. Potential difference between two points separated by a distance of 1cm is:

(1) 10 volt (2) 90 volt

(3) 1000 volt (4) 3000 volt

The electric potential due to an electric dipole at an axial point distant r from the dipole is related to r as :

(1) r^{1}

(2) r^{-1}

(3) r^{2}

(4) r^{-2}

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

(1) m g

(2) m g / e

(3) $m g / c^2$

(4) e / m g

Two point charges A and B are situated in air as shown in the following figure. What is work done in moving B so that distance between the two charges is reduced to 0.1m?

|←------- 0.5m ----------→|

A • 12 μC **3 μC • B**

(1) 2.59 J (2) 1.295 J

(3) 5.18 J (4) 8 J

Two spheres A and B of radius a and b respectively are at the same potential. The ratio of the surface charge density of A to B is :

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

Two free protons are separated by a distance of 1 Ǻ. If they are released the kinetic energy of each proton when at infinite separation is:

(1) 23×10^{19} J

(2) 11.5×10^{-19} J

(3) 46×10^{-19} J

(4) 5.6×10^{-12} J

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

(1) – Q / 2

(2) + Q / 2

(3) - Q / 4

(4) – 4 Q

A uniform wire of length 5 m is carrying a steady current. The electric field inside it is 0. 2 V m $^{-1}$. The potential difference across the ends of the wire is:

(1) 1 V (2) 0.5 V

(3) 0.1 V (4) 5 V

A charge q is divided into two parts q_1 and $(q - q_1)$. What is the ratio q / q_1 so that the force between two parts placed a given distance apart is maximum:

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

(3) 1 : 2 (4) 1 : 4

The electric potential at the surface of an atomic nucleus (Z=50) of radius 9.0×10^{-15} m :

(1) 80 V

(2) 8×10^{6} V

(3) 9 V

(4) 9×10^{5} V

Two point charges placed at a certain distance r in air exert a force of F on each other. Then the distance r ‘at which these charges will experience the same force in a medium of dielectric constant K is:

(1) r (2) r / K

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

Charges + q , - 4 q and + 2 q are arranged at the corners of an equilateral triangle of side 0.15m, if q = 1 μ C, their mutual potential energy is :

(1) 0.4 J (2) 0.5 J

(3) 0.6 J (4) 0.8 J

Point charges 4 q , - 2 q , + q and – 3 q are placed at the corners of a square of side a. The potential at point O

(the point of intersection of

diagonals) is :

(1) Zero

(2) $\frac{1}{4\pi\epsilon_o}(\frac{10q}{a})$

(3) $\frac{1}{4\pi\epsilon_o}\{\frac{2\sqrt{2}}{a}q\}$

(4) $\frac{1}{4\pi\epsilon_o}\{\frac{5q}{a}\}$

A hollow sphere of copper is having a uniform charge density of 0.5 μCm^{-2}, its radius is 0.1 m. The potential at the centre of sphere is :

(1) Zero

(2) 1800 π V

(3) 180 π V

(4) 4.5 k V

ABC is an equilateral triangle of side 1 m. charges of + 1 μ C and - 1 μ C respectively are placed at points B and C .The electric field at A is:

(1) 9×10^{2} N C^{-1} (2) 18×10^{3} N C^{-1}

(3) 9×10^{3} N C^{-1} Parallel to BC

(4) 9×10^{3} N C^{-1} Parallel to CB

Two metal plates having a potential difference of 800 V are 2 cm apart. It is found that a particle of mass 1.96×10^{-15} kg remain suspended in the region between the plates. The charge on the particle must be

(e = elementary charge):

(1) 3 e

(2) 4 e

(3) 6 e

(4) 8 e

An electric dipole of moment p is placed normal to the lines of force of electric field E. The work done in deflecting it through an angle of 180^0 is :

(1) p E

(2) + 2 p E

(3) – 2 p E

(4) zero

The ratio of momentum of an electron and an alpha particle which are accelerated from rest by a potential difference of 100 V is:

(1) 1

(2) $\sqrt{\dfrac{2m_e}{m_\alpha}}$

(3) $\sqrt{\dfrac{m_e}{m_\alpha}}$

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

A solid metallic sphere has a charge + 3 Q. 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?

(1) $\frac{Q}{2\pi \epsilon_0 R}$ (2) $\frac{3Q}{2\pi \epsilon_0 R}$

(3) $\frac{3Q}{4\pi \epsilon_0 R^2}$ (4) $\frac{4Q}{2\pi \epsilon_0 R^2}$

A proton is released from rest at a distance at 10^{-4} Å from the nucleus of mercury atom (Z = 80). The kinetic energy of the proton when it is far away from the nucleus is :

(1) 12 e V

(2) 12 k e V

(3)1.2 M e V

(4)12 M e V.

Two thin concentric hollow conducting Spheres of radii R_1 and R_2 bears Charges Q_1 and Q_2 respectively. If $R_1 > R_2$, then the potential at a point distance r such that $R_1 > r > R_2$ is :

(1) $\frac{1}{4\pi\epsilon_o}\frac{Q_1 + Q_2}{r}$ (2) $\frac{1}{4\pi\epsilon_o}(\frac{Q_1}{r} + \frac{Q_2}{R_2})$

(3) $\frac{1}{4\pi\epsilon_o}(\frac{Q_1}{R_1} + \frac{Q_2}{R_2})$ (4) $\frac{1}{4\pi\epsilon_o}(\frac{Q_1}{R_1} + \frac{Q_2}{r})$

Two thin concentric hollow conducting Spheres of radii R_1 and R_2 bears Charges Q_1 and Q_2 respectively. If $R_1 > R_2$, then the electric field Strength at a point distance r such that $R_1 > r > R_2$ is :

(1) zero

(2) $\frac{1}{4\pi\epsilon_o} \frac{Q_1}{r^2}$

(3) $\frac{1}{4\pi\epsilon_o} \frac{Q_2}{r^2}$

(4) $\frac{1}{4\pi\epsilon_o} \frac{Q_1 + Q_2}{r^2}$

Two small spheres carry charge of + 3 n C, and - 12 n C respectively. The charges are distance **d** apart. The force they exert on one another is F_1. The spheres are made to touch one another and then separated to distance d apart. The force they exert on one another now is F_2 then F_1 / F_2 is :

(1) 1

(2) 2

(3) 1 / 2

(4) 16:9

An electric dipole consists of two opposite charges each of magnitude 1.6×10^{-19} coulomb at separation 1 Ǻ. The dipole moment is :

(1) 1.6×10^{-19} C m (2) 1.6×10^{-29} C m

(3) 3.2×10^{-29} C m (4) 0.8×10^{-29} C m

An electron enters with a velocity of 5×10^{6} m / sec along the positive direction of an electric field of intensity 10^{3} N C^{-1} If mass of electron is 9.1×10^{-31} kg , then the time taken by the electron to come temporarily to rest, is:

(1) 5.8×10^{-8} s (2) 1.45×10^{-8} s

(3) ∞ (4) 2.9×10^{-8} s

Charges of + (10 / 3) x 10^{-9} C are placed at each of the four corners of a square of side 8 cm. The potential at the intersection of the diagonals is

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

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

An electron placed at a distance of 0.5 m from a charge placed at origin, experiences a force of 9.6×10^{-16} N along positive x - axis. The electric field at the position of electron is:

(1) 6×10^{3} NC^{-1} along + ve x - axis

(2) 6×10^{3} NC^{-1} along - ve x - axis

(3) 15.36×10^{-34} NC^{-1} along + ve x - axis

(4) 15.36×10^{-34} $N C^{-1}$ along – ve x- axis.

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 D will be:

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

(2) $\frac{4q^2}{4\pi \epsilon a^2}$

(3) $\left(\frac{1+2\sqrt{2}}{2}\right)\frac{q^2}{4\pi \epsilon_0 a^2}$

(4) $\left(2+\frac{1}{\sqrt{2}}\right)\frac{q^2}{4\pi \epsilon_0 a^2}$

There is an electric field E in x - direction. If the work done on a moving charge 0.2 C through a distance of 2 meters along a line making an angle 60^0 with the x- axis is 4.0 J What is the value of E?

(1) 3 N / C

(2) 4N / C

(3) 5 N / C

(4) 20 N / C